Supporting the professional development of educators for blended learning design using TPACK: A design-based research study

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July 2024

This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

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Author's declaration: This thesis is entirely my own work and has not been submitted in substantially the same form for the award of a higher degree elsewhere.

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Abstract

A growing body of literature on blended learning in higher education suggests that the phenomenon is strategically important on the grounds of flexibility, increased learner engagement, and critical skill development, along with a positive impact on the achievement of learning outcomes. However, the success of blended learning presents a burden on educators to be adept at distinct learning design skills. The current literature does not adequately cover professional development, which addresses how educators should design blended learning or articulate specific pedagogical design approaches for blended learning.

Therefore, this study used a Design-Based Research approach to explore how educators can support the development of their own blended learning designs. Multiple iterations of a professional development course to guide educators' blended learning design approaches have been implemented at a university research site in Dubai. The university endeavoured to become the first accredited institute in the UAE to redesign its programmes for blended learning delivery. The research cycles included an analysis of the literature to inform the development of design conjectures, which in turn underpinned the design of the professional development course. Subsequently, data, including participants' design artefacts and post-course interviews, were analysed for each cycle through the lens of TPACK to evaluate participants' experience in the course, substantiate design conjectures, and inform iterative improvement of the design intervention course.

Cycle-A's findings showed that the inclusion of reflective practices deepened comprehension and encouraged thoughtful design approaches, while the inclusion of a flipped learning model was deemed to support participants' blended learning design decisions. Findings from cycle-B identified that the inclusion of active blended learning strategies and intentional collaborative opportunities significantly enhanced the learning experience. In addition, a learner-centred approach was deemed beneficial in further guiding participants' blended learning design decisions. Finally, cycle-C's findings identified that a cohort-based flipped learning course design could effectively engage participants. In addition, the participants' technological confidence and competence increased through coaching and support.

This study makes several contributions to the literature, including highlighting the centrality of learning design in supporting educators' transition to designers of blended learning. A new iterative blended learning design (IBLD) model is proposed that synthesises the findings and integrates the design conjectures developed across the three DBR cycles, which can serve as the basis for future research in the field of professional development for blended learning design.

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ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor, Dr Brett Bligh, for his invaluable guidance, support, and encouragement throughout the course of this research. His insightful feedback and expertise have been instrumental in shaping this study.

I am also profoundly grateful to my wife, Patricia for her support, understanding, and patience. Her encouragement and belief in me have been a constant source of strength and motivation.

The University of Wollongong on Dubai also provided a great opportunity that allowed me to conduct this research. I thank my former colleagues for their engagement in the project.

Publications derived from work on Doctoral Programme

Tuffnell, C. (2023). Digital transformation of post-pandemic learning and teaching: Utilising TPACK to support educator development in a flipped learning pilot. Studies in Technology Enhanced Learning, 3(2).

Khan, Z. R., Priya, J., & Tuffnell, C. (2022). Culture of integrity–institutional response to integrity during COVID19. *International Journal for Educational Integrity*, *18*(1), 27.

Tuffnell, C. (2021). Faculty learning communities: Supporting the development of online educators. *Studies in Technology Enhanced Learning*, *1*(2).

CHAPTER 1: INTRODUCTION

This research aims to contribute to new knowledge and ongoing discussions in educator professional development (PD) for blended learning (BL) design. The focal point for the project is that the current literature does not adequately address how educators can be supported to design BL, nor does it provide a clear articulation of specific pedagogical design approaches for BL.

Therefore, this study adopted a Design-Based Research (DBR) approach to explore how educators can be supported in the development of their own BL designs. Following a review of literature further sub-research questions of:

RQ1.1: How can educator PD be designed for engagement?

RQ1.2: How can educator PD support learning design skills for BL design?

RQ1.3: What specific pedagogical design approach can be followed for BL design.

Guided the study, culminating in a proposed structured iterative design approach to supports educators' transition to BL designers.

The concept of BL has substantially influenced educational discourse, research, and practice over the past two decades, moving from being an 'innovative' approach to being accepted as a mainstream approach that integrates pedagogical and technological affordances (Bizami et al., 2023; Callo & Yazon, 2020; Garrison & Kanuka, 2004; Huang & Zhou, 2006; Mozelius & Rydell, 2017). Scholars have proposed that the advantages of BL represent a paradigm shift towards more personalised, flexible, and accessible education that outperforms individual modalities of either online or face-to-face to achieve desired outcomes (Baepler et al. 2014; Bligh, 2022; Su, 2019). BL is said to empower learners to engage with material at their own pace, place, and modality of learning, thereby enhancing their autonomy and preparing them for the demands of a rapidly changing world (Eralitaa & Azzizzahb, 2023; Marshall, 2020; Riddle, 2022). However, the literature does not acknowledge educators' lack of preparedness for BL, nor the PD that is needed in learning design skills, in addition to pedagogical, technological development for BL design and implementation.

In recent years, the prominence and pace of change around BL in higher education (HE) institutions has increased significantly. This acceleration is rooted in a long history of educational research on both pedagogical and technological advancements, along with the catalyst of the COVID-19 pandemic. Despite creating substantial pressure and disruption to educators' professional practices, the pandemic period has also highlighted the advantages of synchronous online and asynchronous learning (Lee et al., 2021). These benefits include flexibility and autonomy, which allow students to manage their learning pace and location (Marshall, 2020; Office for Students, 2022).

As the HE sector aims to look beyond the emergency online learning (EOL) period, it is evident that the era of exclusively on-campus learning experiences may end. BL is poised to become a ubiquitous educational model (MacNeill & Beetham, 2023; Office for Students, 2022). Therefore, this study draws upon extensive research related to pedagogical and technological advancements in BL, alongside contemporary experiences from the EOL period to inform and enhance the research.

When considering the transition towards BL, the literature identifies that there is no one-size-fits-all approach due to the variability of contexts and learner needs (Huang & Zhou, 2006). In addition, issues related to inconsistencies in BL terminology and understanding have been highlighted, along with the variability and sometimes lack of educators' learning design skills that impact the effective integration of synchronous and asynchronous learning (Huber & Helm, 2020; MacNeill & Beetham, 2023). Learning design skills need to consider context-specific BL design decisions, evolving learner expectations, and the need for pedagogies that not only convey knowledge but also foster community, collaboration, and critical thinking in synchronous and asynchronous environments (Bligh, 2022; Riddle, 2022).

The increasing adoption of BL is challenging the professional identity of educators, highlighting the need for a new set of capabilities to support educators in becoming designers of learning experiences in unique contexts (Bligh, 2022; Laurillard, 2018; Marshall, 2020; Reidsema et al., 2017). The implications for this study are to identify the key capabilities for designing BL, and to support the development and implementation of these capabilities in educators. The TPACK framework provides a good underpinning for this study, as capabilities can be aligned to the technological and pedagogical aspects of BL design with consideration given to educators' content knowledge.

To support the development of educator capabilities for BL design PD is needed, as many educators in HE institutions receive little formal development on aspects related to BL (Vaughn et al., 2015). As discussed, the TPACK framework can provide a foundation for guiding the development of educators' pedagogical and technological ability, along with a comprehensive design approach across both synchronous and asynchronous environments to ensure that the potential of BL to enhance educational experiences is fully realised (Koehler & Mishra, 2014; Office for Students, 2022). PD should acknowledge the developing discourse related to the evolving role of educators, moving away from solely delivering content to becoming designers of learning (Laurillard, 2018; Garreta-Domingo et al., 2017; Zalavra et al., 2019). PD should provide a learning path and associated materials to support BL design, in addition to covering tasks, tools, technologies, core content, sessions, assessments, and opportunities for interaction and feedback (MacNeill & Beetham, 2023). While TPACK may provide a good starting point as a framework to align educator capability development, it alone may not be sufficient, as unique aspects of educational practices may not be addressed. Therefore, the implications of this study relate to how to design PD that supports educator development for BL design and delivery.

The rest of this chapter sets out my personal motivation for conducting this study (section 1.1). I then outline the policy context for the research (section 1.2) before discussing the practice context (section 1.3), and the research context (section 1.4) of the study. This chapter concludes by presenting an overview of this thesis.

1.1 Personal motivation

My personal motivation for this study stems from my professional experience in HE. I began my career as a Learning Technologist at a close-knit satellite campus for health professionals and education studies. I was the go-to person for technology, be it audience response (clickers), video recording, or eLearning development. Academic staff would make requests, and I would support the use of technology and provide training on its functionality. It was only later in my career that I looked back on this period and reflected that I was in fact a technologist, not a learning technologist. I underappreciated the educators' role as I facilitated the use of technology without questioning its pedagogical value or appropriateness.

My views on the appropriate use of technology in education evolved as I moved into roles that focused on the design of various forms of digital education. To progress in my roles and career, I engaged in personal and professional development including, a MSc. in Technology Enhanced Learning, professional certification that introduced me to learning (instructional) design and design thinking, and more recently, a PhD in Technology Enhanced Learning. These experiences combined theoretical and practical developments and shaped my views and understanding of the pedagogical and technological aspects of education.

I adopted a purposeful design approach in my practice, meaning that a learning design process was followed to make deliberate design decisions at each stage of the process for the development of learning experiences in either online or in-person modalities. I questioned where and when to use technology and considered how it could support the pedagogical aspects of the learning experience, such as active or collaborative learning. On speaking to colleagues and students, I realised that my purposeful approach to learning design was not commonly practiced in the HE setting where I was working. Therefore, I provided faculty training on learning design and TEL with mixed results. Overall, early career faculty were receptive, while more established faculty were resistant to the perceived extra workload the approach needed. However, I was not dissuaded, as the feedback received from students exposed to the purposefully designed learning experiences was positive and prompted me to continue to deliver PD on the topics.

In early 2020, my approach to purposeful learning design and the appropriate use of technology came under scrutiny as the emergency provision of education took hold. The institution I worked at, as did most others, scrambled for a technologically led solution, opting to deliver lectures using tools such as Zoom or MS Teams. Although I understood the intent to replicate lecturing in the online modality, I felt this was an opportunity to employ the pedagogically sound design approaches that I had been promoting in faculty training for the online modality. My calls to slow down and draw upon research related to online and BL design to make pedagogically informed design decisions fell on deaf ears. Therefore, I concluded that a middle ground could be achieved through the pragmatic promotion of a ‘chunking’ approach. I challenged the faculty to visualise their online sessions as a modular sequence of chunks and to swap out a direct instruction chunk with an active learning activity chunk, providing them with a list of options. This had the effect of slightly shifting the needle towards a more purposeful learning design and helped me understand that if the change to educator practice was small and incremental, it would more likely be adopted.

As EOL continued, I moved to a new position at a different university, one that wanted to take advantage of the disruptive period to move away from traditional on-campus approaches and redesign courses for BL delivery. I was given the opportunity to lead the institutional transition to BL, with a large component of the role being focused on the PD of educators. I felt this was an opportunity to support educators with PD using a strategic approach rather than the reactionary approach of EOL. The project coincided with my progression in part one of this PhD programme, during which I came across the TPACK framework. The framework provided me with a thoughtful approach to integrating technology and pedagogy with educators' disciplinary (content) knowledge. I felt that TPACK not only resonated with my views on technology integration and pedagogical consideration but also provided a foundation for the intended PD initiative of supporting educators with pedagogical and technological development for their BL design.

As part of Module 3 in the PhD programme, I wrote an article about utilising TPACK to support educator development in a flipped learning pilot, published in the Studies in Technology Enhanced Learning journal (Tuffnell, 2023). This study focused on the digital transformation of HE to support pedagogical approaches, such as online and BL. The experience of this small-scale study confirmed to me that the TPACK framework can be a useful learning design guide for the development of PD to transform learning and teaching. However, while the framework prompts explicit consideration of pedagogical and technological knowledge development, the lack of community elements for a more impactful approach was highlighted.

This current study is an extension of my experience and evolving perspectives on learning design and technological integration. My motivation is driven by my pragmatic understanding of the current educational landscape, specifically experiences of EOL, which confirmed my belief in the need for educational practices that are thoughtful in the integration of technology and pedagogically sound approaches for BL. This project represents an opportunity to critically examine how educators can be facilitated by PD in learning design for the development of BL.

In addition to using the TPACK framework, which resonates with my views on integrating technology with pedagogy and content knowledge, I chose DBR as the methodological approach for this study. The selection of DBR is linked to my pragmatic outlook, which allows for the continuous refinement and improvement of the PD course through multiple cycles of analysis, design, implementation, and evaluation. This iterative process is crucial for capturing the complexities and dynamic nature of BL design, enabling the adaptation of interventions based on real-world feedback and evolving educational context.

1.2 Policy context

Engaging with policy in the context of BL is crucial, as it shapes how HE Institutions adapt to evolving pedagogical and technological landscapes, influencing the quality and delivery of educational experiences. Policymakers worldwide recognise BL's importance as a strategic response to contemporary educational demands (Office for Students, 2022; TEQSA, 2020). However, existing policies often lack clarity and direct relevance to practice, which can result in inconsistent implementation and suboptimal educational outcomes (MacNeill & Beetham, 2023).

This section is specifically focused on UK policies, due to my professional experience and Australian policies due to the research site being part of an Australian university network, and UAE policy, due to the research site being physically located in Dubai, UAE, and operating under the UAE Ministry of Education. The following discussion focuses on policy considerations relating to *BL terminology*, *reimagining pedagogical practices for BL*, *the role of learning design in BL*, and *the need for specialised educator PD for BL design*.

The first policy point identified is the need for a shared understanding of *BL terminology* to avoid confusion and to clearly articulate course offerings (Office for Students, 2022). The Commission for Academic Accreditation (CAA), UAE, stipulate that a shared definition and understanding of BL terminology is needed because of evolving pedagogical, methodological, and technological changes in HE. To ensure that CAA, HE institutions, and External Review Teams (ERT) share the same understanding in communications, reviews, and applying the requirements of BL, a clear and concise definition should be proposed by the institution implementing the BL approach. Two contemporary definitions from the Office for Students (2023) and JISC’s (2020) report, ‘reimagining blended learning in higher education’, define BL with slight variances, and a combination of both definitions was used in this study to define BL as ‘a complimentary combination of synchronous (in-person) group delivery and asynchronous (online) delivery in a digital learning environment.’ I acknowledge that due to advancements in synchronous technology such as Zoom, in-person delivery could happen online, however due to CAA mandates relating to contact hours, synchronous learning in this study will remain defined as in-person, on-campus learning.

The second policy point identifies a *reimagining of pedagogical practices* as a requirement for BL according to the Higher Education Policy Institute (HEPI) report titled ‘Blended learning: a long-term shift in pedagogy’ (Marshall, 2020). This point is related to the HE sectors transition towards a more considered blend of teaching modalities, according to OfS, building on lessons learned from recent experiences in EOL to inform both curriculum design and pedagogic practice (Office for Students, 2022). Regulators have identified many instances of poor teaching practices, despite some pockets of innovation during EOL. Some examples include educators selecting what they believe best suits their subject matter or based on the convenience of their digital capabilities rather than sound pedagogical reasoning (Office for Students, 2022). While reports have been critical of HE policies due to the autonomy provided to individual departments in deciding the nature of their BL approaches (Office for Students, 2022), what ‘reimagined’ pedagogical practices and approaches should look like is not offered. Therefore, this study aims to clarify the term by adopting a purposeful and deliberate approach to BL design that builds on a shared definition. A well-articulated learning design model is proposed for all participants to provide a universal pathway to BL design.

The third policy point identifies *the role of learning design in BL.* Digital education thought leaders JISC state that without effective support for educators involved in BL, there is a risk that the advantages of BL will not be seen if BL experiences are poorly designed and associated with negative experiences of EOL (MacNeill & Beetham, 2023). In relation, a report from the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) discussed the rising prominence of the learning designer role to work with and support educators in pedagogically sound BL design. However, the role was said to be ill-defined, underdeveloped, and complex, with further research needed into professional standards, competencies, and frameworks (D'Souza, et al., 2022). However, the ASCILITE report does not consider a key aspect pertaining to learning design approaches, being that the skillset of the learning designer role could be incorporated into redefined educator practice, something this study will explore in more detail.

The final policy point identified in this study relates to the need for *specialised educator PD for BL design*. The Australian Government's Tertiary Education Quality and Standards Agency (TEQSA) 'Foundations for good practice' report, calls for educators who can optimise the student experience to ensure quality and the achievement of learning outcomes (TEQSA, 2020). The UAE's CAA document also stipulates that educators involved in BL should undergo PD focused on advances in BL pedagogy and technology to ensure that courses are well-designed and facilitate learning across asynchronous or synchronous modalities (CAA, 2022).

Therefore, this study will align with existing policy to promote a PD approach; however, the absence of clarity from existing policy will be addressed in this study with a clear definition of BL, complemented by a well-defined BL approach, and a contribution related to the development of educators' learning design competencies for quality BL design, currently missing in policy, will be explored in this study.

1.3 Practice context

The practice context for this study is my former place of work, the University of Wollongong in Dubai (UOWD), part of an Australian University network, discussed in more detail in section 4.4. The university positions itself as a Western education experience in the UAE and has a tagline of "*your Australian University in Dubai*" (UOWD, n.d.). UOWD aims to follow the same BL strategic direction as the University of Wollongong (UOW) in Australia while also endeavouring to be the first CAA-accredited institute in the UAE approved for BL delivery. The CAA guidelines on BL implementation, discussed in section 1.3, have specific criteria to follow, such as submitting a substantive change of delivery application, outlining a BL model, development of institutional-level policy, and PD of educators involved in the identified programmes. These explicit requirements are not required at the Australian-based institution for their BL transition and, therefore, provide a unique consideration for this study to adhere to CAA requirements while implementing the Australian-led strategy.

My role at the time was responsible for the BL transition of UOWD programmes, I started discussions and consultations with educators at the institution to gain insight into their thoughts and experiences with BL. Educators, overall, were identified as experienced in teaching traditional face-to-face environments but not in BL. When discussing BL, it was apparent that there were varying definitions and understandings of the concept, in line with the policy documents discussed in section 1.3.

Overall, the opportunities that BL provides were not identified by educators, and concerns raised were not related to the development of pedagogical practices, as identified by policy documents in section 1.3; instead, comments were focused on the potential workload impact for designing and developing digital learning components. Educators also expressed an element of anxiety about "replacing" in-person teaching with online delivery methods as they felt there would not have time to "cover" all their content due to a reduction in class time. These conversations were useful as they provided me with insight into perceived challenges for the project and, in turn, this study, prompting me to think about the fundamentals of the educator PD to be designed.

1.4 Research context

This research is part of the scholarship on educator PD for BL design. It primarily engages with two sub-areas of the literature, discussed further in Chapter 2, focusing on designing educator PD (section 2.3) and on designing BL (section 2.4). The first area of literature, designing educator PD, explores sub-themes that emerged during the literature review which addresses *the* *changing role of the educator* (section 2.3.1), exploring ‘why’ the rise of BL is necessitating PD for the adaptation of pedagogical practice and technological competence to design and deliver BL. The second sub-theme that emerged looks at *learning design as a priority skill for educator PD* (section 2.3.2), discussing ’what’ educators could do to incorporate pedagogical and technological advancements effectively in BL. Continuing the discourse on learning design, the final sub-theme that emerged from the literature review looked at *learning design frameworks for educator PD* (section 2.3.3) exploring ‘how’ a variety of frameworks guide the learning design process of educators. The literature on designing educator PD for BL design identifies the evolving role of educators in BL, highlighting the critical need for PD that supports pedagogical and technological competencies to address the complexities of effective BL design. However, the literature also identifies educators’ resistance to change, which, if not addressed, can impede the adoption of innovative educational approaches, such as BL. Moreover, there is a deficiency in the literature regarding practical frameworks and strategies that can be readily implemented to overcome these challenges, something this study aims to address by providing targeted PD interventions that explore practical learning design frameworks for educators BL design.

The second area of the literature explores the theme of designing BL, with sub-themes emerging first of *pedagogical considerations for BL design* (section 2.4.1), highlighting the importance of understanding pedagogical practice in BL design for the promotion of elements such as flexibility, social interaction, and learner support. Second, the sub-theme of *technological considerations for BL* *design* (section 2.4.2) focuses on the affordances of technology to provide flexibility, time conservation, learner control, learner analytics, and the improvement of interaction, collaboration, and communication opportunities. The literature on designing BL emphasises the importance of understanding pedagogical practices that are crucial for creating engaging and effective BL environments. However, there is a lack of detailed, specific pedagogical design approaches, as the literature often falls short of providing concrete, actionable strategies that educators can implement. Furthermore, while the literature provides a comprehensive overview of the technological affordances that enhance BL, research often lacks practical frameworks and support mechanisms to guide educators to leverage technology effectively and align it with their pedagogical goals. Ultimately, there is a need for more research on how to integrate pedagogical practices effectively with technological tools in a cohesive manner. The literature indicates that educators' confidence in and comfort with technology significantly influence their willingness to integrate these tools into their teaching. However, there is insufficient guidance on how educators can build confidence and competence in technology integration in BL design.

1.5 Thesis overview

The thesis is presented in nine chapters: Chapter 1: Introduction, and the remainder are as follows.

In Chapter 2, I review the literature in the areas of designing educator PD and design of BL environments. The chapter explores key aspects of BL, such as the changing role of the educator, learning design considerations, and pedagogical and technological considerations.

In Chapter 3, I outline my ontological and epistemological perspectives and discuss how this influenced my choice of TPACK framework as the theoretical foundation for this study. I then detail how this framework underpins the design and implementation of the design intervention PD course, aimed at enhancing educators' competencies in BL design.

Chapter 4 presents the research design and methodology, explaining the rationale for using a DBR approach. This chapter describes the research site, participant selection, data collection methods, and the ethical considerations involved in the study. It also discusses how the TPACK framework and DBR methodology are integrated to iteratively develop and refine PD interventions.

Chapters 5, 6, and 7 report the findings from the three DBR cycles. Each section details the analysis, design, implementation, and evaluation phases of the respective cycles. Chapter 5 focuses on cycle-A, highlighting the inclusion of reflective practices and the flipped learning model. Chapter 6 discusses cycle-B, emphasising active blended learning strategies and collaborative opportunities. Chapter 7 covers cycle-C, showcasing the cohort-based flipped learning course design and the enhancement of participants' technological confidence and competence.

Chapter 8 provides a comprehensive discussion of the findings from across the three cycles, synthesising the insights gained and evaluating their implications.

Importantly, this chapter addresses how the research findings contribute to the literature on educator PD for BL design.

Finally, Chapter 9 concludes the thesis by reflecting on the overall contributions to knowledge, acknowledging the limitations of the research, and discussing its implications for policy, practice, and future research.

Chapter 2: Literature Review

The overarching aim of this research is to contribute new knowledge to the field of educator PD in BL design. The literature reviewed in this chapter demonstrates that the study is grounded in the existing literature. The literature has been critically reviewed to identify potential areas that this study can make contributions to and to inform this study's research questions.

As this study employs a DBR methodology, there is also literature analysis in each of the DBR cycles (section's 5.1, 6.1 and 7.1) that have the aim of identifying design consideration to inform the design intervention course.

The following chapter first discusses the process of literature selection (section 2.1) and the mechanism of the literature search (section 2.2) before outlining two main areas of focus: *Designing Educator Professional Development* (section 2.3) and *Designing Blended Learning* (section 2.4), with sub-themes identified, discussed, and summarised.

2.1 Process of literature selection

The literature selection process for this study was structured to ensure an understanding of educator PD for BL design, particularly in HE. My initial research interest stemmed from a professional desire to engage with educational discourse related to BL, following disruptions to education provision in recent years and the subsequent impact on the educator role in adapting to emerging requirements. This growing area of interest is also specifically related to my professional role in supporting university educators in redesigning their courses for BL delivery.

The literature was chosen to reflect a focused scope and set a foundation for the study's contributions. The literature selection began with identifying research that detail the design of BL. The intention was to focus on pedagogical and technological considerations for BL design and identify areas for contribution. Due to this scope more general BL literature, such as the history of BL, the online learning only aspect of BL and student outcomes or experiences of BL was discounted as they were not areas of intended contribution.

Following on from literature that discussed pedagogical and technological considerations for BL design, the second area of focus was aimed at literature that discussed PD design, specifically related to educator competencies for the design of BL. This area was a key focus for identifying potential contributions for the intersection of PD for BL design. Therefore, literature related to the impact of BL on the educator role was reviewed to develop a nuanced understanding of changes in educational practice along with identification of competencies for development. As the focus of this study was on HE professionals, literature that was not transferable to this study's area of focus was disregarded, such as a literature PD for K-12 teachers.

To present the review in a logical manner that correlates to the study's contribution aims, Area1: Designing Educator Professional Development is presented first, followed by Area 2: Designing Blended Learning.

2.2 Literature search

To identify relevant studies in my literature review on educator PD for BL design, I conducted a systematic search using databases such as OneSearch and Google Scholar. The search terms included combinations of the keywords "blended learning," "professional development," "technology integration," "pedagogical design," and "higher education." The goal was to find empirical studies exploring various facets of PD specifically tailored to enhance educators' capabilities in designing and implementing BL environments.

I aimed to gather insights into how different PD approaches impact educators' technological, pedagogical, and content knowledge, and how these approaches facilitate the transition from traditional teaching methods to BL. Additionally, I focused on studies that provided evidence of design processes that aligned with the DBR methodology employed in this study. This included examining the role of reflective practices, collaborative learning opportunities, and integration of active learning strategies within PD courses.

To ensure the relevance and quality of the literature, several inclusion and exclusion criteria were applied. Studies that explicitly addressed the design and implementation of PD approaches for BL in HE contexts were included. Studies that focused primarily on corporate training, K-12 education or those that did not provide detailed discussions on the design of PD for BL design were excluded. Furthermore, I excluded studies in which PD was part of a broader technological initiative, unless the specific focus on BL design was evident.

Through this process, a shortlist of 45 relevant studies were identified. To further enhance the literature pool, I employed the 'snowball' method, reviewing the reference lists of these studies to uncover additional relevant works that met my criteria. The results of this process yielded a total 83 literature sources that were relevant for review. This iterative process allowed me to build a comprehensive and focused literature base that informed the development of the PD intervention course, supported by the theoretical underpinnings of this study.

2.3 Area 1: Designing Educator Professional Development

In this section, I explore the theme of designing educator PD and examine key considerations and frameworks essential for equipping educators with the necessary skills and competencies for BL design. My analysis in this section draws on 56 of the 83 papers I obtained in my literature search, which was previously described in section 2.2.

The sub-sections will explore the changing role of the educator (section 2.3.1), Learning design as a priority skill for educator PD (section 2.3.2), and various learning design frameworks for educator PD (section 2.3.3). Through this exploration, I aim to identify the key elements related to the process of designing PD that support educators in BL design.

2.3.1 The changing role of the educator

The following analysis draws on 16 of the 56 identified literature sources. The literature highlights that the increase in innovative educational practices, such as BL, is impacting education, prompting the need for educator empowerment to reshape and reimagine educational practices (Bligh, 2022; Tuffnell, 2023).

Commentators also note that the complexity of BL design can be challenging for educators because they are required to align the virtual and in-person learning environments through design (Bligh, 2022; Lee et al., 2021). In addition, they are required to disseminate, engage, and interact with learners via appropriate learning materials that stimulate both affective and cognitive engagement in the BL environment (Carrillo & Flores, 2020; Vaughan et al., 2017).

Reconceptualising the educator role will have implications for practice that require ongoing consultation with professionals such as learning designers (Bligh, 2022; Bligh & Crook 2017). Commentators have said that educators can be unfamiliar with the practices of designing courses in the BL environment (Cheung & Hew, 2015). They often do not receive adequate training to support them (Copper, 2019). Therefore, repositioning educators away from being conveyors of knowledge and instead to designers of learning experiences is a challenge (Carrillo & Flores, 2020; Vaughan et al., 2017).

Comas-Quinn (2016) call for a review of educators' PD, proposing that a pedagogical over technological focus should be prioritised for educators engaged in BL. However, Falloon (2020) and Huber and Helm (2020) highlighted that investment in educators' digital competence is necessary to best serve learners in BL. Additional considerations on the impact of BL on the educator role come from Kaymakamoglu (2018), who identify that educators' transformation for BL design could be inhibited by resistance to change teaching practices. Several authors have identified potential reasons for resistance to adapting pedagogical approaches for BL, ranging from previous teacher training, an intuitive rather than evidence-based approach to teaching, or a perceived reduction in educators' role, responsibilities, or influence (Robinson, 2010; Weinstein et al., 2018; Kaymakamoglu, 2018).

Regarding the technological aspect of BL design, authors highlight that resistance to change could stem from the redistribution of educators' workload due to capability with digital tools for the creation of digital learning content, additional planning and preparation time, or the understanding of how technology can change aspects of learning and teaching and not simply be used as an add-on (Adedoyin & Soykan, 2023; Bligh, 2022; Mishra & Koehler, 2009).

Consequently, the literature discusses that the increasing demand and complexity of BL design impacts the educator's role, usefully highlighting that there is a requirement to develop pedagogical approaches and technological competencies. While the need for continuous PD and consultation with learning designers is also usefully acknowledged, what seems underexplored is the effective strategies to develop appropriate PD that mitigates potential resistance and focuses on the development of both pedagogical and technological competencies in a balanced manner to support educators in transitioning to designers of BL experiences.

2.3.2 Learning design as a priority skill for educator PD

The following analysis draws on 9 of the 56 identified literature sources. A key theme identified (section 2.3.1) has been the need for educators to reassess their educational practice and competence in digital technologies to adapt to BL teaching environments. When considering this complex challenge of BL design, scholars advocate adopting a mindset of teaching as design science can support educators' transition to BL through design and experimentation (Laurillard, 2018; Mishra & Koehler, 2009; Vaughan, 2013). Lee et al. (2016) and Suartama et al. (2019) state that a clearly defined learning design approach should be followed for the design of BL to ensure the inclusion of effective instructional components, selection of learning activities, dissemination of learning content, systematic feedback, and evaluation. This, as Suartama et al. (2019) attest, not only helps the educator thoughtfully incorporate key elements that are related to BL but also considers ways of engaging learners more deeply with BL experiences.

However, several authors have identified a deficit in educators' practical learning design skills for BL (Carrillo & Flores, 2020; Huber & Helm, 2020; Hawks et al. 2020). Therefore, learning design skills (and mindset) have been identified as a priority PD area to support educators in BL design. Carrillo and Flores (2020) argue that the development of such skills is a key priority for PD to facilitate the purposeful design of BL experiences.

Consequently, the literature usefully advocates for a mindset shift towards teaching as design science, highlighting that educators must reassess their practices and enhance their competencies to effectively design and implement BL experiences. However, what seems underexplored is the practical development and application of learning design skills among educators, which is essential for the successful transition to designers of BL.

2.3.3 Learning design frameworks for educator PD

The following analysis draws on 33 of the 56 identified literature sources. When exploring the literature on designing educator PD, a theme related to deficits in educators' learning design skills has been identified (section 2.3.2). In the literature reviewed, a collection of instructional design frameworks was discussed to guide educators' understanding of the learning design process. The following frameworks of *ADDIE, Community of Inquiry (CoI), Universal Design for learning*, and *The Conversational Framework* have been identified from the literature, and their strengths and weaknesses will be discussed.

The *ADDIE framework* is one of the most popular approaches for developing digital and online education in both corporate and education sectors. Gunawardena et al. (2018) described ADDIE as a means through which instructional designers approach the design of instruction through a systematic approach consisting of *Analysis, Design, Development, Implementation*, and *Evaluation*. *Analysis* prompts consideration of what is to be learned, by whom, to what requirements, and within what parameters in advance. *Design* focuses allow for specifics to be targeted systematically and logically. *Development* is the creation of the training in question. *Implementation* relates to the delivery of training and *Evaluation* engages both formative and summative assessments, from which improvements might be made (Calhoun et al., 2021; Piskurich, 2015). However, Krzyszkowska and Mavrommati (2021) identified that the ADDIE framework does not consider social interaction and may tend towards static, didactic, and non-interactional, and with that the maintenance of top-down information dissemination, rather than being actively facilitative of learners' engagement.

The *Community of Inquiry (CoI) framework*, which emphasises the interplay of teaching, cognitive, and social presence, has been widely used as a learning design model in online and BL environments (Nolan-Grant, 2019; Shea et al., 2022; Swan, 2021). Nolan-Grant (2019) and Swan (2021) found that the CoI framework significantly increased learner engagement and supported online and blended learning environments. Stewart (2017) and Makri et al. (2014) further demonstrated the framework's effectiveness in designing and assessing interactive learning activities, particularly in teacher training. Xu et al. (2018) and Hasani et al. (2022) expanded the application of the CoI framework by examining its relationship with learning behaviour data and designing an asynchronous online discussion forum interface.

Despite its widespread use, the CoI framework has been subject to constructive critiques, Rourke and Kanuka's (2009) review of literature stated that the authors felt that deep and meaningful learning was unlikely in the cases of CoI implementation they reviewed. Cooper and Scriven (2016) cautioned that the CoI model should be used as a communication and design guide rather than a universal truth claim.

The *Universal Design for Learning (UDL)* framework is a learning design framework aims to provide equal learning opportunities for all learners by making design considerations related to varied approaches to learning and considering the variability of learners' backgrounds, environments, and personal situations (Rose, 2000). The Centre for Applied Special Technology (CAST) developed a framework that enhances the accessibility of learning materials for diverse learners (CAST, Inc., 2012). Their UDL framework advocates flexible and practical approaches to learning, with three core principles focusing on learner engagement, representation, and expression (Glass et al., 2013; Rose, 2000). The first principle emphasises multiple means of engaging students, such as offering choices and ensuring content relevance. The second principle encourages multiple means of represent information, such as by combining lectures with videos or podcasts. The third principle advocates for multiple means of expression, providing students with different tools and assessment methods to demonstrate understanding and ensuring that all activities align with learning outcomes (CAST, Inc., 2012; Meyer et al., 2014; Novak & Bracken, 2019; Rose, 2000).

Yuan (2017) and Rogers-Shaw et al. (2018) highlight the potential of the UDL framework in improving learning outcomes, along with its application in PD and online instruction. Wu (2010) underscored the importance of collaboration in the UDL process, particularly in curriculum design. However, Mangiatordi (2018) noted that research evidence on the effectiveness of UDL is limited.

The Conversational Framework devised by Dianna Laurillard (2002) is a pivotal learning design approach that emphasises the importance of dialogue in the learning process, grounded in constructivist principles. It delineates the cyclical interaction of discussion and reflection between educators and learners, extending to peer interactions, thereby fostering deep learning and knowledge construction. According to Laurillard (2002), this framework is adaptable across various educational settings, including face-to-face, online, and BL environments, thereby highlighting the significance of feedback and collaborative learning. Its application in BL design is particularly noteworthy as it guides the integration of digital and traditional learning activities, promoting an engaging and reflective learning experience (Laurillard, 2002).

However, the conversational framework, while initially promising, has been found to have limitations that require amendments (Heinze et al., 2009). These limitations include the need for a more comprehensive theoretical framework that accounts for the diverse cultures and activity systems involved in BL (Thorne, 2000). The need for a more interactive and adaptive system that integrates courseware with tutoring conversation capability was also identified (Song, 2021). Furthermore, the framework should be flexible enough to accommodate different modes of learning (Grgurović, 2011) and should consider the strengths and limitations of various instructional delivery approaches (Saliba, 2010). Finally, the framework should consider the effects of interactions on students' social presence experience in a blended synchronous learning environment (Szeto et al., 2016) and should be grounded in the theory of experiential learning, which emphasises the role of conversation in constructing meaning from experiences (Baker et al., 2005). Despite these challenges, Laurillard's (2002) framework remains influential in shaping educational practices that prioritise deep learning through dialogue, feedback, and collaboration, underscoring the ongoing evolution of pedagogical strategies in the digital age (Kirkwood & Price, 2014; Selwyn, 2014).

Consequently, the literature in this section usefully builds on the discussion from section 2.3.2, that there are significant deficits in educators' learning design skills. Therefore, the solution of adopting various instructional design frameworks to guide the effective design of BL experiences is discussed with several frameworks described with strengths and weaknesses highlighted. However, what seems underexplored is the identification of a framework that is effective in addressing the diverse and dynamic needs of educators and learners, that is also adaptable to different educational contexts.

2.3.4 Summary: Area 1

In the landscape of PD design for educators, it is evident that the role of educators is being impacted by increasing innovative educational practices, such as BL (section 2.3.1). A crucial gap has been identified in the form of deficient learning design skills (section 2.3.2) that, if present, would support educators' transition to designers of learning experiences enhanced by technology.

Learning design frameworks were discussed as a support mechanism to be included in PD to enhance educator competencies in BL design (section 2.3.3). When considering these frameworks, ADDIE stands out for its systematic approach, fostering a methodological development of educational experiences. However, its limitations are evident in its lack of emphasis on social interaction and potential to perpetuate top-down knowledge transfer. Extending to online and blended contexts, the CoI framework focuses on the interaction of teaching, cognitive, and social presence, thus enhancing learner engagement.

However, it faces scepticism regarding its depth in fostering meaningful learning. The UDL framework champions inclusivity, emphasising engagement, representation, and expression to accommodate diverse learning needs. However, while it is recognised for its potential to improve learning outcomes, its effectiveness awaits substantial empirical support. Finally, Laurillard's Conversational Framework, with its dialogic and reflective cycle, promises to be adaptable and engaging in blended learning environments, yet calls for refinement to embrace cultural diversity and interactive dimensions of learning.

Reviewing this area of literature has influenced the focus of this study by highlighting key considerations that will guide the study, specifically around the transforming of educators practice and integration of learning design components in the design of a PD model. In addition, instructional design frameworks have highlighted elements of strength from that can be integrated in the design intervention of this study while also addresses their limitations.

2.4 Area 2: Designing Blended Learning

In this section, I explore the pedagogical and technological considerations that are crucial for effective BL design. My analysis in this section draws on 37 of the 83 papers I obtained in my literature search, which was previously described in section 2.2.

Pedagogical considerations for BL (section 2.4.1) delve into the aspects necessary to facilitate meaningful learner interactions and foster an effective learning climate in BL environments. Conversely, technological considerations (section 2.4.2) focus on leveraging digital tools and platforms to support flexible learning opportunities and enhance communication and collaboration between learners and educators. By examining both pedagogical and technological aspects, I aim to gain insights into the intricate process of BL design.

2.4.1 Pedagogical considerations for BL design

The following analysis draws on 21 of the 37 identified literature sources. BL research highlights promising aspects of the approach in educational contexts, scholars discuss the novel and flexible opportunities for learners to actively engage with course content and activities to enhance comprehension, critical reflection, and problem-solving skills among learners within academic settings (Precel et al., 2009; Palmer & Holt, 2014; Müller & Wulf, 2023; Wong et al., 2020). However, despite the growing body of BL research supporting this approach, studies have often focused on learner perceptions, satisfaction, achievement, or technological intervention, and there remains a notable deficit concerning the design aspects of BL (McGee, 2014; Müller & Wulf, 2023).

According to Chen and Yao (2016), studies that focus on BL design often focus on the technology affordances rather than the pedagogical considerations. However, the emphasis on pedagogical aspects of BL design should be prioritised because of its complexity, which requires more than simply integrating digital technologies into existing face-to-face instruction (Gedik et al., 2013; Vaughan et al., 2017). Scholars have identified that it is crucial to underscore the importance of understanding pedagogical practices or pedagogical knowledge for BL design (Bizami et al., 2023; Shand et al., 2016).

When considering pedagogical practices for BL design, having a strong understanding of the BL concept is key. Vaughan et al. (2017) found that it was essential that educators had a pedagogically correct understanding of the concept of BL in order to engage and perform in the BL design process. When approaching the design of BL, Graham et al. (2013) highlights the need for robust models and theories to guide BL research and practice. The researchers identify that the BL field is moving towards more theoretically grounded approaches to design and implementation, compared with earlier work from Charles Graham, 2006. In relation, Liu et al. (2024) advocates for considering appropriate learning theories, along with curriculum design and implementation models to guide BL design. Precel et al. (2009) argues for pedagogical design considerations in relation to course materials, learning platforms, and educational roles. McGee (2014) proposes that effective BL design should prioritise pedagogical aspects, such as how to design for knowledge acquisition, active participation, and reflection to enhance the learning experience.

Despite general agreement on the pedagogical focus on BL design, Bizami et al. (2023) discussed that little is still known about the best way to design effective BL experiences. Graham (2013) identifies key areas of emerging research in BL, including instructional design strategies, and institutional support structures and Boelens et al.'s (2017) study necessitates careful pedagogical considerations to address challenges, such as the promotion of flexibility, social interaction, support for learner diversity, and the cultivation of an effective learning climate. The importance of understanding how these factors interact to create effective BL environments as discussed by Graham, 2013.

Gedik et al.'s (2013) suggests that pedagogical frameworks can provide valuable guidance in helping educators navigate course design elements such as pedagogical approach, course organisation, materials preparation, interactions, and the roles of educators and students. However, educators have criticised the current types of BL models (i.e. rotational, flex, self-blend, and enhanced virtual models) for being impersonal, sequential, and disconnected elements (Bidarra & Rusman, 2017; Lucke, 2011; Whyte, 2018). Bligh (2022) discusses the flipped learning pedagogical model, which is often focused on information delivery through online materials and can be uncertain about the positioning of in-person or synchronous aspects of the learning environment. In relation to this, Picciano (2015) states that there remains a lack of clearly articulated pedagogical models to guide BL course design, something this study aims to address.

Consequently, the literature highlights that BL provides promising opportunities for enhancing learner engagement, comprehension, and critical thinking through active participation and interaction with course content. However, what seems underexplored is the specific design aspects of BL, particularly the need for clearly articulated pedagogical models that effectively integrate both digital technologies and face-to-face instruction to address flexibility, social interaction, and support for learner diversity.

2.4.2 Technological considerations for BL design

The following analysis draws on 20 of the 37 identified literature sources. According to several scholars, the affordances of the technology aspect of BL include providing flexibility in terms of time and place, time conservation, learner control over pace and content, the ability to track learner progress, and the improvement of interaction, collaboration, and communication opportunities (Bizami et al., 2023; Gedik, et al., 2013; Müller & Wulf, 2023). An equally important aspect for consideration in the design of BL is educators' technological skills and competencies, as they will inevitably influence educators' design approaches (Prasetya et al., 2020). Appropriate utilisation of technology can allow educators to reach a wider audience that is not bound by time or location; however, challenges arise with its utilisation. Although, Vaughan et al. (2017) identified that barriers to educators' adoption of BL relate to their confidence in technologies, indicating that even educators who identify as being comfortable with technology in their teaching do not have confidence in utilising technology in BL design due to lack of time to prepare new and appropriate teaching and learning materials, restricted access to technological resources, and a lack of innovative teaching strategies to address the digital preferences of learners.

The design of BL is a complex process, and several scholars have highlighted the importance of technological considerations in the design and integration of effective blended synchronous and asynchronous learning environments (Angelone et al., 2020; Precel et al., 2009; Lakshmi &Lakshmi, 2020). According to Kaufman (2018), it is essential to involve both pedagogical and technological elements to promote active learning experiences and student-centred pedagogies. McGee (2014) discussed how technology plays a key role in allowing active participation in virtual learning environments. Milad (2018) argues that BL design should utilise technology in both face-to-face and online learning environments.

However, educators’ use of digital technology is often limited to research, academic writing, and communications. Few have advanced experience using technology for teaching activities with educators’ perceptions and skill levels relating to technologies directly related to their adoption of digital technologies for BL (Vaughan et al., 2017)

Núñez-Canal, et al. (2022) and Jayashanka et al. (2018) both stress the significance of educator digital competence and the synergy between learning analytics and design in improving BL. Sibanda and Josua (2022) and Ismaya (2022) further explore the role of technology in enhancing student engagement and the capabilities of digital education technology in BL. The creation of digital learning content for BL also requires appreciation for the affordance that technologies offer to support the design, development, and dissemination of digital learning content (Papanikolaou, et al., 2017). Researchers have stated that educators with little experience in creating and utilising digital learning content and tools will typically be resistant to BL, whereas educators who are enthusiastic about the prospects of digital learning content and tools will be much more likely to actively facilitate a shift towards BL (Prasetya et al., 2020).

Tayag (2020) and Falloon (2020) both identified that for effective BL design, educators and learners should be provided with appropriate technological support or technical skills and training. To ensure that educators utilise technology to adequately design BL and that learners have the necessary skills to benefit from the affordance's technology offers in a BL environment. Falloon (2020) also proposed a digital competence framework that builds on Mishra and Koehler’s (2009) TPACK model.

Consequently, the literature usefully highlights the affordances of technology in BL to provide significant benefits, such as flexibility, learner control, and enhanced interaction, while also emphasising the importance of educators' technological skills in designing effective BL environments. However, what seems underexplored is how educators develop the necessary technological competence to leverage these tools effectively in their teaching practices, suggesting a need for further investigation into strategies for building digital skills and integrating technology in a pedagogically sound manner.

2.4.3 Summary: Area 2

In conclusion, BL presents a multifaceted challenge encompassing both pedagogical and technological considerations. While BL research highlights promising aspects of learner engagement and critical skill development, a notable deficit remains in articulating specific pedagogical design approaches for BL. Several scholars identify the need to prioritise pedagogical aspects over technological ones due to the complexity of BL design, although this viewpoint is not a consensus.

Technological considerations play a crucial role in shaping effective BL environments, with scholars stressing the importance of educators' technological skills and competencies. Despite the affordances that technology offers, challenges persist, such as educators' limited experience with digital learning tools and the need for adequate support and training. Moving forward, a comprehensive approach that integrates both pedagogical and technological elements is essential for promoting engaging learning experiences in BL environments.

2.5 Research Questions

The literature review discussed the increasing demand for BL while acknowledging the complexity of BL design. The impact on the educator's role to develop competencies for BL was also highlighted. However, the literature was lacking in proposing strategies to support educators in designing BL. Therefore, this study's main research question is:

RQ1: How can educators be supported to design BL?

The literature did highlight the role of PD in supporting educators' pedagogical approaches and technological competencies for BL design. However, educator resistance to PD was highlighted as an area of concern, leading to the sub-research question of:

RQ1.1: How can educator PD be designed for engagement?

In addition, learning design skills were identified as a priority area of focus for PD in BL design. However, what was not evident was what the practical development and application of learning design skills among educators looked like, leading to the sub-research question of:

RQ1.2: How can educator PD support learning design skills for BL design?

Finally, in addition to discussions of learning design frameworks, the literature discussed both pedagogical and technological considerations for BL design. However, there was no consensus of approach that combines the best of both elements for successful design of BL. This led to the formulation of the sub-research question:

RQ1.3: What specific pedagogical design approach can be followed for BL design.

2.6 Conclusion

This chapter provided a review of literature to set a foundation for the study and identify areas for potential contributions relevant to the design of PD for BL design in HE. The systematic literature search focused on empirical studies that identify research that detail the impact of PD approaches on educators' practice and on both pedagogical and technological considerations for BL design. The inclusion/exclusion criteria ensured the selection of studies that addressed the specific relevance of PD for educators transitioning to BL.

The review highlighted key themes that this study should further explore in alignment with the research question of, how can educators be supported in the development of BL designs. The themes of the changing role of educators, the importance of learning design skills, and the value of learning design frameworks will be considered. The review also highlighted the dual challenge of integrating pedagogical and technological skills in BL design, emphasising a need for a balanced approach in the design intervention.

Moving forward, the next chapter will explore the underpinning theoretical framework that will guide this study. This will include a deeper exploration of the TPACK framework, including its use in this DBR study for guiding the analysis, design, implementation, and evaluation of the PD interventions.

CHAPTER 3: THEORETICAL FRAMEWORK

This DBR study aimed to explore PD for educators' design of BL. Given the complexity of integrating the BL elements of technology, pedagogy, and content in educational settings, this study utilised the Technological Pedagogical and Content Knowledge (TPACK) framework as its foundational theory. The TPACK framework provides further structure to the DBR phases of analysis, design, implementation, and evaluation, ensuring a balanced integration of technological, pedagogical, and content considerations throughout the research process. This chapter first discusses the ontological and epistemological positions (section 3.1) that informed my approach in selecting a theoretical framework. Next, the linkage between my ontological and epistemological positions and the selection of TPACK is discussed (section 3.2), the TPACK framework is then covered in more detail (section 3.3). Finally, this chapter discusses how TPACK and DBR are aligned (section 3.4) before discussing the role of TPACK in the study (section 3.5), using a structured approach across the analysis, design, implementation, and evaluation phases of three DBR cycles.

3.1 Ontological and epistemological assumptions

The theoretical foundation of this study is underpinned by the pragmatic ontological and epistemological perspectives. Pragmatism does not confine itself to subjective interpretations of reality, and advocates practicality, flexibility, adaptability, and utility over rigid adherence to a single philosophical stance or set of beliefs (Creswell & Creswell, 2017; Morgan, 2014). With roots that can be traced to scholars such as, Charles Sanders Peirce, William James, and John Dewey, who proposed that knowledge is constructed through the interplay between the researcher and the research context, endorsing the coexistence of multiple perspectives and interpretations (Dewey, 1918).

Pragmatism permits the integration of multiple epistemologies contingent on the research context, examining alternative perspectives, including constructivism, post-positivism, and transformative stances (Creswell & Creswell, 2017; Morgan, 2014), to make informed decisions for this study. In terms of this study, pragmatism aligns with my professional experiences and understanding of the current educational landscape (section 1.1), which I am motivated to produce outcomes with practical relevance to educational practice.

Pragmatism enabled me to seek the most effective methodologies to investigate the complex phenomena of BL design as it is open to multiple viewpoints and interpretations, encourages collaboration among diverse stakeholders, and fosters a comprehensive understanding of the research problem (Morgan, 2014). DBR was ultimately selected for this study, discussed in detail in section 4.2, to allow a comprehensive examination of educator PD for BL design.

In relation to my stance on learning design, although my personal learning approach tends towards individual, self-directed, and practical learning methods. I view myself as a designer of learning and, overall, subscribe to the constructivist philosophical perspective. I believe that learning experiences should be intentionally built to address learners' needs, ‘selecting’ appropriate vehicles or components to achieve desired goals without adhering to a single prescribed method is my goal. Pragmatism aligns with my stance on learning design and allows me to recognise the value of various methods, ranging from concepts of constructivism, recognition of multiple realities, problem-centric approaches, and mixed data collection methods that can be amalgamated when appropriate from a pragmatic perspective (Creswell & Creswell, 2017).

The pragmatic perspective is advantageous for this DBR approach to PD for BL design, as it recognises the diverse experiences and perspectives of the stakeholders involved in the research. In addition, the flexibility it offers ensures that the PD interventions developed in this study will be responsive to the dynamic educational landscape; however, I feel a solid theoretical underpinning is needed to balance the flexibility of a pragmatic perspective. Fundamentally, both Pragmatism and DBR are intertwined to ensure that the findings of this study are not only theoretically sound but also applicable in a pragmatic real-world context.

3.2 Selection of TPACK as the theoretical framework

The TPACK framework was selected as the theoretical framework for this study. As previously discussed (section 3.1), my pragmatic ontological and epistemological perspective offers flexibility of epistemologies, methodologies, and methods for a practical outcome. In the context of BL design, a pragmatic perspective acknowledges that there is no singular optimal way to design or deliver PD (Evans, 2018). However, foundational navigation is needed to balance the flexibility offered by pragmatism and guide the direction of the study.

The TPACK framework embodies a pragmatic application to the development of teaching practice by focusing on the dynamic reciprocal relationship between the domains of content, pedagogy, and technology (Koehler & Mishra, 2014). While acknowledging that different situations require different combinations of these three elements (Koehler et al., 2013), TPACK provides a robust, well-defined theoretical underpinning for this study.

TPACK aligns with my pragmatic viewpoint that knowledge is neither fixed nor universal but rather shaped by context and the specific problem at hand (Morgan, 2014). The framework has emerged as a reliable theoretical framework aimed at specifying what knowledge is required for teaching in a technology-enhanced era such as BL (Pareto & Willermark, 2019). While the TPACK framework has been extensively applied in practical settings, more recent applications have utilised the framework to assess educator competence in the domains of TPACK (Willermark, 2018). However, this study utilised TPACK for its original purpose, a qualitative, design-focused approach, to identify the essential learning design process to enhance teaching practice (Koehler & Mishra, 2014; Pareto & Willermark, 2019).

While the TPACK framework provides a valuable lens for understanding the complex interplay of technology, pedagogy, and content knowledge for this study, it is important to acknowledge its limitations and weaknesses.

A significant criticism of TPACK is the challenge institutions face in implementing effective PD programmes based on this framework. Archambault and Barnett (2010) argue that the boundaries between the different knowledge domains in TPACK are often blurred, making it challenging to focus PD interventions. Cox and Graham (2009) highlight that while TPACK provides a conceptual understanding of the knowledge required for effective technology integration, it does not offer clear guidelines on how to develop this knowledge in educators. Furthermore, Brantley-Dias and Ertmer (2013) point out that the TPACK framework, while conceptually sound, often proves difficult to operationalise in practice, potentially limiting its practical application in PD contexts.

This gap between theory and practice often results in PD efforts that fail to effectively enhance educators' technological and pedagogical competencies. Therefore, in this study I decided to utilise TPACK's strengths by aligning specific content and learning activities to specific knowledge domains, for holistic development of pedagogical and technological skills in a practical approach.

Alternative theoretical frameworks were considered such as Social Learning Theory (SLT), highly valuable for understanding how individuals learn from observation modelling, and reinforcement of others (Bandura, 1977). SLT's focus on the interaction between cognitive, behavioural, and environmental influences offers rich insights into learning processes. However, it was not chosen for this study as it does not sufficiently address the integration of technological and pedagogical elements specific to BL.

In addition, Communities of Practice (CoP) was considered as the approach provides a powerful framework for peer-led communities that support participants to share experiences and collaborate on topics of shared interest, such as BL (Wenger-Trayner & Wenger-Trayner, 2015). CoPs aim to foster deep, collaborative learning and professional growth. Nevertheless, CoPs were not selected for this study as the primary focus is on designing PD for BL, which TPACK addresses more directly.

Finally, the Community of Inquiry (CoI) framework was considered for creating collaborative-constructivist learning experiences by developing social, cognitive, and teaching presence (Garrison et al., 2003). While CoI is particularly effective in online and BL environments, it was not selected as TPACK offers a more comprehensive framework for understanding the specific knowledge domains necessary for effective BL design and implementation.

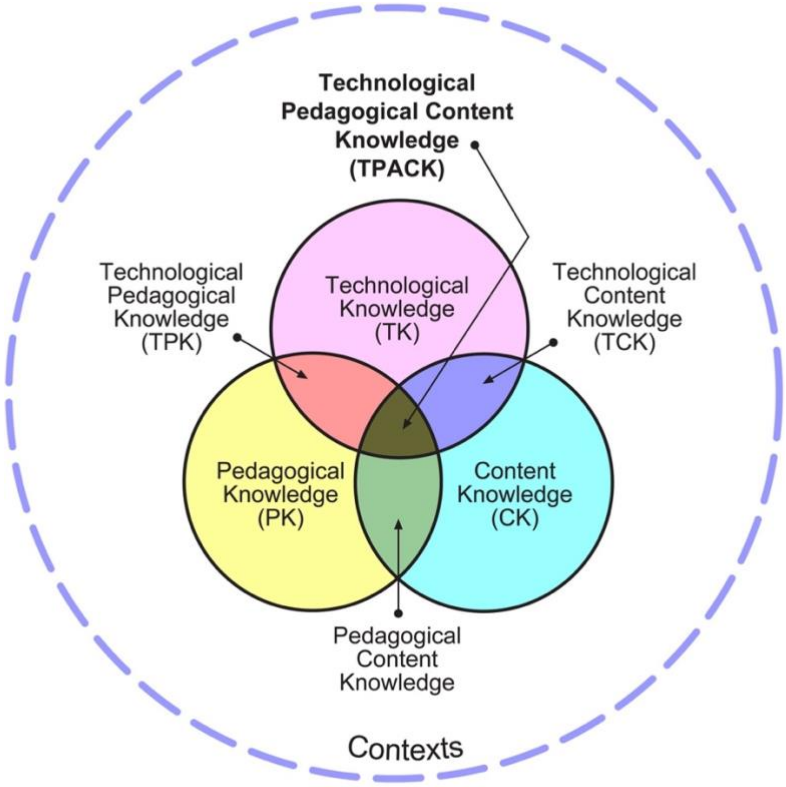
These alternatives were considered for their valuable contributions to understanding learning and collaboration. However, the TPACK framework was ultimately selected for its comprehensive approach to integrating technology, pedagogy, and content knowledge, which aligns closely with the goals of this DBR study.

3.3 Exploring the TPACK Framework

A design-focused TPACK framework is crucial for this study, as it delineates the integral knowledge domains for the effective integration of technology and pedagogy for enhanced teaching practice (Mishra & Koehler, 2009). The TPACK framework (Figure 3.1) comprises three main interrelated knowledge domains: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). TK refers to educators' proficiency in various learning and teaching tools and systems, including hardware, software, and digital tools for supporting student learning. PK pertains to educators' strategies and methods for supporting student learning, assessment, and classroom management along with an understanding of how to adapt teaching strategies to meet diverse learners' needs. CK involves educators' understanding of their discipline areas, such as Maths, Science, English, etc., encompassing the knowledge of facts, theories, frameworks, concepts, principles, and processes (Koehler & Mishra, 2014).

The intersection of the three main domains forms sub-domains of pedagogical content knowledge (PCK), which relates to the understanding and representation that an educator makes of the specific teaching content for its teachability and learnability; technological content knowledge (TCK), which corresponds to the understanding and representation that an educator makes about how a technology can enhance or limit a specific teaching content; technological pedagogical knowledge (TPK), which accounts for the understanding and representation that an educator makes about how a technology influences the strategies used in pedagogical application. Finally, technological pedagogical content knowledge (TPCK) arises from the integration of PCK, TCK, and TPK, which corresponds to the understanding that an educator has for the good teaching of content with integrated technology (Koehler & Mishra, 2009; Sierra et al., 2023).

Figure 3.1: *Representation of the TPACK Framework, (Koehler & Mishra, 2009)*



Since its introduction in 2006, educational discourse has identified TPACK as a universally recognised framework for supporting technology integration in educational settings. While the impact of the framework is difficult to summarise because of its vast usage and interpretation, several systematic reviews have discussed its overall usefulness in educator development research, along with potential challenges (Chai et al., 2013; Rosenberg & Koehler, 2015; Sierra et al., 2023; Voogt et al., 2013; Willemark, 2018; Wu, 2013). A primary challenge identified in the current study relates to ensuring the effective balance and integration of educators technological, pedagogical, and content knowledge (Sierra et al., 2023; Voogt et al., 2013). Many educators struggle with this balance, often due to a lack of targeted PD that addresses the development of domains simultaneously (Chai et al., 2013; Voogt et al., 2013). In addition, much of the recent research relating to TPACK has focused heavily on quantitative survey-based approaches to measuring educators' TPACK, although this approach has significant limitations (Archambault & Barnett, 2010; Bostancıoğlu & Handley, 2018). These methods often rely on educators' self-reported data, which can introduce biases and fail to capture the complexities of integrating technology, pedagogy, and content knowledge in specific contexts (Voogt et al., 2013; Willemark, 2018).

Therefore, this study seeks to overcome these limitations by adopting the original approach taken by Koehler and Mishra (2005), a qualitative, design-focused approach that includes observations, interviews, and artefact analysis. By doing so, the design-focused approach will address the challenges of the successful development and integration of TPACK by utilising the framework to guide the design of PD interventions, ensuring that educators develop a holistic understanding of BL design and enhance the practical applicability of the findings (Joubert, et al., 2020; Pareto & Willermark, 2019; Valtonen et al., 2015).

3.4 Linking design-focused TPACK to DBR

The integration of a design-focused TPACK framework with DBR methodology is essential for exploring pedagogical practices and technological integration in this study. Koehler and Mishra's (2005) seminal work on TPACK supports a design-focused research approach, while DBR aims to enhance educational practices through iterative cycles of analysis, design, implementation and evaluation. This collaborative process between researchers and practitioners in real-world settings ensures practical applicability and continuous improvement (Anderson & Shattuck, 2012).

Therefore, a design-focused TPACK framework provides a robust theoretical grounding for this DBR study, with both emphasise on the ongoing design and enhancement of educators' practices. The TPACK framework is dynamic, responsive to technological advancements and evolving teaching demands, aligning well with the iterative nature of DBR. Both approaches prioritise the cyclical refinement of teaching practices and technological integration, informed by feedback, reflection, and data analysis.

This DBR study has incorporated concepts, such as *constructivist principles, collaborative design, reflective evaluation, and iterative design processes,* identified from various design-focused TPACK studies and are discussed in more detail below.

PD based on *constructivist principles* is essential in developing educators' pedagogical and technological skills. PD centred on collaborative design activities and practical experience in integrating technology into their teaching can develop a deeper understanding of how to design and implement effective BL environments (Papanikolaou et al., 2017). This study's pragmatic approach aligns with constructivist elements, aiming to create PD courses that emphasise hands-on collaborative learning experiences.

The *collaborative design* of technology-integrated lessons is crucial for developing educators' TPACK competencies. Facilitating such collaborative efforts among educators can help them understand how to integrate content, pedagogy, and technology effectively into their lesson plans. Collaborative design sessions enable educators to share insights and strategies and enhance their ability to meaningfully use technology in their teaching practices. (Koh & Divaharan, 2013; Koh et al., 2012). The approach is relevant to this study, as it emphasises the importance of collaboration during PD, and discussion related to fostering TPACK development is essential for creating robust BL environments.

Reflective evaluation is also vital for understanding how educators implement TPACK in their instructional approaches. By analysing reflections on peer teaching performance and student teaching placements, educators can gain deeper insights into their pedagogical strategies and technology integration. Reflective evaluation helps educators identify areas of strength and need improvement, fostering a culture of continuous professional growth (Tokmak et al., 2013; Maeng et al., 2013). This study adopted this reflective approach to ensure that PD programmes encourage educators to continuously assess and improve their teaching methods.

Finally*, Iterative design processes* are essential for developing effective PD programmes that can adapt to the evolving needs of educators and technological advancements. This iterative approach is crucial for fostering sustainable improvements in educators' technological and pedagogical practices, ultimately enhancing the quality of BL environments (Koehler & Mishra, 2009; Angeli et al., 2016). Through continuous refinement and improvement of PD interventions across multiple cycles of analysis, design, implementation, and evaluation, this study ensures that PD programmes remain relevant and effective. Both the design-focused TPACK framework and DBR methodology are complementary in this study because of their shared flexible, iterative, and collaborative nature.

3.5 The role of TPACK in the DBR phases

DBR approaches allow for iterative refinement of designed PD interventions, ensuring that they are both effective and relevant. The iterative nature of TPACK and DBR supports continuous improvement and adaptation, aligned with the goals of this project to create sustainable PD programmes. This study utilised TPACK in the DBR approach to structure and guide the study through cycles of *analysis, design, implementation*, and *evaluation*, as discussed below.

TPACK's role in the *analysis* phase of each cycle provided a structure for literature analysis. Key considerations from the literature were highlighted in relation to aspects of course design, the content-related piece in this study (CK), along with pedagogical knowledge (PK), and technological considerations (TK) to inform the design interventions, as shown in cycle-A, section 5.1.4, cycle-b, section 6.1.8, and cycle-C, section 7.1.4.

TPACK's role in the *design* phase was built on the key considerations from the analysis phase of each cycle, to provide and organise structure for the design conjectures (DCs), clustered by domains of CK, PK, and TK as shown in cycle-A (section 5.2.1), cycle-B (section 6.2.1), and cycle-B (section 7.2.1). This organisational structure helped ensure that the conjectures were balanced across the key domains of TPACK. In addition, when mapping the design elements in each cycle's conjecture map, the domains of TPACK development were identified, as shown in cycle-A section 5.2.3, cycle-B section 6.2.3, and cycle-C section 7.2.3, which ensured that the key domains and sub-domains of TPACK were considered in the design of the intervention courses.

TPACK's role in the *implementation* phase intended to develop participants' knowledge domains, ranging from CK, PK, TK, PCK, TPK and TPACK. The content and activities within the design intervention resulted in the creation of design artefacts as part of a participant portfolio, as shown in cycle-A section 5.3.4, cycle-B in section 6.3.4, and cycle-A in section 7.3.4.

TPACK's role in the *evaluation* phase of each design intervention focused on the organisation of the evaluated DCs around the domains of CK, PK, and TK, as shown in section 5.4.8, cycle B section 6.4.6, and cycle C section 7.4.4. This structure provides a consistent alignment with the next iteration of the DCs.

Overall, the TPACK framework provides a robust theoretical underpinning for this DBR study, facilitating a comprehensive exploration of PD in BL design. This chapter discussed the significance of collaborative design, reflective evaluation, constructivist training, and the application of TPACK in DBR, highlighting their roles in developing effective PD programmes. Moving forward, the next chapter will build on these discussions by examining the specific methodologies and interventions employed in this study, further detailing how TPACK and DBR were utilised to enhance educators' competencies in BL design.

3.6 Conclusion

This chapter has explored the foundational role of the TPACK framework in guiding the design of PD for BL within the DBR methodology for this study. My pragmatic ontological and epistemological perspectives underpinning this study allow for flexibility and adaptability, ensuring that PD interventions are responsive to a dynamic educational landscape. How the TPACK framework supports the consideration of content, pedagogy, and technology by providing a robust structure for iterative cycles of analysis, design, implementation, and evaluation was discussed.

The alignment of TPACK with DBR methodologies emphasises the importance of collaborative design, reflective evaluation, and constructivist training in developing educators' competencies. By utilising a design-focused approach, this study aimed to address the challenges of integrating TPACK domains, ensuring that PD programmes are both theoretically sound and practically applicable. Moving forward, the next chapter on research design will delve into more detail related to the DBR methodology and interventions employed in this study, detailing how TPACK and DBR were utilised to enhance educators' competencies in BL design.

CHAPTER 4: RESEARCH DESIGN

The first section of this chapter discusses the rationale for selecting a DBR methodology (section 4.1), including the characteristics of DBR that align with the study and the consideration of alternative methodologies. The role of the TPACK framework is discussed (section 4.2). The application of DBR is discussed in detail in the third section of this chapter, covering the research site (section 4.3), insider research (section 4.4), and participants (section 4.5), before discussing the design of the DBR study (section 4.6). The various data collection methods are then discussed in the fourth section of this chapter (section 4.7), and the data analysis is discussed (section 4.8) before moving onto research ethics (section 4.9) and the conclusion (section 4.10).

4.1 Rationale for a Design-Based Research Methodology

My motivation for this research, discussed in section 1.1 and 3.1, stems from the desire to explore a pragmatic, pedagogically focused approach to support educator PD for BL design. I carefully considered the contextual realities of the organisation, particularly the teaching workloads of educators. This consideration was crucial, as it could potentially limit their capacity to participate in research activities. Therefore, my goal was to implement a methodology that would allow for direct collaboration with educators, placing them at the heart of the research process, to guide the application of theory in a way that would mutually benefit the development of their teaching practices. Furthermore, I sought a research method that would facilitate meaningful improvements to their BL design while being mindful of not adding significantly to their existing workload pressures.

To achieve my intention in this research, I employed the DBR approach. The DBR methodology acknowledges the limitations of traditional research methods which often fail to account for the intricacies of 'real-world' educational settings and teaching practices (Vaezi et al., 2019). In relation to my pragmatic approach, the iterative nature of DBR focuses on continual learning and improvement, which is important for refinement of the design intervention (McKenney & Reeves, 2021). In DBR methodology, the process is as important as the product, and each iteration is considered a sub-result that leads to the next iteration (Bourdeau, 2017). DBR is also well suited to the complex and dynamic nature of BL design, where theory and practice are intertwined and knowledge is context-dependent (Morgan, 2014; Reeves, 2005). In addition, DBR provides opportunities for collaboration between researchers and research participants, facilitating the co-creation of context-specific interventions and refinement of novel solutions (Anderson & Shattuck, 2012; Armstrong et al., 2022; Martinez-Alvarez & Bannan, 2013).

My research design draws on evidence-based, iterative, theoretically grounded, pragmatic, and collaborative DBR characteristics (Chammas, 2020; Creswell & Poth, 2016; Design-Based Research Collective, 2003; Koehler & Mishra, 2009; McKenney & Reeves, 2021; Mercer, 2007; Papanikolaou et al., 2017; Vaezi et al., 2019; Wang & Huang, 2018). An overview of which is presented below:

1. Evidence-based: The design intervention was informed by contemporary literature on identified themes, in combination with qualitative data gathered from participants.
2. Iterative: The design intervention was refined over three cycles of analysis, design, implementation, and evaluation, before concluding with contributions.
3. Theoretically grounded: This research is rooted in the TPACK framework and seeks to address the 'real-world' challenges of improving educators' blended learning design skills.
4. Pragmatic: The design intervention was developed with the intention of supporting participants' pedagogical and technical skills in blended learning design.
5. Collaborative: As an insider researcher, I worked directly with participants throughout the design intervention. Data were collected from participants informed subsequent iterations of the course, including the structure, content, and modality of delivery.

4.1.1 Knowledge contributions of DBR

DBR in education advances knowledge through a collaborative iterative process and knowledge contributions can be categorised as *theoretical outcomes* and *practical outcomes* (Armstrong et al., 2022).

Theoretical outcomes aim to further understand and advance educational theories (Collins et al., 2016). The emphasis on context within DBR strengthens the validity of its knowledge claims. Researchers have studied cognition in real-world settings to develop evidence-based insights into learning processes (Barab & Squire, 2016). This new understanding of learning informs and drives future research and practice, thus continuously contributing to the field's growth. In this study, TPACK provides the theoretical focus with its relationship with DBR, as discussed in section 4.2.

Practical outcomes are the primary objective of the DBR approach, aligning with my pragmatic stance, to create context-specific, meaningful interventions and practices (Barab & Squire, 2016). DBR aims to advance our knowledge of how to design interventions and processes that lead to the creation of adaptable and transferable solutions capable of migrating from experimental settings to real-world educational settings for the benefit of learners and educators (Brown,1992; Plomp, 2013). Educational solutions can include technological tools, curricula, artefacts, and, as in the case of this study, a learning design model.

4.1.2 Limitations of DBR

The selection of DBR for this study was made on consideration of several limitations that can be categorised into five top-level areas: *Contextual Constraints*, *Participant Diversity and Sample Size*, *Design Constraints*, *Technological and Pedagogical Scope,* and *Reflective Practices and Participant Engagement*. Each of these categories are discussed below, highlighting specific aspects of the DBR methodology that may affect the generalisability and interpretation of the findings. For a more detailed exploration of these categories and limitations, along with specific examples, refer to Table 4.1.

The first category*, contextual constraints,* encompasses the limitations related to the specific setting of the DBR research. For example, the study was conducted in the UOWD, a unique institutional environment with its own policies and cultural dynamics, along with accreditation limitations.

The second category, *participant diversity and sample size*, reflects constraints regarding the DBR study's relatively small participant pool. In addition, there were limitations related to the participants' similar professional experiences.

The third category, *design constraints,* relates to the challenges of the research design and data collection methods. Limitations related to consistency, along with the sources of data used in the study and the lack of longitudinal exploration of the PD aspect of the study are outlined in Table 4.1.

The fourth category discusses *the technological and pedagogical scope* and highlights the limitations associated with the theoretical framework and technological focus of the study.

Finally, the fifth category, *reflective practices and participant engagement,* addressed the variability in participants' engagement levels and the subjective nature of reflective practices.

Table 4.1: *Limitations of DBR*

Category	Limitation	Details
Contextual Constraints	Single Research Site	The research was conducted at the University of Wollongong in Dubai, a unique setting with specific institutional policies and cultural dynamics, therefore findings may not be directly transferable to other HEI internationally with different contexts or cultures.
	Accreditation-Driven Blended Learning	The implementation of BL at UOWD was shaped by UAE's CAA accreditation guidelines, which may limit the generalisability of the findings to other contexts with alternative understandings of BL and accreditation requirements.
Participant Diversity and Sample Size	Limited Participant Pool	The study involved a relatively small number of volunteer participants, which may affect the generalisability of the findings. The self-selection bias could influence outcomes as participants might have been more motivated or predisposed to adopt BL strategies.
	Homogeneity of Participants	Most participants identified as experienced in traditional face-to-face teaching but had limited prior experience with BL, potentially underrepresenting challenges faced by more technologically adept or pedagogically diverse groups of educators.

Design Constraints	Consistency	The iterative nature of DBR can pose challenges in maintaining consistency across cycles. Elements of the design that have been selected to stay the same in one cycle might not be perfectly replicated in subsequent ones, affecting the comparability of data.
	Data Collection and Analysis	Primary data sources included participants' design artefacts and post-course interviews, which may not capture the full extent of participants' learning and development. Reliance on self-reported data may introduce biases such as social desirability bias.
	Lack of Longitudinal Data	The study did not include a long-term follow-up to assess the sustainability and long-term impact of the PD interventions, reflecting primarily short-term outcomes and immediate feedback from participants.
Technological and Pedagogical Scope	Focus on TPACK Framework	The selection of the TPACK framework for the theoretical framework might have overlooked other relevant frameworks or models, potentially limiting the exploration of alternative or complementary approaches to PD in BL design.
	Technological Limitations	The PD course emphasised specific technological tools and platforms available at the research site, which would likely differ significantly in contexts with different technological infrastructures or resources.

Reflective Practices and Participant Engagement	Varied Engagement Levels	Participants' engagement with reflective practices and collaborative activities varied, potentially influencing the depth and quality of the data collected. Some participants might have engaged more deeply, providing richer data, while others might have been less engaged.
	Subjectivity in Reflective Practices	Reflective practices introduce subjectivity, affecting the consistency and objectivity of the findings as participants' reflections are inherently personal and can vary widely in depth and honesty.

4.1.3 Alternative methodologies

Before selecting DBR for this study, alternative methodologies were considered and discounted. These included the Change Laboratory, rooted in activity theory, which was recognised for its utility in collective transformation within educational practices (Sannino & Engeström, 2018; Bligh & Flood, 2015). However, concerns about sustained participant engagement in the research site of this study led me to discount the approach. Phenomenology was considered to provide insights into educators' lived experiences (Creswell & Poth, 2016). However, its individualistic focus might overlook broader systemic influences on BL implementation. Case study research was considered for its effective examination of contemporary phenomena (Yin, 2018). However, it was discounted by my concerns over generalisability. Finally, action research was considered due to its participatory in nature and facilitation of close collaboration with participants (Cohen et al., 2017). However, it was discounted as it might not achieve the theoretical depth provided by the DBR.

Ultimately, DBR's theoretical and practical duality, its iterative and responsive nature, and its capacity to integrate diverse data types advocated by pragmatic philosophy (Morgan, 2014; Reeves, 2005) made it the most fitting methodology for this complex investigation into educator professional development for BL design.

4.2 The role of TPACK in this DBR study

As discussed in Chapter 3 and in relation to the theoretical outcomes, the TPACK framework serves as the theoretical foundation for this study. The role of theory in a DBR study is essential in guiding the design of interventions, providing a lens through which to interpret the findings and contribute to the further refinement of the intervention (Vaezi et al., 2019). In this DBR study, TPACK played a deliberate role in the following ways:

- Analysis - TPACK forms the structure of the literature analysis in cycle-A to ensure that considerations related CK, PK and TK will inform the design intervention
- Design - Conjectures: TPACK domains of CK, PK and TK structure the development of design conjectures that inform the design of the intervention
- Design - Conjecture map: domains of PCK, TK TPK and TPACK are identified on the conjecture map to indicate task structures and participants' outcomes that intend to foster these elements in the design intervention
- Implementation - Intervention Course Structure: TPACK sub-domains are identified on the learning content and activities of the design intervention to indicate the focus area of development for participants'
- Evaluation - Interpreting the data: TPACK forms the structure for the evaluation of design conjectures

The TPACK framework plays a central role in this DBR study by informing the design intervention, offering a perspective for interpreting the data, and evolving through the insights gained during the research process. The application of TPACK in this DBR study exemplifies the dynamic interplay between theory and practice, reflective of both the essence of DBR and the pragmatic ontological perspective anchoring this research (Barab & Squire, 2016; Morgan, 2014).

4.3 Research site

This research was conducted at the oldest private university in Dubai, UAE, which was established in 1993. Part of an international network, with its main campus in Australia and additional branches in Hong Kong and Malaysia.

This site has a culturally diverse population of approximately 3,500 undergraduate and postgraduate students who engage in a face-to-face, on-campus educational model.

However, this model was disrupted due to provisions made during the COVID-19 pandemic, leading to the offering of EOL from March 2020 to September 2021. This provision of EOL differed from purposefully designed blended or online learning, as in many cases little thought was given to pedagogical design during this period. Consequently, the institution started investigating more innovative strategies for future educational provisions, particularly the BL redesign of five postgraduate programmes:

- Master of Engineering Management
- Master of Supply Chain Management
- Master of Business Administration
- Master of Business
- Master of Nursing

Each programme consists of 10 modules that run for 10 weeks. A module will have one educator assigned as the module coordinator responsible for the design and delivery of the module. An educator can be a coordinator for 2-3 modules per 10-week trimester. My role at the university was to guide the BL redesign of these programmes through learning design support and PD of educators.

The reasons why this university was an intriguing research site for studying educators' PD for BL design are as follows:

1. Historically, the university's fully face-to-face approach has predominantly been teacher-led.
2. The university has secured approval from its accrediting body, the Commission for Academic Accreditation (CAA), for a substantial change in the delivery modality for the initial five programmes to be redesigned for blended learning.
3. Developments in this transition to blended learning at the Dubai campus could inform decision-making at the campuses in Australia, Hong Kong and Malaysia
4. Despite the strategic move towards blended learning, the organisation has not invested in learning designers, apart from my role as a Lead for Innovative & Digital Education.
5. The onus for redesigning the identified courses relies solely on existing educators. Although these educators have years of teaching experience, many lack specific experience in designing blended learning.

This tension and transition towards blended learning, coupled with limited support, presents an interesting dynamic that this research aims to explore and contribute to the literature related to educator professional development for BL design.

4.4 Insider research

The university selected for this study was based on the rationale set out in section 4.3, including the insight that I held a professional role at the university during the period of the study. The DBR approach allowed me to leverage "insiderness", to engage with study participants' who were also colleagues, to "effect change" (Reinking, 2021).

Insiderness is a concept that exists on a continuum and is influenced by the researcher's familiarity with the components of the research (Chammas, 2020; Mercer, 2007). My then position in both the research project and the institution offered certain advantages. For instance, we were all working towards a common goal of BL redesign and my direct interactions with participants—many of whom I know professionally—allowing me to closely support the realisation of their BL design objectives. Furthermore, working in collaboration with study participants afforded me valuable insights that will enable improvements to design interventions, thereby achieving more impactful outcomes (Anderson & Shattuck, 2012; Barab & Squire, 2016).

However, this approach also presented some potential issues. For instance, there might have been a perception of a top-down approach, given that the roles of the participants differed from my own. While I functioned as the designer and facilitator of the proposed design interventions, the participants' role was to incorporate their learning from the PD intervention and apply it to redesign their individual courses. This role disparity could lead to disengagement among participants, potentially affecting the power dynamics between myself and the participants and may result in reduced engagement in the training course.

Additionally, my direct involvement in this research must be carefully considered. There was a risk of bias towards me seeking a "positive" outcome due to personal investment in the project. I could have overlooked or misinterpreted issues or data because of personal agendas or relationships.

To address potential challenges and biases associated with insider research, several steps were taken to ensure the integrity of the research. These steps relate to data quality, discussed in more detail in section 4.8.3, and data credibility discussed in section 4.8.4. However, an overview of the approaches taken were, setting clear boundaries between my roles as a researcher and a colleague. Participants were assured of confidentiality and their right to withdraw from the study at any time, addressing potential power imbalances (Floyd & Arthur, 2012). Also being explicit about my insider status and its potential implications for the research through the thesis. This transparency allows readers to consider the findings in light of my positionality (Dwyer & Buckle, 2009). I also engaged in reflexive practices to acknowledge and mitigate potential biases. This involved documenting my thoughts, decisions, and considerations in an online notebook and helped me to continuously question my interpretations and decision-making processes (Berger, 2015)

In addition, multiple data sources were triangulated to corroborate findings and reduce the risk of insider bias influencing the results (Greene, 2014). This approach included comparing interview data with participant artifacts and observational notes. Finally, to ensure that my insider perspective did not unduly influence the interpretation of participants' experiences, I employed member checking, see section 4.8.4. Participants were given the opportunity to review and comment on the accuracy of interview transcripts and preliminary findings. Ultimately, I aimed to leverage the benefits of insider research while mitigating potential biases and maintaining the rigor and credibility of the study.

4.5 Research Participants’

The participants were recruited based on the following criteria:

1. Educators at the research site.
2. Teaching a postgraduate course identified blended learning redesign, as discussed in section 4.3.
3. Primarily responsible for course redesign.
4. Willing to engage in a training course to guide the redesign of their courses.

The study aimed to enlist approximately 18-20 educators to engage in each cycle of the design intervention training course. This number was selected based on guidance from qualitative sampling, as Creswell and Creswell (2017) suggested that a sample size of 5-25 participants’ is typically appropriate.

An email invitation was sent to all educators teaching on the identified programmes selected for BL redesign. The invitation contained participant information that explained the purpose of the study and criteria for participation. The email also described the requirement to participate in a PD training course over a period of time designed to develop educators' understanding and application of BL design. Therefore, the participants were given the option to volunteer for this opportunity and were selected based on the criteria stated below.

Interested educators completed an online consent form and were screened to determine their eligibility. In total, 43 participants were recruited across three cycles, none of these participants were involved in more than one cycle, and a total of 29 completed the design intervention, see Table 4.2. The recruited participants came from diverse disciplinary backgrounds, and most had predominantly taught traditional face-to-face courses in the past.

Table 4.2: *Participants recruited*

DBR Cycle	Participants Recruited	Participants completed the design intervention course
Cycle-A	P-A1, P-A2, P-A3, P-A4, P-A5, P-A6, P-A7, P-A8, P-A9, P-A10, P-A11, P-A12, P-A13	P-A1, P-A2, P-A3, P-A4, P-A5, P-A7, P-A11, P-A12, P-A13
Cycle-B	P-B1, P-B2, P-B3, P-B4, P-B5, P-B6, P-B7, P-B8, P-B9, P-B10, P-B11, P-B12, P-B13, P-B14	P-B1, P-B2, P-B3, P-B4, P-B5, P-B6,
Cycle-C	P-C1, P-C2, P-C3, P-C4, P-C5, P-C6, P-C7, P-C8, P-C9, P-C10, P-C11, P-C12, P-C13, P-C14, P-C14, P-C15, P-C16	P-C1, P-C2, P-C3, P-C4, P-C5, P-C6, P-C7, P-C8, P-C9, P-C10, P-C11, P-C13, P-C15, P-C16

4.5.1 Participant engagement

While participant recruitment was successful across all three DBR cycles, it is important to note that participant disengagement varied across the cycles. Considering this variation can provide valuable insights into the effectiveness of different approaches to PD and the challenges faced by educators engaging in BL design.

Cycle-A: In this cycle, 13 participants were initially recruited, with 9 completing the course (69% completion rate). The main reasons for disengagement included:

- Time constraints and workload issues (reported by 2 participants)
- Leaving the organisation (1 participant)
- Unspecified reasons (1 participant)

Cycle-B: 14 participants were recruited for this cycle, but only 6 completed the course (43% completion rate). This marked decrease in completion rate was attributed to:

- The fully online, asynchronous nature of the course, which some participants found challenging to navigate
- Increased workload due to the start of the teaching term
- Technical difficulties with accessing course materials

Cycle-C: 16 participants were recruited, with 14 completing the course (87.5% completion rate). While there was significant improvement in engagement, remaining considerations for improvement consisted of to:

- The course schedule, some participant's found stressful to keep pace with the scheduled activities and workshops
- The course workload volume, some participant's found it overwhelming at times, particularly the pre-class workload

- Technological proficiency, some participant's felt that the technical learning curve to accessing the material hindered engagement

These variations in disengagement across cycles highlight the importance of course design and delivery modality in maintaining participant engagement, discussed further in section 8.3.1.1. The higher completion rate in cycle-C suggests that the flipped learning approach provided flexibility and structure, the introduction of a cohort-based learning model fostered peer support and accountability, and improved technical support helped engage participants through the PD process.

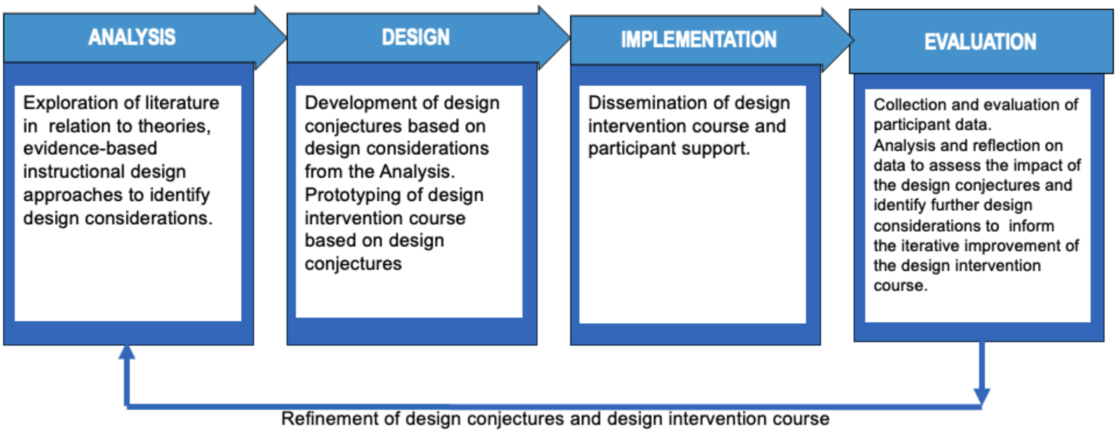
It's worth noting that despite efforts to contact non-completing participants, detailed reasons for disengagement were not always obtainable. This limitation in data collection presents an opportunity for future research to explore more deeply the factors contributing to educator disengagement in PD initiatives.

4.6 Developing the design intervention course

The design intervention for this DBR study took the form of a PD training course that aimed to develop participants' competence in BL design.

The development of the PD intervention course followed an adapted version of McKenney and Reeves's (2021) DBR model (Figure 4.1). One cycle of the model consisted of the completion of the *analysis* (section 4.6.1), *design* (section 4.6.2), *implementation* (section 4.6.3), and *evaluation* (section 4.6.4) phases.

Figure 4.1: *Adapted DBR model (McKenney & Reeves, 2021)*



There is no set number of DBR iterative cycles to refine design interventions to enhance their effectiveness (McKenney & Reeves, 2021; Vaezi et al., 2019). However, the study concluded following three cycles due to three main factors:

1. Reaching a point of saturation with participant recruitment
2. Reaching a point that valuable contributions were able to be made
3. Time considerations for write-up

In addition, as discussed in Chapter 3 (section 3.2), the TPACK framework played a central and varied role in each of the DBR phases, which will be touched upon in the detailed explanation of each phase below.

4.6.1 Analysis

The purpose of the *analysis* phase was to conduct an in-depth exploration of the research problem to pinpoint specific areas that the design intervention should target (McKenney & Reeves, 2021). This study's in-depth exploration focused on the analysis of the literature to identify research-informed key design considerations that would inform the development of design conjectures in the subsequent *design* phase.

Key considerations that were identified during the analysis of literature were marked with the letter ‘A’, ‘B’, or ‘C’ depending on the cycle, along with a corresponding number i.e. ‘A1’, ‘A2’ during cycle-A and ‘B1’, ‘B2’ during cycle-B and so on. At the end of each analysis phase a summary table of all key considerations identified from the literature analysis, organised into appropriate themes and aligned to sub-domains of TPACK is presented cycle-A (section 5.1.4), cycle-B (section 6.1.8), cycle-C (section 7.1.4).

While each cycle followed the same process during the analysis phase, there were slight variations between cycle-A and the following two cycles. *Cycle-B’s analysis phase* was informed by cycle-A’s evaluation of design conjectures, and *cycle-C’s analysis phase* was informed by cycle-B’s evaluation of design conjectures. Further details are provided below.

Cycle-A’s analysis phase (section 5.1) analysis of literature built on the output of the Chapter 2 literature review. The analysis aimed to identify further literature related to PD and BL design with the purpose of informing the design intervention. The literature search sought to uncover the outcomes of PD initiatives designed to equip educators with the skills required to design and implement BL.

To this end, the following search terms were used in the OneSearch database, to identify the appropriate literature:

1. **Professional Development**: This term was used to find literature pertaining to the ongoing education of faculty, with the aim of

understanding how educators are equipped to meet the demands of evolving learning modalities.

2. **Faculty Development**: Included as a synonymous term to professional development to broaden the search and capture any studies that may not explicitly use the term 'professional development'.

3. **Blended Learning Design**: To capture literature that specifically addresses the methodologies, strategies, and frameworks applied in creating blended learning curricula.

The conjunction ‘AND’ was used to ensure that the literature we retrieved discussed both blended learning design and professional or faculty development. The inclusion of ‘OR’ allowed me to cast a wider network, acknowledging that there may be a variety of terms and phrases used in the literature to discuss these concepts.

Filters for publication dates and citations ensured that I focused on the most relevant and recent contributions to the field, which is rapidly evolving due to technological advancements. The inclusion of seminal works through cross-referencing and snowballing allowed me to construct a foundational understanding of this topic.

The results of the literature search, presented in cycle-A: Analysis (section 5.1), are structured in relation to TPACK sub-domains of CK, relating to considerations for the design of professional development, along with PK and TK domains relating to considerations for pedagogical and technological aspects of blended learning design, respectively.

Cycle-B's analysis phase (section 6.1) and *cycle-C's analysis phase* (section 7.1) had less emphasis on analysis of the literature to identify key consideration for 'foundational' design conjectures, instead literature in these two cycles intended to identify key considerations to inform the next iteration of 'partially validated' design conjectures from previous cycles.

4.6.2 Design

The design phase focuses on developing or refining *design conjectures* based on key considerations identified in the analysis phase. A *conjecture map* was then developed to visualise the explicit linkage between design conjectures that inform *embodiments, mediating processes*, and *intended outcomes* for the design intervention.

4.6.2.1 Design Conjectures

The process of developing *design conjectures* is about hypothesising knowledge about which actions under what circumstances will lead to which kind of intended consequences (Bakker, 2018). In this study, the development of design conjectures was based on key considerations derived from the analysis of literature in each DBR analysis phase.

To develop design conjectures, an iterative ideation technique taken from design thinking was applied. The approach involved writing each key consideration, from the analysis phase, on post it notes, grouping them before brainstorming conjectures focused on PD design (CK) and BL design (PK and TK). This process was iterative and involved employing a divergent thinking mindset to create broad, high-level conjectures, followed by convergent thinking to focus on explicit conjectures that could be actionable in the design intervention.

The outcome of the ideation process resulted in several design conjectures underpinned by TPACK to inform the conjecture map, see Table 5.2 for reference. This process was followed for the two additional DBR cycles to refine the design conjecture (Tables 6.2 & 7.2).

4.6.2.2 Conjecture map

The *conjecture mapping* approach allows for an explicit linking between design elements and expected outcomes by hypothesising how these design elements could bring about the desired change (Sandoval, 2014). The visual nature of a conjecture map helps identify potential gaps in design interventions, such as missing links between design elements and their intended outcomes. Additionally, conjecture mapping aids in identifying and anticipating potential issues or challenges that may arise during the implementation phase (Sandoval, 2014). This proactive approach to problem identification can lead to more effective and efficient design solutions.

The conjecture maps for this study, cycle-A (section 5.2.2), cycle-B (section 6.2.2), and cycle-C (section 7.2.2), have four main sections.

1. The ‘design conjectures’, previously discussed (section 4.6.2.1) which are the hypotheses for the design intervention derived from key consideration from the analysis of literature.

2. The intended ‘outcomes’ appear on the far-right of the conjecture map in this study. However, they are considered first in the concept of conjecture mapping, as they are directly related to design conjectures. Outcomes are essentially the 'what'—what is expected to occur as a result of the design intervention course (Sandoval, 2014; Cobb et al., 2003).
3. The ‘embodiment’ section refers to tangible features that can test design conjectures (Sandoval, 2014; Bakker, 2018). In this study, the sub-sections of the embodiment section are *task structures*, *participant structures, discursive practices*, and *tools and materials* purposefully designed to support the achievement of learning outcomes.
    a. *Task Structures* refer to the learning content and activities that participants are expected to engage in as part of the intervention course (Sandoval, 2014; Bakker, 2018). The course structure of the intervention course is presented in this section and provides an overview of the learning content and activities, in addition to the sequencing and hierarchy of the content. The evolution of course structures can be seen for cycle-A (section 5.2.2), cycle-B (section 6.2.3), cycle-C (section 7.2.3).

    b. *Participant structure* refers to the roles, relationships, and social interactions that are established to facilitate learning and engagement in the intervention course (Sandoval, 2014).
    c. *Discursive Practices* refer to specific ways in which communication is used to facilitate learning (Sandoval, 2014).
    d. *Tools and materials* refer to the practical, tangible elements of design interventions (Sandoval, 2014).

4. The ‘mediating processes’ section provides the "how" and "why" linking the features of a designed intervention to its anticipated outcomes. They identify the cognitive, affective, and behavioural activities that are expected to be initiated or influenced by participants’ involvement in the design intervention (Sandoval, 2014; Bakker, 2018). In this case, regarding what observable integrations are there and what participant artefacts are produced, both sub-categories can help to determine whether the outcomes of the design intervention have been achieved and to what degree.

In addition, as the overall intention of the design intervention was to develop participants’ pedagogical and technological knowledge for BL design, the sub-domains of the TPACK framework were identified with various colour coding and overlaid on the conjecture map to help identify specific elements that may need to be adjusted in future iterations.

4.6.3 Implementation

The implementation phase represents a pivotal stage in the DBR cycle, transitioning from theoretical foundations and hypothesised design into the practical application of the intervention in the real-world context (Barab & Squire, 2016; Vaezi et al., 2019). The intervention course was constructed and delivered using alternative modalities (i.e. self-directed, online and blended) across three cycles of development, as discussed in cycle-A (section 5.3), cycle-B (section 6.3), cycle-C (section 7.3). The implementation covers the deployment of the design intervention course, facilitation and support provided, monitoring of participants' engagement in the course, and development of the participants' portfolio of design artefacts.

4.6.4 Evaluation

The evaluation phase involved reflective analysis of data collected from participants during the implementation phase and following their learning experience. Diverse data sources, such as participants' portfolio artefacts (section 4.7.2) and participant feedback (section 4.7.3), are discussed in more detail in the following section. The evaluation aimed to substantiate or revise the original design conjectures and hypotheses. Moreover, this phase provides an empirical foundation for iterative refinement of the design intervention (McKenney & Reeves, 2021). The ultimate goal was not merely to conclude whether the intervention was successful, but to generate nuanced insights that could inform future design iterations and contribute to enhancing the literature on PD for BL design. Findings related to the three iterative cycles can be found in chapters Chapter 5 (cycle-A), Chapter 6 (cycle-B), and Chapter 7 (cycle-C).

4.7 Data collection methods

DBR does not stipulate specific data collection methods, it encourages a variety of methods and analytical approaches that best suit the needs of individual studies (Reinking, 2021). Therefore, as this research focused on the complex processes of PD for BL design via participation in a training course intervention, I selected qualitative data collection methods based on my perception of their suitability to inform the iterative development of the design intervention and ultimately contribute to the literature on PD for BL design.

The data collection methods used to support my investigation were literature analysis (section 4.7.1), design portfolio artefacts (section 4.7.2), and interviews (section 4.7.3). Data collection for each cycle followed the same sequence of:

1. Literature analysis to identify key considerations for the design conjectures
2. Design artefacts were created during participant's engagement in the PD course
3. Interviews were conducted following participant's course engagement

4.7.1 Literature analysis

The analysis of literature in DBR serves multiple purposes (Anderson & Shattuck, 2012). First, builds on the initial literature review (Chapter 2), providing further understanding of the research field. Second, it grounds the design intervention in theoretical knowledge to ensure its relevance to the research field. Finally in relation to data collection purposes, the systematic examination of prior research as previously discussed in detail in the analysis section (section 4.6.1) provides the foundation for the design of the intervention. This approach was used across the three DBR cycles to identify key considerations from the literature that went on to inform the development of design conjectures for the design interventions.

4.7.2 Portfolio artefacts

Learning has been said to be more meaningful when participants construct learning artefacts (Chrysti et al., 2020). The creation of artefacts can offer valuable insights into how participants' grapple with design challenges and the strategies they adopt in response (Hay et al., 2020). This insight can prove invaluable for refining future iterations of design interventions.

Participants engaged in a range of reflective and practical activities during the three DBR cycles. Participant's portfolio development can be seen in cycle-A (section 5.3.4). cycle-B (section 6.3.4) and cycle-C (section 7.3.4). Each portfolio activity aligns with the domains of TPACK, which aims to develop both technological and pedagogical knowledge for BL designs. An example of cycle-A is presented in Table 4.3 below. The artefacts created include reflection posts (PCK), digital learning objects (TCK, TPK, and PCK), and learning design documents (TPACK). The intention of these artefacts was for participants to reflect on their practice and provide evidence of their understanding of the concepts covered during the intervention. Thus, the incorporation of design artefacts as a data collection method in this DBR study enriches the understanding of participants' learning experiences, informs the refinement of the intervention, and ultimately contributes to the overall contributions of the study.

Table 4.3: *Portfolio artefacts - Cycle-A*

Cycle-A		
Portfolio artefact	Course Activity	TPACK
1. Educator Introduction Video	Develop camera confidence by following step-by-step instructions and using the software provided to create an introduction video.	TK

2. Reflective Forum posts	Engage in reflective online forum posts related to content on learning design and the changing role of the educator.	PCK
3. Learning Outcomes development	Develop constructively aligned course learning outcomes based on templates and content related to Bloom's revised taxonomy.	PCK
4. Visual learning design	Develop session-level visual learning designs following the flipped learning model based on a template and supporting content	PCK
5. Instructional video	Create an instructional video with user-friendly tools based on content and guidance.	TPK
6. Revised visual learning design	Revise and further develop visual learning designs based on additional content covered and workshops since artefact #4.	PCK
7. 3-2-1 Evaluation	Provide self-evaluation of the course experience, highlighting 3 things learnt, 2 things to improve and 1 thing still unsure of.	PCK
8. Peer-review	Provide a review on peers' visual learning design and instructional video based on the course template	TPK

9. Quality Assurance Check	Complete the evidence-based self-assessment on redesign course components including digital learning environment.	TPK
10. Action Plan	Develop an action plan for further iterations of course redesign based on results from peer-reviews and quality assurance check.	TPACK

4.7.3 Interviews

Semi-structured interviews are a valuable data collection method within DBR studies, playing a potentially instrumental role in the investigation of educators' PD in BL design (Creswell & Poth, 2016; Brinkmann, 2014). The flexibility inherent in semi-structured interviews is a significant asset. This data collection tool offers an approach to delve into complex topics, such as PD and BL design in a nuanced and thorough manner. As a researcher, it allow me to probe deeper into compelling points and tailor questions based on interviewees' responses, thereby gathering rich, multifaceted data. In addition, participants' perspectives are shared in their own words to articulate their experiences, insights, and reflections on the PD programme and its impact on their practices (Creswell & Poth, 2016; Brinkmann, 2014).

Participants were invited to participate in the interview following the completion of the intervention course. Course completion was an important prerequisite to the interview, as the participant's portfolio artefact provided reflection prompts in relation to some of the questions.

Once participants accepted an interview invitation, the list of interview questions was emailed to them, as detailed in Appendix 1, along with the proposed time slots for a 30-to 40-minute interview to be conducted via Webex. It was also shared that the interview question would be a guide, and the discussion may vary depending on the set of questions.

The interviews were recorded using the Webex software, which also generated transcripts of the interviews. Following cycle-A's interviews, I acknowledged that the interview questions for cycle-B and cycle-C should be more closely aligned to the DCs of the cycle to more explicitly validate or reconsider the DCs.

4.8 Data analysis

The study used a combination of inductive and deductive thematic analyses across all three cycles of DBR, which was also guided by the TPACK theoretical framework.

4.8.1 Selecting the data analysis approach

In line with the pragmatic underpinnings of this DBR study, thematic analysis was identified as the most suitable data analysis approach. Thematic analysis offered the necessary flexibility to uncover rich, detailed insights and accommodate both deductive and inductive coding, aligning with the iterative nature of DBR. This approach allowed for a nuanced exploration of educators' experiences and adaptation of analysis to emerging data patterns, thus supporting the study's aim of refining the design intervention and contributing to the research field (Terry et al., 2017; Kiger & Varpio, 2020).

Alternative techniques were considered, such as grounded theory, while systematic and inductive approaches were set aside because of the need for continuous comparative analysis for theoretical saturation, as it was deemed impractical for this study's iterative and pragmatic objectives (Charmaz & Thornberg, 2021; Gentles et al., 2015). Content analysis, known for its systematic and quantitative examination of artefacts, was also considered, but ultimately discounted. I felt its qualitative nature, with predefined codes, lacked depth to fully explore the subjective and nuanced experiences crucial to understanding educators' professional development in blended learning (Kyngäs, 2020).

4.8.2 Applying the data analysis approach

The *analysis of literature*, *portfolio artefacts*, and *interviews* followed slightly different approaches, as discussed below.

In relation to the *analysis of literature*, once literature was identified, the first task was to 'familiarise' myself with the data by reading the articles (Terry et al., 2017). An inductive approach was then employed to identify potential key considerations that could inform the development of design conjectures in the design phase. To do this, I used an MS Excel spreadsheet to capture key excerpts from the literature, along with authors and potential themes. There was an iterative development of the key considerations before overarching themes were considered, such as 'engagement factors', to group the key considerations. The final step was to align the themes and considerations to the previously identified domains of the TPACK framework, namely CK, PK, and TK, in a deductive categorisation.

In relation to the *analysis of portfolio artefacts*, a deductive approach was adopted. Portfolio activities were identified in the design intervention course that were linked to the achievement of intended learning outcomes, which were aligned to the previously identified domains of the TPACK framework, namely PK, PCK, TK, TPK, and TPACK, to ensure that participants were developing both pedagogical and technological aspects of their blended learning design.

In relation to the *analysis of the interviews*, following the conclusion of interviews for the cycle, transcripts of each participant were produced from the Webex software used for conducting and recording the interviews. I then read the transcripts to familiarise myself with the data and to correct any errors in the transcription by cross-referencing it with the recorded video.

Next, an approach for generating initial codes without any preconceived outcomes was then implemented (Terry et al., 2017). To do this, I used an MS Excel spreadsheet, documenting statements from the transcripts in one column and noting down relevant codes in the corresponding column. This required at least two iterations per participant to ensure that codes were not missed. This study aimed to capture a broad understanding of participants' experiences and perceptions of the design intervention course. I reflected on the codes identified in the data and searched for themes (Terry et al., 2017). I did this by sorting and merging the different codes into logical groups. Themes that emerged from cycle-A dataset for example were ‘reflection on teaching practice’, ‘perceptions of flipped learning’ and ‘challenges in content creation’ to name a few.

Following the inductive approach, a round of deductive analysis allowed for a comprehensive exploration of themes and datasets with the aim of aligning to and evaluating predefined DCs to either validate the DC or identify areas for future refinement of the DC. Each DC is also linked to the TPACK domains of CK, PK, and TK. An example from cycle-A was the theme ‘reflections on teaching practice’ was linked to DC-A2 - Integration of content and activities to provide real-world relevance will increase engagement, and the TPACK domain CK. The theme ‘perceptions of flipped learning’ was linked to DC-A6- The flipped learning model will support educators’ learning design decisions, and the TPACK domain PK and the theme ‘challenges in content creation’ was linked to DC-A7. The considered utilisation of technology will develop participants’ technological experience and competence, and TPACK domain TK. This inductive/deductive analysis supported the evaluation of DCs across all three cycles and informed the literature on the analysis phase of cycle-B and cycle-C.

4.8.3 Data quality

Ensuring data quality is a critical aspect of any study. In the context of this DBR study, several approaches were considered to bolster data validity.

One commonly utilised strategy is triangulation, in which different data sources are used to corroborate the findings. As previously discussed, this study utilised multiple data sources across all three DBR cycles. By analysing multiple data sources, such as portfolio artefacts and semi-structured interviews, it is possible to identify consistencies and discrepancies, thus enhancing the credibility of the findings (Moon, 2019). This approach is particularly effective in this study because it relies on diverse data sources, enhancing the trustworthiness and depth of research findings.

The study also employed iterative questioning during interviews. This technique ensures that the research questions are continually refined and clarified in response to emerging data, thus strengthening the construct validity of the study (Yin, 2018). In addition, by asking the same questions in various ways or revisiting topics later in the interview, researchers can gauge the consistency of the participants' responses, which enhances the validity of the data.

Finally, the validity of this DBR study will be strengthened by maintaining a clear and accurate record of all stages of the research process, often referred to as an audit trial (Creswell & Poth, 2016). This detailed account enhances the dependability of the study by providing transparency on how the data were collected, analysed, and interpreted.

By employing these strategies, this study aimed to ensure the quality of the data, thus enhancing the credibility and reliability of the findings.

4.8.4 Credibility and trustworthiness

Ensuring the credibility and trustworthiness of the research design, analysis, and findings is crucial in qualitative research, particularly in a DBR study. Credibility refers to the confidence in the truth of the findings, including an accurate understanding of the context (Johnson & Onwuegbuzie, 2004), while trustworthiness encompasses the overall quality and rigor of the study (Levitt et al., 2017).

This section outlines the strategies used in this study to address the concerns around credibility and trustworthiness. A combination of, *member checking*, validating findings with participants (Birt et al., 2016)*, triangulation,* using multiple data sources to enhance understanding (Patton, 2015), *audit trail*, to provide a transparent account of the research process (Nowell et al., 2017) and *reflexive practices,* involving critical self-reflection on potential biases and their impact on the research (Berger, 2015) were used.

Member checking was a key mechanism used to ensure the credibility of the analysis in this study. This process involved sharing preliminary findings and interpretations with participants to verify the accuracy of their representations and to gain additional insights. As Birt et al. (2016) suggest, member checking is a crucial technique for exploring the credibility of results. In this study, member checking was conducted as an end of cycle review. At the end of each DBR cycle, a summary of the cycle's findings was shared with participants. They were asked to comment on the accuracy of the interpretations and provide any additional perspectives. This process not only enhanced the credibility of the findings but also provided an opportunity for deeper engagement with the data and richer interpretations. This technique directly addressed credibility by ensuring that the findings truthfully represented participants' experiences and perspectives.

Data *triangulation* was employed to further enhance the credibility of the findings. This involved comparing and cross-referencing data from multiple sources, including interviews, participant artifacts, and observational notes. As Patton (2015) argues, triangulation strengthens a study by combining methods and data sources. In this study, such triangulation helped to identify consistencies across data sources and highlight any discrepancies that required further investigation. This approach contributed to both credibility and trustworthiness by providing a more comprehensive and nuanced understanding of the research context.

A detailed *audit trail* was maintained throughout the research process. This included raw data, analysis notes, process notes, and drafts of interpretation. The audit trail provides a transparent account of the research process and decision-making, allowing for the dependability and confirmability of the findings to be assessed (Nowell et al., 2017). In this study, the audit trail consisted of a digital research journal documenting all research activities, decisions, and reflections. This journal was organised chronologically and included sections for each phase of the research process. It was regularly reviewed and updated to ensure comprehensive documentation. The audit trail was used to enhance trustworthiness by providing a clear record of how conclusions were reached and allowing for external review of the research process.

Throughout the research process, I engaged in *reflexive practices* to acknowledge and mitigate potential biases. This involved documenting my thoughts, decisions, and considerations in an online notebook. As Berger (2015) notes, reflexivity is crucial in qualitative research to enhance the accuracy and credibility of the findings. These reflexive practices contributed to both credibility and trustworthiness by ensuring transparency in relation to my position and its potential influence on the study.

By employing these strategies, this study aimed to ensure the credibility and trustworthiness of the analysis and findings. These mechanisms provided multiple checks on the credibility and trustworthiness of interpretations and helped to mitigate potential biases, enhancing the overall quality and reliability of the research.

4.9 Research Ethics

Ethical approval for this study was obtained from the Lancaster University Ethics Committee on 6th December 2022. Throughout this study, ethical considerations were adhered to, including informed consent and confidentiality (outside of each cohort cycle). These considerations ensured that the rights and well-being of the participants were respected and protected, and that the research was conducted in an ethical and responsible manner.

Informed consent was obtained from the research participants by first providing a participant information sheet (PIS), that detailed the intentions and approach of the study (Appendix 2). The information included in the PIS highlighted participants' right to withdraw from the study and at any point, how participants' data will be handled, and how their confidentiality will be maintained. If the participant chose to continue a consent form (Appendix 3) was then send to the participant to sign.

I ensured that all information collected from participant's maintained confidential outside of each cohort cycle, meaning that participants within a cohort cycle were able to see and interact with each other, but data collected were anonymised following their participation in the design intervention. Additionally, all individual responses from the semi-structured interviews were anonymised and stored securely.

Despite these approaches, I faced two ethical dilemmas related to power imbalance that needed to be addressed. The first was between participants who were all educators in the same organisation. I was concerned that the required sharing of portfolio artefacts within the cohort of each cycle may result in disengagement from participants due to a fear of judgement from colleagues. I aimed to address this by highlighting the advantages of peer review and offering support to participants who had concerns with any of the activities to ensure they were able to submit an artefact they were happy with. A second power imbalance emerged after the delivery of cycle-A's intervention course. I had intended to conduct focus groups at the end of each cycle for data collection. However, the university president insisted upon joining the first focus group. I noted that the participants went on to reply only positively about their experiences with minimal critically reflective information. I felt that this was not a balanced or valid form of data collection and therefore withdrew the data from the focus group from the study.

4.10 Conclusion

This chapter has outlined the rationale for selecting DBR as the methodology for this study, highlighting its suitability for addressing the complexities of BL design. The role of the TPACK framework was emphasised, demonstrating its utility in guiding the iterative cycles of analysis, design, implementation, and evaluation within the DBR approach. Detailed discussions were provided on the research site, insider research, participant recruitment, and the development of the design intervention course, alongside the methods of data collection and analysis employed.

In summary, the integration of DBR and TPACK in this study has provided a robust framework for developing context-specific, practical interventions that enhance educators' competencies in BL design. The iterative and collaborative nature of DBR ensured continuous improvement and adaptation, while TPACK offers a structured theoretical foundation. Moving forward, the next chapter will delve into the specific findings from the three iterative cycles, detailing how the interventions were refined and the impact on participants’ PD.

Chapter 5: Findings – DBR Cycle-A

This chapter presents the findings from the first iteration of the design intervention course, cycle-A. Subsequent chapters will present findings from cycle-B (Chapter 6) and cycle-C (Chapter 7).

In this chapter the *Analysis* section (section 5.1) presents an analysis of literature, that was conducted to identify key considerations with the aim of informing the development of design conjectures in the following design phase. The *Design* section (section 5.2) discusses the development of design conjectures, based on key considerations identified, from the analysis section. The conjecture map, based on the design conjectures, is presented along with details of the design intervention. The *Implementation* section (section 5.3) discusses the deployment of the design intervention course, in addition to how participants were supported in the course and their portfolio development. The *Evaluation* section (section 5.4) presents an analysis of participants' data produced during their experience of cycle-A's design intervention course, and the validity of design conjectures is discussed. The *Conclusion* section (section 5.5) wraps up cycle-A with a conclusion in preparation for cycle-B.

5.1 Cycle-A: Analysis

Chapter 4 describes the analysis of the literature process for this DBR study (section 4.6.1). The results of the literature search for cycle-A yielded 40 literature sources selected for analysis. Several sources provided relevant information for more than one knowledge domain.

The identification of key considerations throughout the literature analysis provides a robust foundation to inform the development of design conjectures (section 5.2.1) for cycle-A's design intervention course. Key considerations that emerge are identified with the letter 'A' representing cycle-A and then a corresponding number, 'A1', 'A2' etc. Following the identification of key considerations across the analysis phase, a table summary is presented (section 5.2.4).

5.1.1 Content Knowledge

As discussed in section 3.5, the role of TPACK in the DBR phases, Content knowledge (CK) in the context of this study refers to the theoretical and practical knowledge related to the design and creation of PD course. The consideration of CK is important as it requires a nuanced understanding of how experienced educators integrate new information, concepts, and technological tools into their existing mental schema to provide an effective PD learning experience.

The following discussion of CK utilised 17 of the 40 identified literature sources. Themes around *engagement factors for adult learners*, *the educator's role in BL design*, and *barriers to engagement in PD courses* emerged as imperative factors to consider for design intervention.

A summary of all the key considerations identified is presented in Table 5.1.

5.1.1.1 Engagement factors for adult learners

According to 5 of the 17 identified literature sources related to CK, the design of PD for adult learners' engagement is a key area to be considered. This is a focus area for CK because the participants of the PD course were adult learners with prior knowledge and experience. The authors identified that a nuanced understanding of adult learners' unique learning attributes and challenges is central to either enhancing or diminishing their learning effectiveness by impacting cognitive engagement (Evans et al., 2022; Müller & Wulf, 2023; Kintu et al., 2017). Critical factors influencing cognitive processing and engagement among adult learners in the literature range from acknowledging the prior experiences of learners (A1), linking learned skills to real-world applications (A2), considerations related to the time allocated for task completion (A3) and the significant role of Metacognition, primarily manifested as self-regulation and reflection (A4), in the mental organisation and integration of new information (Eom & Ashill, 2018; Evans et al., 2022; Müller & Wulf, 2021; Kintu et al., 2017). D'Mello et al. (2014) suggested that scaffolding learning content can lead to reflection and deeper cognitive processing, thereby facilitating improved achievement of learning outcomes. While it has been suggested that scaffolding enhances cognitive processing, it remains unclear how to achieve this in practice due to the diverse learning preferences of adult learners. The potential to scaffold learning content in a manner that prompts reflection and deeper cognitive processing presents an avenue for refining design interventions to better support adult learners in achieving the desired learning outcomes.

Therefore, the identified key considerations related to the design of PD for adult learners' engagement consist of, acknowledging the prior experiences of learners (A1), linking learned skills to real-world applications (A2), considerations related to the time allocated for task completion (A3) and the significant role of self-regulation and reflection (A4), will be considered when developing design conjectures in section, 5.2.1 (Design phase).

5.1.1.2 Educators' role in blended learning design

This changing role of the educator theme builds upon the literature review section of the same name (section 2.3.1) and focuses on 11 sources of literature from the 17 identified sources for CK. A significant point raised in the literature is the need for educator PD. This is a focus area for CK, as participants in this study are educators with prior teaching experiences, which, while valuable, may not align with the prerequisites for effective BL design. Many prior experiences of educators align with traditional lecturer-focused approaches often adopted in conventional settings (Sharp et al., 2017). These approaches have been critiqued in the literature to foster academic disengagement and limit learner flexibility (Meguid & Collins, 2017; Sharp et al., 2017). In addition, Wicks et al. (2015) argue that some educators exhibit scepticism or lack preparedness for the transition to BL, because they perceive online components as inferior to traditional face-to-face instruction. McDowell and Tasker (2023) suggest that these sentiments are magnified by entrenched beliefs, assumptions, and cultural practices, which make numerous educators hesitant towards adopting innovative methodologies that might expand their responsibilities. Therefore, to compile this part of the discussion into a key consideration, I would summarise that educators need encouragement to think about designing and facilitating learning experiences. (A5).

The literature also suggests that PD is instrumental in a mindset shift towards learning design and facilitation among educators (Müller & Wulf, 2023; Volery & Lord, 2000; McDowell & Tasker, 2023). One suggested approach to bolster this growth mindset was explored in an earlier article of mine, which advocates for the establishment of Faculty Learning Communities (FLCs) to enhance teaching practice, particularly in designing learning experiences (A6) (Tuffnell, 2021). These FLC's, a specialised form of Community of Practice (CoP), leverage the collective experience of educators and utilise vicarious experiences alongside social persuasion to bolster faculty confidence in BL design (Baran & Correia, 2014; Booth, 2012; Tuffnell, 2021; Wenger-Trayner, & Wenger-Trayner, 2015).

Therefore, the identified key considerations related to educators' role in BL, consists of the requirement for PD in the design and facilitation of learning experiences (A5) and the establishment of an FLC (A6) will be considered when developing design conjectures in section 5.2.1.

5.1.1.3 Barriers to engagement in Professional Development

The relevant literature on this theme drew from 7 of the 17 sources related to CK. While the literature from the previous theme identifies PD as a key to developing educators for BL design, this theme focuses on literature that discusses potential barriers to PD engagement, which is a focus area for CK because the aim of this study is to design an effective PD course that promotes engagement.

McDowell and Tasker (2023) identified a notable challenge faced by many adult learners, which is time constraints when engaging with PD opportunities (A7), a factor exacerbated by demanding professional obligations, as is the case with university educators. Furthermore, the duration of some PD sessions has been identified as a deterrent to face-to-face sessions (McDowell & Tasker, 2023). Several authors suggest that providing flexibility in how, when, and where learners can access PD empowers them with better control over their time, aiding them in balancing study with personal and professional commitments (Arbaugh, 2014; Boelens, et al., 2017). This flexibility, in turn, might enhance participants interest and motivation, and trigger more active cognitive processing (Garrison & Kanuka, 2004; Scheiter & Gerjets, 2007). Therefore, one implication that I took for the design intervention course was the necessity to create a flexible learning environment to mitigate some barriers faced by the participants (A8).

An additional factor highlighted in the literature is the collective understanding of terminology used in PD. Some authors suggest that deliberate efforts to foster a shared understanding of specific terminology, concepts, and methods, such as "blended learning" or "flipped learning", are paramount for enhancing learners' engagement (Moskal et al., 2013). This clarity in understanding helps align participants with the goals of the design intervention course, ensuring coherent comprehension and application of BL design principles (A9).

Therefore, the identified key considerations related to barriers to engagement in PD**,** consist of time constraints for PD and the need for a flexible course design, identified with A7 and A8, along with the need for shared comprehension of terminology (A6), will be considered when developing design conjectures in section 5.2.1.

5.1.1.4 Summary of CK section

In summary, the analysis of the 17 sources of literature related to CK has several implications for the design of interventions. First, the key takeaway from section 5.1.1.1 is the recognition of adult learners' unique attributes and challenges that influence cognitive engagement and, ultimately, their learning effectiveness. Four key considerations were identified from the literature: recognition of prior learning experiences (A1), real-world application of learned skills (A2), time management for task completion (A3), and the role of self-regulation and reflection (A4) in the assimilation of new information.

Second, the literature in section 5.1.1.2 highlights the contrast between traditional teaching experiences and the requirements of effective BL design. Pointing out that educators past experiences may not align with BL design approaches, and therefore stresses the importance of shifting educators' roles towards a design and facilitation mindset, underpinned by PD (A5). To help achieve this, the establishment of FLCs is recommended to foster a community-based approach to learning design, which could enhance educators' confidence and collaboration in BL environments (A6).

Finally, section 5.2.1.3 identifies time constraints as a major barrier for educators engaging in PD, which is critical for BL design (A7). The literature suggests that flexibility in accessing PD can enhance learners' interests, motivation, and cognitive engagement (A8). Moreover, it underscores the importance of a shared understanding of the terminology used in PD as a foundational element for engaging learners and ensuring the successful application of BL design principles (A9). Therefore, an intervention course should be designed to provide flexibility and clarity of terminology to overcome these barriers and foster learner engagement.

5.1.2 Pedagogical Knowledge

Pedagogical knowledge (PK) has traditionally referred to effective educational practice encompassed by an understanding of teaching and learning methodologies, assessment strategies, and the facilitation of meaningful learning experiences in combination with disciplinary expertise (PCK). However, in the context of this study, PK also seeks to further develop a pedagogical understanding that transcends traditional boundaries, to integrate learning design approaches along with appreciation and utilisation of technological affordances (TPK) to foster dynamic, engaging, and efficacious design of blended learning environments.

The following discussion of PK drew upon 18 relevant literature sources from the 40 identified for cycle-A. Themes pertaining to *learning design frameworks* and *models of blended learning* to inform the design intervention for cycle-A are discussed.

5.1.2.1 Learning Design Frameworks

This theme focused on 11 of the 18 sources identified for PK. Learning design frameworks are a focus area for PK because they can facilitate educators' development and the combination of CK and PK (Clement et al., 2016). Learning design frameworks are pivotal in directing participants' design decisions and ensuring consistency and sustainability in design outcomes. Additionally, the structured approach inherent in learning design encapsulates the theoretical foundations required for effective pedagogical progression (Bower & Vlachopoulos, 2018; Clement et al., 2016; Vaughan & Garrison, 2005).

Therefore, the design intervention for cycle-A would incorporate robust learning design frameworks, which could act as a scaffold, guiding educators to effectively blend their knowledge and pragmatic experiences. As highlighted in the literature and discussed below, these frameworks can provide a roadmap for educators to help make informed design decisions that are not only consistent but also sustainable over time.

5.1.2.1.1 The Backward Design approach

According to Bitetti (2019), *backward design* provides a beneficial approach to educators who are less versed in learning design. Alfauzan and Tarchouna (2017) identified backward design as a practical learning design framework for educators new to instructional design, prioritising constructively aligned, outcomes-based educational experiences. This approach, developed by Wiggins and McTighe (2005), reverses the traditional forward-thinking approach to course development, in which educators start by considering what they intend to “cover” and create course materials, as this has been shown to lead to learner disengagement and content irrelevance. Instead, educators start by defining clear, achievable learning outcomes, informed by taxonomies such as Krathwohl’s (2002) revision of Bloom’s taxonomy. Evidence of learning through formative or summative assessments was used to measure these outcomes. Only then are content and learning activities developed to ensure relevance and focus (Biggs, 1996; Wiggins & McTighe, 2005). This structured, outcomes-focused approach aligns teaching with learning goals, making the educational process transparent and ultimately privileging learning over teaching (Wiggins & McTighe, 2005). Although it does not dictate specific learning activities, backward design provides a clear structure for developing aligned and logical learning experiences.

Therefore, backward design, with its capacity to equip educators with a useful process for devising constructively aligned, outcome-oriented educational experiences, is selected to guide participants in the design intervention course for cycle-A (A10).

5.1.2.1.2 Incorporation of the Community of Inquiry (CoI) Framework

Despite the benefits of backward design, critics have argued that it falls short of providing explicit guidance as to what types of learning experiences are best suited to supporting an effective or quality-blended learning experience (Vaughan & Garrison, 2005).

Consequently, CoI framework, discussed in section 2.3.3, presents an augmented guide for participants to make informed learning design decisions pertaining to the types of learning content and interactions. This framework underscores three core elements as essential facets of blended learning design: Teaching Presence (TP), Cognitive Presence (CP), and Social Presence (SP) (Vaughan & Garrison, 2005). Through the lens of CoI, educators are encouraged to consider learners' needs, facilitate sustained reflection and discourse, and establish a supportive community to mitigate feelings of isolation, all of which are posited to enhance the achievement of learning outcomes (Garrison et al., 2003; Wicks et al., 2015). In addition, Nolan-Grant (2019) argued that the CoI framework was a “robust” learning design framework, particularly for the flipped learning design of postgraduate courses.

This literature led me to consider the nuances required in the design of learning experiences, extending beyond the mere alignment of outcomes and assessments. One implication that impacted the design intervention was the potential synergies between backward design and the CoI framework in crafting a guiding learning design approach for participants (A11).

Therefore, the identified key considerations related to learning design frameworks consist of integrating a backward design approach (A10) that is augmented with design decisions based on the CoI Framework (A11) will be considered when developing design conjectures in section 5.2.1.

5.1.2.2 Models of blended learning

This theme focused on 8 sources of literature from the 18 sources identified for PK. The selection of a BL model is a focus area for PK, because it supports participants' design decision-making. While there are various BL models, the literature identifies that the 'flipped learning' model has been particularly useful for its flexibility and structured approach when integrating asynchronous (online) and synchronous (in-person) learning environments (Bergmann & Sams, 2014; Lee, et al., 2017; Moskal et al., 2013; Zhao & Song, 2022). Some authors have suggested that a well-articulated flipped learning model can be instrumental in focusing on the learning designs of participants, especially when rooted in the synergies of backward design and CoI (Moskal et al., 2013).

The literature also suggests that the strength of the flipped learning model is its clear articulation of the asynchronous learning environment that facilitates learners' interaction with content at their own pace. This model purposefully aligns asynchronous learning with synchronous teaching sessions (A12), which are geared towards the application and enrichment of the knowledge acquired (Clay, 2020; Lancellotti et al., 2016). However, research from both Müller and Wulf (2023) and Vaughan and Garrison (2004) presents the challenge of striking the right balance in content delivery, activities, and learning materials across both learning environments, which will be a key consideration in design intervention (A13).

Therefore, the identified key considerations related to selecting the flipped learning model consisting of participants' requirements to link asynchronous and synchronous learning components (A12) in addition to balancing content delivery and learning activities across synchronous and asynchronous learning environments(A12) in their BL design will be considered when developing the design conjectures in section 5.2.1.

5.1.2.3 Summary of PK section

In conclusion, the analysis of 18 sources of literature related to PK presents several implications for the design of interventions. First, the key takeaway from section 5.2.2.1 affirms the critical role of learning design in guiding educators' decisions, ensuring consistency and sustainability in learning design, specifically, the backward design and CoI. The design intervention for cycle-A is thus anchored with these robust frameworks to provide participants with a systematic approach to designing learning experiences that are both effective and sustainable over time (A10 & A11).

In addition, the selection of the flipped learning model in section 5.1.2.2 is justified for its flexibility and structured approach, merging asynchronous online and synchronous in-person learning (A12). Despite some debate over the balance of content delivery and learning materials, the flipped learning model was selected for its potential to guide participants effectively through the blending of these learning experiences (A13).

5.1.3 Technological Knowledge

Technological knowledge (TK) is a key consideration for this study, exploring how flexibility, online teaching presence, familiarity with technological tools, choice of platforms, design of digital learning content, and strategic integration of technology weaves the fabric of effective blended learning experiences.

The following discussion related to TK draws on 13 of the 40 literature sources. Themes around *flexibility offered by technology for BL*, *educators' familiarity with technology* and *designing engaging instructional materials* to inform the design intervention for cycle-A are discussed.

5.1.3.1 Flexibility offered by technology for blended learning

This theme focuses on 3 sources of literature from the 13 sources identified for TK. The flexibility offered by technology is a focus area for TK, as it affords learners the autonomy to engage with content according to their unique temporal, spatial, and pacing preferences (D'Mello et al., 2014). This highlights a key consideration for designing interventions (A14). Additionally, studies have found that the amalgamation of online learning benefits with the traditional classroom advantages of personal interaction, collaboration, and community building substantiates the indispensable role of technology in BL (Arbaugh, 2014; Boelens et al., 2017). This concept is key for participants in the design intervention to understand (A15), which not only amplifies the pedagogical potential of BL, but also exemplifies how technology can be leveraged to augment the educational landscape, thereby fostering a more learner-centric and interactive learning ecosystem.

Therefore, the identified key considerations related to flexibility offered by technology in BL (A14) and the combined benefits of online and traditional learning (A15) will be considered when developing the design conjectures in section 5.2.1.

5.1.3.2 Educators' familiarity with technology

This theme focused on 7 of the 13 sources identified for TK. Familiarity with technology is a focus area for TK, as several authors have argued that the efficacy of technology integration in BL is considerably influenced by educators' proficiency and ease of use of technological tools (Namyssova et al., 2019; Müller & Wulf, 2023). Müller and Wulf (2023) discussed a notable correlation between educators' positive attitudes and adeptness with technology and learners' attitudes, motivations, and ultimately, their learning outcomes. However, despite these potential benefits, McDowell and Tasker, (2023) found that there exists a challenge, as some educators perceive the transition to new technological methodologies as daunting. This predicament underscores the significance of fostering digital skills training and adopting teaching approaches to facilitate effective technological integration (Arbaugh, 2000; Müller & Wulf, 2023). Extending this notion, Müller and Wulf (2023) advocate for a user-centric approach, suggesting the employment of learning technologies that are easy to use for both educators and learners, thereby potentially alleviating technological hurdles and fostering a conducive BL environment. Therefore, the design intervention course will incorporate technologies based on ease of use and intuitive design (A16).

In addition, the utilisation of technology platforms such as Learning Management Systems (LMS) has been shown to be a pragmatic approach to embodying BL within HE settings (Suartama et al., 2019). Several studies have found that the provision of PD through the same instructional technology that the participants’ learners would engage with can significantly enhance technology adoption (Boyd & Sampson, 2016; Evans et al., 2022). This approach not only familiarises educators with technological tools but also potentially mirrors the learning environment, thus fostering a better understanding and appreciation of learners' experiences with technology. The impact on the design intervention is that cycle-A will be developed in the same Moodle LMS as the participants will use to teach their blended learning courses (A17).

Therefore, the identified key considerations related to educators' familiarity and comfort with technological tools consisting of the selection of user-friendly learning technologies (A16) and usage of platforms such as Moodle LMS for PD training (A17) will be considered when developing the design conjectures in section 5.2.2.

5.1.3.3 Designing engaging instructional materials

This theme focuses on 2 sources of literature from the 13 sources identified for TK. The ability of participants to design instructional materials is a focus area for TK, as it is key competency for engaging learners in a BL environment. Although there is not a quantity of literature analysed for this theme, Richard Mayer, in particular, is a well-established authority on digital education content design; therefore, his recent studies carry the weight of credibility. Richard Mayer’s (2021) article argues that when crafting instructional materials, particularly educational videos, the principal objective should be to foster engagement and that merely repurposing lengthy lecture recordings is insufficient for this purpose. Both Mayer (2021) and Guo et al. (2014) recommend that educational videos should be concise, segmented into digestible chunks of information, when necessary, delivered with enthusiasm, and occasionally depict the educator in informal settings. As suggested by the authors, the focus should extend beyond high-quality studio recordings to the creation of content that genuinely resonates with learners, thus potentially enhancing the efficacy and appeal of instructional materials in a BL environment (Guo et al., 2014; Mayer, 2021). These strategies have led to the final key consideration for this section of the study by identifying that creating concise, enthusiastic, and authentic digital content (A18) is crucial for nurturing a personal connection and augmenting learner engagement.

Therefore, the identified key considerations related to designing engaging instructional materials consisting of creating concise, enthusiastic, and authentic digital content (A18) will be considered when developing design conjectures in section 5.2.1.

5.1.3.4 Summary of TK section

In conclusion, the analysis of 13 sources of literature related to TK has several implications for the design of the intervention. First, insights from section 5.1.3.1 emphasise the role of technology in enhancing the flexibility of blended learning environments. This flexibility is crucial for allowing learners to access content according to their individual needs and preferences (A14). The integration of online and in-person learning underscores the pivotal role of technology in facilitating personal interaction and community building in blended learning contexts (A15).

Second, section 5.1.3.2 emphasises that a positive relationship between educators' adeptness for technology and student outcomes is noted, with the caveat that some educators may find transitioning to new technologies challenging; therefore, user-friendly technology should be adopted to ease technology integration (A16). Additionally, the design intervention incorporated the use of Moodle LMS, mirroring the participants' teaching environment to enhance familiarity and adoption (A17).

Finally, although less extensive, the literature pertaining to section 5.1.3.3, particularly Mayer's work on digital content design, is potent. The key takeaway is the necessity of creating engaging educational videos that are concise, segmented, and enthusiastically delivered to foster learner engagement. The focus on content authenticity over high-quality production stresses the importance of resonance with learners to enhance material efficacy (A18).

5.1.4 Summary of Analysis phase for Cycle-A

This literature analysis provided a detailed exploration of the key areas of PD and BL design structured around the domains of content, pedagogical, and technological knowledge. Numerous considerations were identified for creating engaging professional development and designing effective BL that stem from the exploration of the literature and will now serve as a clear, actionable basis to inform the following design conjectures. This exploration has now been distilled into a summary table, shown in Table 5.1, to organise and reference the key considerations. These considerations will serve as a foundational basis for devising design conjectures for interventions.

Table 5.1: *Key considerations - Cycle-A*

TPACK Domain	Key area	Key considerations – cycle-A
Content Knowledge	Adult learners' engagement	A1. Acknowledge prior experience. A2. Link skills to real-world application A3. Time allocation for tasks A4. Learner reflection
	Educator role in blended learning design	A5. Encouragement towards design and facilitation of learning experiences A6. Development of Faculty learning communities
	Adult learners' barriers	A7. Time constraints/ workload A8. Course flexibility A9. Shared Terminology
Pedagogical Knowledge	Learning design frameworks	A10. Following a Backward design approach A11. Augmented with design decisions based on the CoI Framework
	Flipped learning model	A12. Linking asynchronous and synchronous learning environments A13. Balancing content delivery and learning activities
Technological Knowledge	Flexibility offered by technology	A14. Flexibility in time, place, and pacing A15. Combining benefits of online and traditional learning
	Familiarity and comfort with technological tools	A16. User-friendly learning technologies A17. Usage of platforms like Moodle LMS for PD training
	Designing engaging instructional materials	A18. Creating concise, enthusiastic, authentic digital content

5.2 Cycle-A: Design

This section focuses on identifying the design conjectures that hypothesise key design decisions for the intervention course. Therefore, the proposed design conjectures for cycle-A are presented. A design conjecture map is presented to visualise the explicit linkage between design conjectures that inform embodiments, mediating processes, and intended outcomes for the design intervention course. The section concludes with a discussion related to the components of the design conjecture map to provide a more detailed insight into the design decisions for cycle-A's intervention course.

5.2.1 Design Conjectures for Cycle-A

As discussed in section 4.6.2, following the analysis of the literature and identification of key considerations, an iterative ideation technique was employed to develop the hypothesised design conjectures.

The outcome of the ideation process for cycle-A resulted in several design conjectures, derived from the key considerations from the analysis phase and underpinned by TPACK, to inform the design of the intervention course.

Table 5.2 shows the design conjectures, offers a description of each conjecture, and identifies the underlying key considerations that informed its creation.

Table 5.2: *Design Conjectures -Cycle-A*

TPACK Domain	Design Conjecture (DC)	Description of conjecture	Based upon key consideration, see Table 5.1
Content Knowledge	DC-A1: A flexible, self-directed learning experience will increase participant engagement	Allowing participants to control their learning pace and path will enhance engagement. The design intervention will provide a variety of learning pathways and self-assessment opportunities, enabling participants to tailor their experience to individual needs. This flexibility is thought to lead to increased motivation and sustained engagement.	A3, A7, A8, A14
	DC-A2: Integration of content and activities to provide real-world relevance will increase engagement.	Integrate content and activities that have direct real-world applicability to enhance the relevance and practicality of learning experiences. This approach is predicted to increase participant engagement and retention by providing meaningful learning scenarios that mirror authentic challenges and tasks they are likely to encounter outside the educational setting.	A1, A2, A5, A17, A18
	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension.	Embed reflective practices within the design intervention to deepen understanding and foster metacognitive skills. Reflection prompts and activities will be strategically placed throughout the course, encouraging participants to contemplate their learning processes and outcomes, thus reinforcing the acquisition of knowledge and skills.	A1, A2, A4, A5

	DC-A4: Providing collaborative opportunities will foster a faculty learning community	Design the learning environment to include collaboration spaces that support the development of a faculty learning community. This communal space will leverage the collective expertise of participants', facilitating peer-to-peer learning and support, which is expected to enhance the collective efficacy and adoption of blended learning methodologies.	A1, A2, A6, A18
Pedagogical Knowledge	DC-A5: Learning design approaches will help guide intentional BL design for participants'	By utilising structured learning design frameworks, participants' will be better equipped to undertake intentional and informed blended learning blended learning design. The frameworks provide a scaffold that enhances the quality and effectiveness of design decisions.	A10, A11, A18, A15
	DC-A6: The flipped learning model will support participants' learning design decisions.	A clearly articulated flipped learning model will aid participants' in structuring their blended learning designs effectively, ensuring that asynchronous and synchronous components complement each other. This support is expected to facilitate participants' design decisions.	A9, A12, A13, A15
Technological Knowledge	DC-A7: The considered utilisation of technology will develop participants' technological experience and competence.	Focus on hands-on experiences with user-friendly educational technologies to develop participants'' technical skills and confidence. The intervention will offer scaffolded technology integration ensuring participants' gain familiarity and proficiency with the tools necessary for effective blended learning design.	A16, A17, A18

5.2.2 Developing the Design Conjecture Map for Cycle-A

As discussed in section 4.6.2, the design conjecture map builds on the identified design conjectures to provide a visual blueprint for the design intervention, specifying the intended learning outcomes of the intervention, how the design features support this learning, and the mediating processes through which such learning may occur. The conjecture map for cycle-A is presented in Figure 5.1, followed by a more detailed discussion relating to the map.

Figure 5.1: *Cycle-A – Design Conjecture map*

5.2.3 Components of the conjecture map for cycle-A

As discussed in (4.6.2.2), the goal of the design conjecture map is to provide a better understanding of the relationships between the different components of the intervention course. The following sections discuss the four components of *design conjectures: intended learning outcomes, embodiments, and mediating processes* in relation to cycle-A's design intervetion.

5.2.3.1 Design Conjectures

The design conjectures (DCs) for cycle-A are shown in the first column of the conjecture map, which consists of:

- *DC 1:* A flexible, self-directed learning experience will increase participant engagement
- *DC 2:* Integration of content and activities that relate to real-world scenarios will enhance relevance
- *DC 3:* Incorporation of reflective exercises will deepen learning comprehension
- *DC 4:* Providing collaborative opportunities will foster a faculty learning community
- *DC 5:* Learning design approaches will help guide intentional BL design for participants'
- *DC 6:* The flipped learning model will support participants' learning design decisions
- *DC 7:* The considered utilisation of technology will develop participants' technological experiences and competence.

These DC's provided clear hypotheses regarding the intention of the design intervention.

5.2.3.2 Intended learning outcomes

Intended learning outcomes (ILOs) of the design intervention course identified what the participants engaged in the course should achieve at the end of their learning experience.

The ILOs are aligned to the design conjectures, while the conjecture map is presented in a systematic layout for clarity, with ILOs displayed in the far-right column. In practice, the development of outcomes and design conjectures followed the same iterative ideation process, as discussed in Chapter 4 (4.6.2.1), until a settled state was achieved. ILOs were then used in the embodiment component to further develop the course, as discussed next.

5.2.3.3 Embodiments

Embodiments for cycle-A are displayed in the second column from the left (5.2.2). This element of the conjecture map refers to the concrete mechanisms or tangible aspects of the design intervention related to DCs. The sub-components of embodiments, consisting of *task structures*, *participant structures*, *discursive practices*, and *tools and materials* involved in cycle-A's design of the intervention course, are discussed in more detail below.

*Task Structur*es, discussed in section 4.6.2.2, for cycle-A's design intervention consisted of the following:

1. the learning content and activities sequenced in the LMS
2. on-campus workshops
3. learning design templates

The design of these three elements was dependent on a well aligned ‘course structure’ to ensure a quality course design. Therefore, a backward design approach was adopted. Developed ILOs were utilised, and appropriate assessments were selected that would show achievement outcomes.

Following the selection of assessments linked to ILOs, the ideation of session topics and session-level learning outcomes were then developed to further ‘chunk down’ the course design into pieces of appropriate learning content and activities.

As with many course design processes, there were many iterations before settling on the final design. Table 5.3 below, depicts this constructively aligned intervention course design.

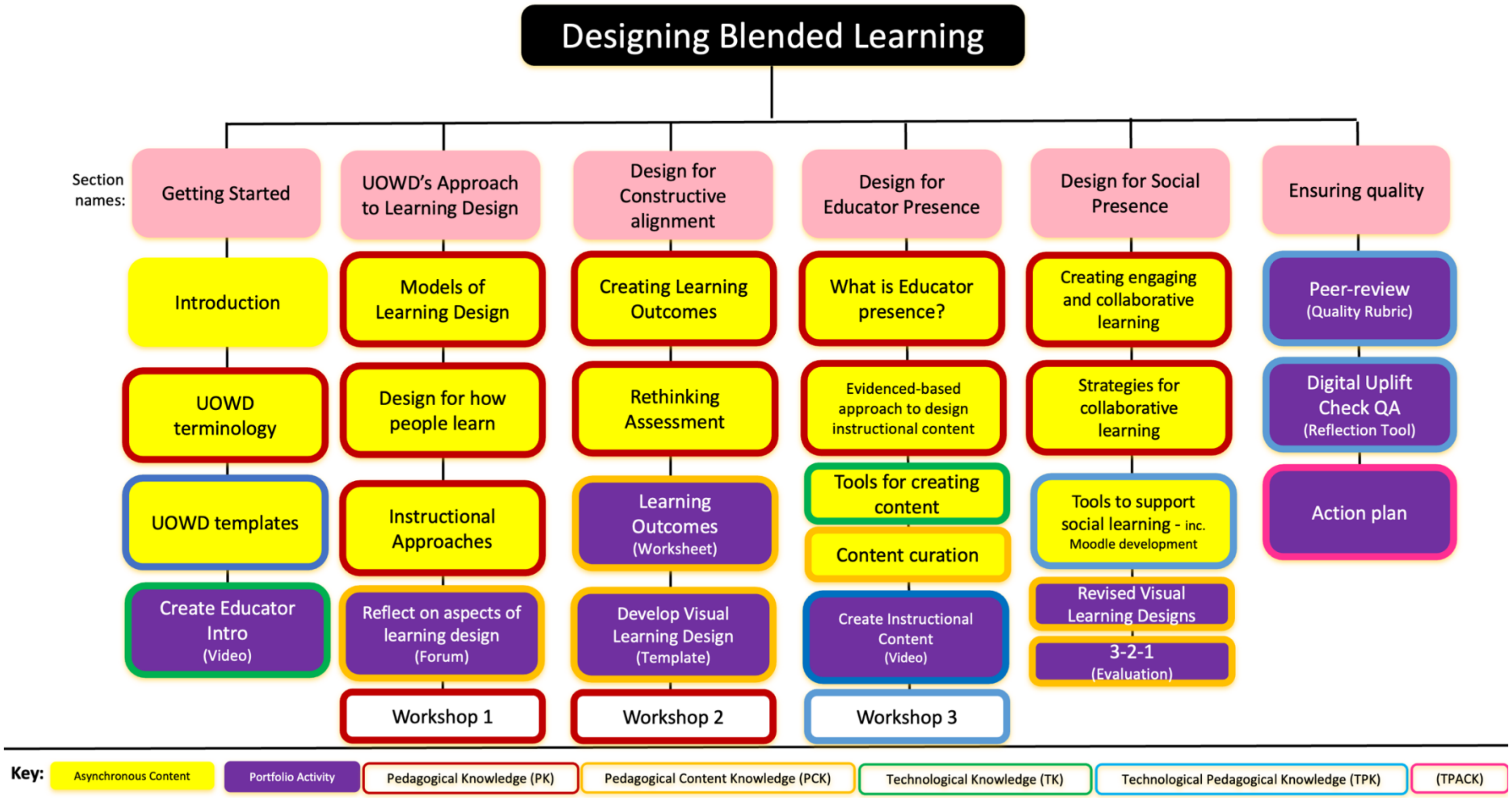
Once the overall course alignment was finalised, the course structure and sequence were designed with the aim of providing participants with flexible engagement. Figure 5.2 below, depicts an overview of the course elements, in which participants’ assessment/portfolio activities are and where elements of the whole design aligned with the TPACK framework are addressed in the course content and activities.

Table 5.3: *Course Alignment - Cycle-A*

Session	**Session learning outcomes**	**Course learning outcomes**	**Assessment measure**
UOWD's Approach to Learning Design	• **Discuss** the role of design in relation designing for all learners • **Identify** models and concepts of learning design • **Explain** how the brain works in relation to how we learn	**Adapt** theories and models of learning design to support blended learning design	• Online Discussion Forum • Visual Learning Design • Educator Action Plan
Design for Constructive Alignment	• **Define** learning outcomes in relation to constructive alignment • **Identify** a taxonomy of learning to support your development of learning outcomes • **Apply** an iterative approach to designing learning outcomes that are aligned with assessment • **Create** learning outcomes for your own sessions	**Construct** clear, measurable learning outcomes for your module and sessions **Align** intended learning outcomes to assessments and learning activities	• Learning Outcomes Worksheet • Visual Learning Design
Design for Educator Presence	• **Identify** the role digital content to increase educator presence • **Discuss** evidenced-based principles for digital design • **Discuss** the pros and cons of curation vs creation • **Collaborate** to plan content creation • **Create** a course video with peers	**Implement** appropriate tools and approaches for digital learning content creation in your sessions	• Educator Intro Video • Instructional content creation
Design for Social Presence	• **Debate** the role of social presence and its value to learning • **Discuss** underpinning theories that support social learning		

	• **Identify** tools to support social learning and communication • **Develop** approaches to foster social presence in your Subject		
Multiple sessions	• **Correlate** approaches to learning design with current teaching practice • **Revise** visual learning design to reflect current understanding of COI	**Reflect** on how best to implement blended learning in your module **Engage** in a faculty learning community to foster continuous improvement and innovation in blended learning design practices	• 3-2-1 Evaluation • Visual Learning Design • Digital environment self-assessment
Ensuring Quality	• **Utilise** the UOW Digital Uplift Check (DUC) tool • **Review** peers' Subject site(s) and offer recommendations for improvement • **Develop** an individual action plan for further iterations	**Create** a plan for implementing blended learning in your module	• Visual Learning Design • Peer review • Digital environment self-assessment • Educator Action Plan

Figure 5.2: *Cycle-A – Self-directed Course Structure*



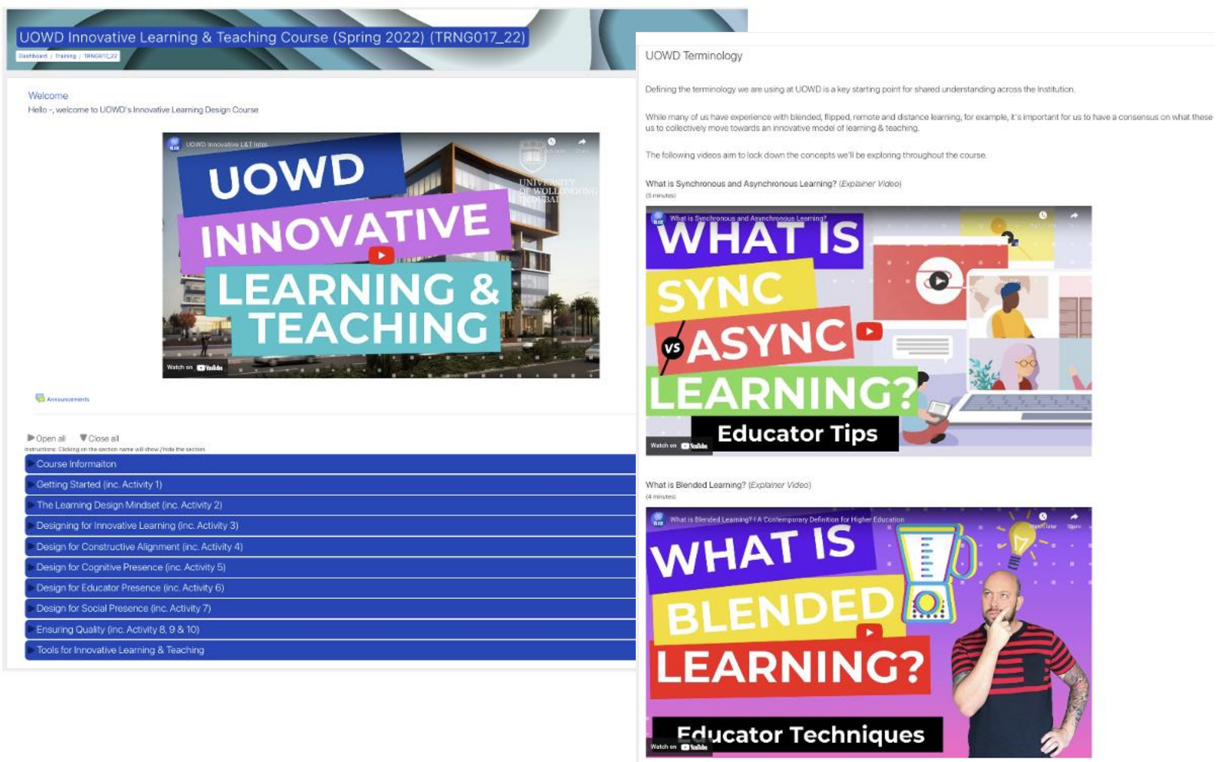
Participant Structures, discussed in section 4.6.2.2, relate to DC-A1 and highlight the need for a flexible, self-directed learning experience for participants in cycle-A's intervention course. The course structure provided participants with flexibility in their engagement in the learning content and activities. They could follow the learning pathway sequentially or self-directed with a pathway they chose (DC-A1).

In addition, participant structures that support collaboration and community building activities for participants in cycle-A are shown below in the form of online discussion forums (DC-A6). The peer review activity has the dual focus of being a collaborative activity by providing feedback to fellow participants on their learning designs (DC-A6), and in carrying out the activity, the reviewing participants also reflect on their own designs (DC-A5).

Discursive Practices, discussed in section 4.6.2.2, *address* DC-A3 and DC-A4 in cycle-A's intervention course. As shown in cycle-A's Design Conjecture map (Figure 5.1), opportunities were designed for participants to communicate with each other (learner to learner) at designated activities in the LMS, namely, online discussion forums, peer feedback activities, and on-campus workshops. As a course facilitator, I also designed opportunities to communicate with participants through the delivery of asynchronous learning content and on-campus workshops (course facilitator to learner). I aimed to provide participants with opportunities to communicate with me (learner to course facilitator) during the on-campus workshops.

The tools and materials, discussed in section 4.6.2.2, for cycle-A's design intervention consisted of an online learning environment, online community tools, and various educational technologies. The online learning environment tool or ‘container’ for the PD course was created in is Moodle LMS, Figure 5.3 below, shows the course landing page and learning content. The learning content and activities (based on *DC-A2, DC-A3, DC-A4, DC-A5, DC-A6 & DC-A7*) were built into the LMS and allowed participants to access them at times and in locations that they decide (*DC-A1 & DC-A7*)

Figure 5.3: *Course Landing Page and Learning Content*



The selection of the Moodle LMS tool to build the intervention was a deliberate decision, as participants would be using Moodle to develop their own BL courses, thereby allowing the building of competence in the platform (DC-A7) and showcasing the best design practices for the online learning environments (DC-A2). The course utilised the Moodle discussion forum tool (Figure 5.4) for online community building (DC-A4), and the user-friendly Padlet technology tool was embedded into the LMS, as shown in Figure 7, for discussion, sharing of digital artefacts, and increased interaction (*DC-A3, DC-A4, and DC-A7*).

Figure 5.4: *Moodle discussion forum example*

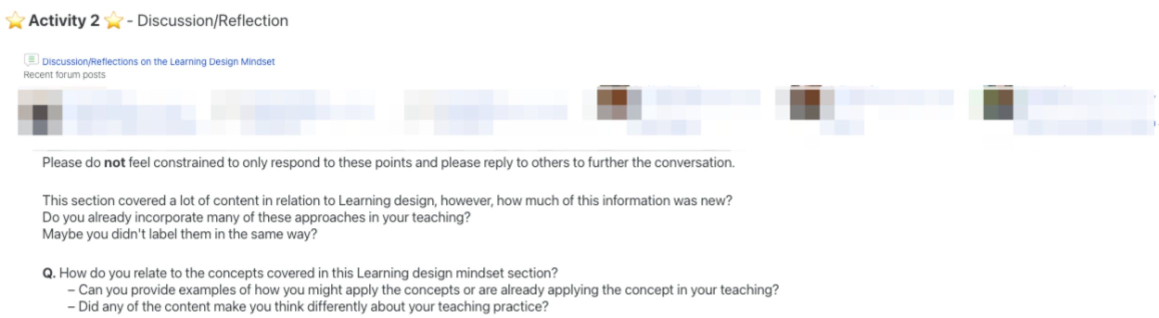
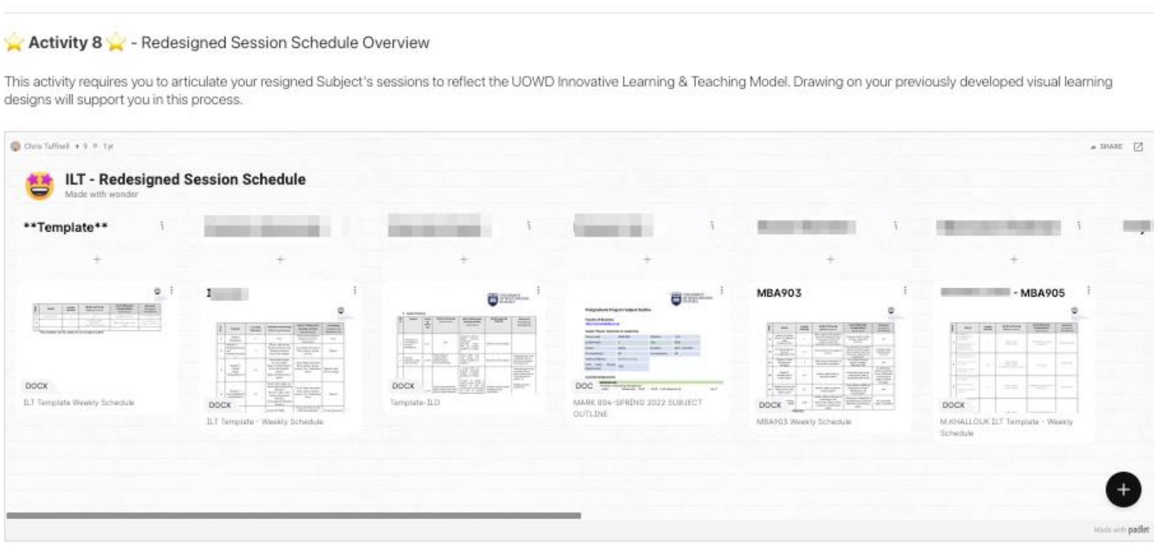
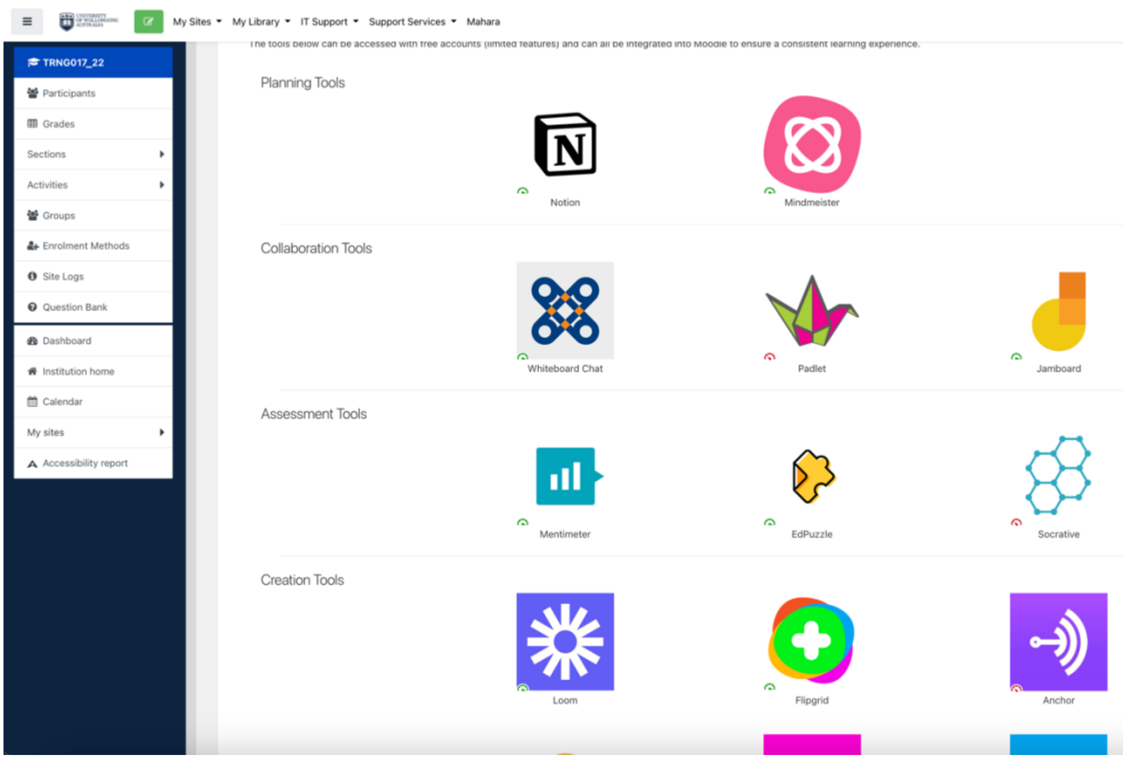


Figure 5.5: *Padlet example*



In addition, Figure 5.6 shows a selection of user-friendly technological tools that were also embedded into the Moodle course for ease of access both during course delivery and beyond (*DC-A7*).

Figure 5.6: *Examples of Technology Tools*



5.2.3.4 Mediating Processes

As discussed previously in section 4.6.2.2, mediating processes are the cognitive, social, or emotional activities that learners undertake, which are hypothesised to lead to the achievement of the design interventions ILOs. The mediating processes for cycle-A's design intervention are shown in the third column from the left in Figure 5.1. They consist of '*observable interactions*' and '*participant artefacts*.

As the design intervention course was project-based, *observable interactions* consisted of participants' completing practical activities that led to their own course redesign, as evidenced by a portfolio of participant design artefacts. Access logs and item completion tracking were activated in the LMS to determine the frequency of access. Contribution to discussion forums was visible to all the cohort, as were design artefacts uploaded to Padlet boards.

In relation to the *participant artefacts*, section 5.2.3.3, these were representations of the activities/assessments which were aligned to the intervention course's ILOs and elements of TPACK (Figure 5.1). The participants were required to complete and upload design artefacts at key points as they progressed through the course.

5.2.4 Summary of the Design Phase for Cycle-A

The design approach for cycle-A in this study has been outlined, emphasising both a systematic and iterative design approach. First, the development of design conjectures was based on key considerations from the literature analysis phase.

Second, building on the design conjectures to follow a mapping approach to visualise key elements of the design of the intervention. Four key steps guided this process: design conjectures, intended learning outcomes, detailing embodiments, and understanding the mediating processes.

The development of the conjecture map and subcomponents ensures that the design intervention is aligned to conjectures and theory and that each component is thoughtfully crafted to contribute to the overall learning outcomes. It operationalises design conjectures into actionable components, allowing for the implementation of the design intervention followed by the evaluation of cycle-A.

5.3 Cycle-A: Implementation

As discussed in more detail in section 4.6.3, the implementation phase moves beyond the development of design conjectures and planning of the design intervention course by applying the intervention course in the study context. The implementation of this study involved the delivery of the intervention course to cycle-A's participants.

This phase is pivotal, as it provides an opportunity to observe participants in the real-world context of the study. Data are collected from the participants and the design intervention to inform the evaluation phase, and ultimately to understand the degree of impact the design intervention has.

This section covers the deployment of the design intervention course, facilitation and support provided, monitoring of participants' engagement in the course, and development of the participants' portfolio of design artefacts.

5.3.1 Deployment of Training Course

As discussed in Embodiments (section 5.2.3.3), the course was constructed in the Moodle LMS with six section topics realised each week with learning content and one activity per section available in the Moodle LMS. In addition, three workshops running for two hours each were made available to complement the digital content. Participants had up to 10-weeks (aligning with the 10-week trimester of participant educators) to complete the course.

The course structure (Figure 5.2) identifies course content and activities in the six sections. It was estimated that each section topic would take no longer than 1-2 hours per week to complete and did not require a specific time or location in order to complete (DC-A1). However, some activities were sequential, meaning that they had the prerequisite activities to be completed. Completion of the real-world activities (DC-A2) resulted in the participants' creation of artefacts that combined to provide a portfolio of a BL course design and digital learning components that in turn showed the achievement of the ILOs of the design intervention. In addition to the flexible LMS-based learning experience, three on-campus workshops were delivered in the middle of the course, for two hours each. The workshops provided hands-on opportunities and consolidation for the topics of learning design for BL and content creation (DC-A2, DC-A5, DC-A6, and DC-A7). The workshops also provided an opportunity for participants to come together around a focused topic and to support each other (DC-A4).

5.3.2 Facilitation and Support

The design intervention course was launched with an in-person 'kick-off' session. This gave me the opportunity to provide an overview of expectations, course content, and support options available, in addition I was able to ensure that everyone had access to the course and was able to navigate through successfully. The session also allowed the participants to ask clarification questions.

Because the learning content and activities could be engaged flexibly (DC-A1), there was no fixed learning pathway for completion. However, I sent weekly emails of an activity to remind the participants and prompt progression through the course. The only restriction in access to the course content was that the course would end 10-weeks after the launch.

5.3.3 Monitoring Participant Engagement

As discussed in section 4.3, the participant selection criteria let to thirteen educators agreeing to participate in cycle-A of the design intervention course. Each participant was assigned a code consisting of P-A plus a sequential number to anonymise the data presentation.

As shown in Table 5.4, the majority of participants (n=9/13) completed the course activities. From this, n=7/13 completed in the 10-weeks' timeframe, followed by a further (n=2/13) during an extension of 4-weeks that was granted, while the remainder (n=4/13) were unable to complete the course in the extended timeframe.

Participants' P-A6 and P-A8 did not engage with the course following the initial kick-off session, follow-up communications were sent to enquire why, and time constraints/workload were given as barriers to engagement. Participant P-A9 did not complete the course due to leaving the organisation, and anecdotal feedback was provided that she was enjoying the experience and was disappointed not to finish. Finally, Participant P-A10 accessed and engaged with one activity. He requested more time to engage, and extra time was provided, but no further progression was made. Therefore, for the purpose of evaluating cycle-A, only data from participants' P-A1, P-A2, P-A3, P-A4, P-A5, P-A7, P-A11, P-A12, and P-A13 were used, as their interview responses could be corroborated with their design artefacts.

Table 5.4: *Participants' activity completion - Cycle-A*

Activity	Participant												
	P-A1	P-A2	P-A3	P-A4	P-A5	P-A6	P-A7	P-A8	P-A9	P-A10	P-A11	P-A12	P-A13
Educator Video	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓
Discussion - The Learning Design Mindset	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓
Creating Learning Outcomes	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓
The Visual Learning Design	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓
Instructional Video	✓	✓	✓	✓	✓	✗	✓	✗	✓	✗	✓	✓	✓

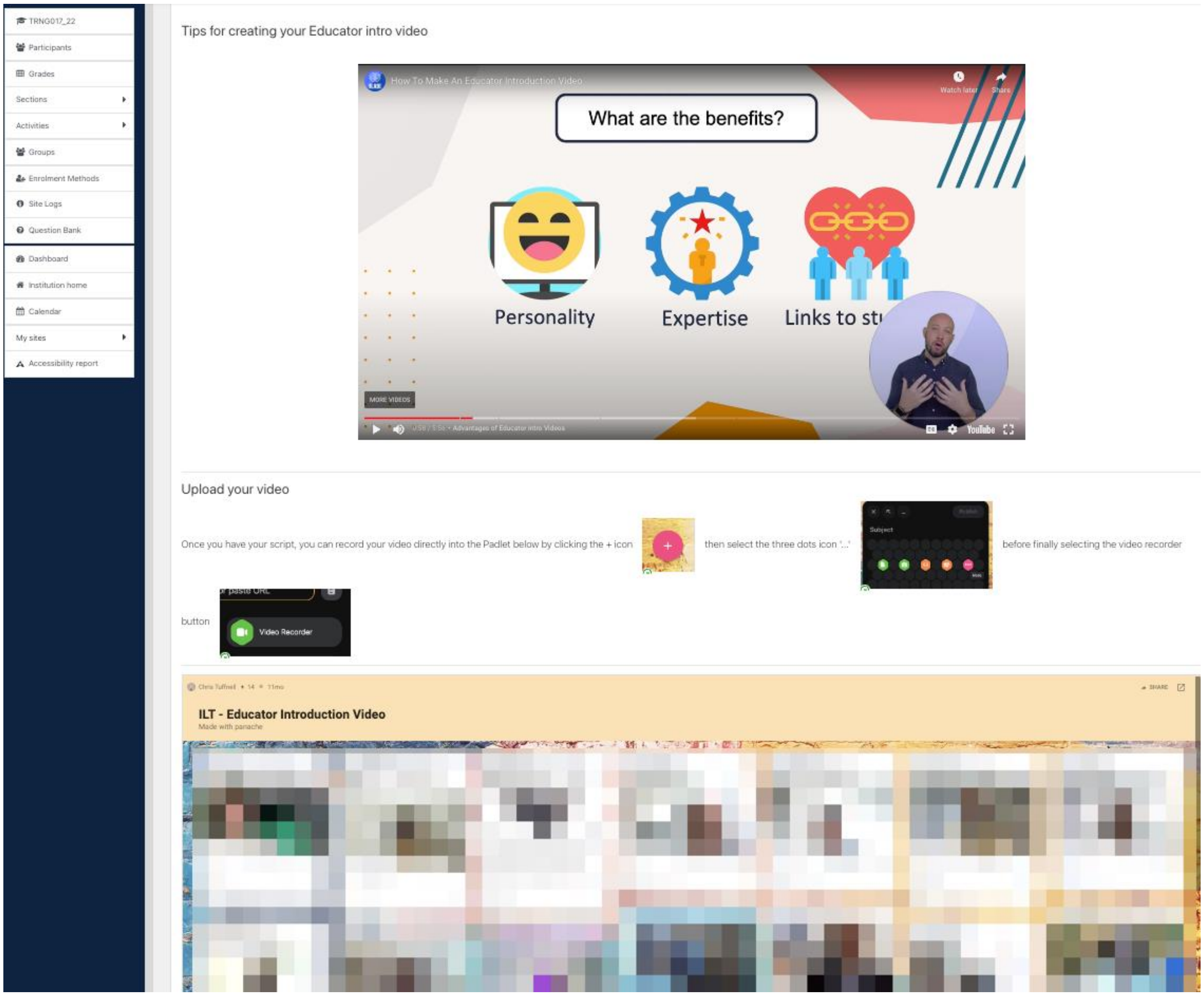
Redesigned Module Overview	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✓	✓
Peer review of design	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✓	✓
Complete DUC QA Reflection Tool	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✓	✓

5.3.4 Participants' Portfolio development

As discussed in section 4.6.3, participants' engagement with course activities produced learning artefacts. These artefacts formed a design portfolio for the participants, which was crucial for understanding design decisions, providing evidence for the achievement of outcomes, and identifying practical implications related to the development of DCs and TPACK to inform the necessary adjustments for the next iteration of the course. The design portfolio of learning artefacts also demonstrates participants' grasp of the course content and domain knowledge in relation to the aspects of the TPACK framework.

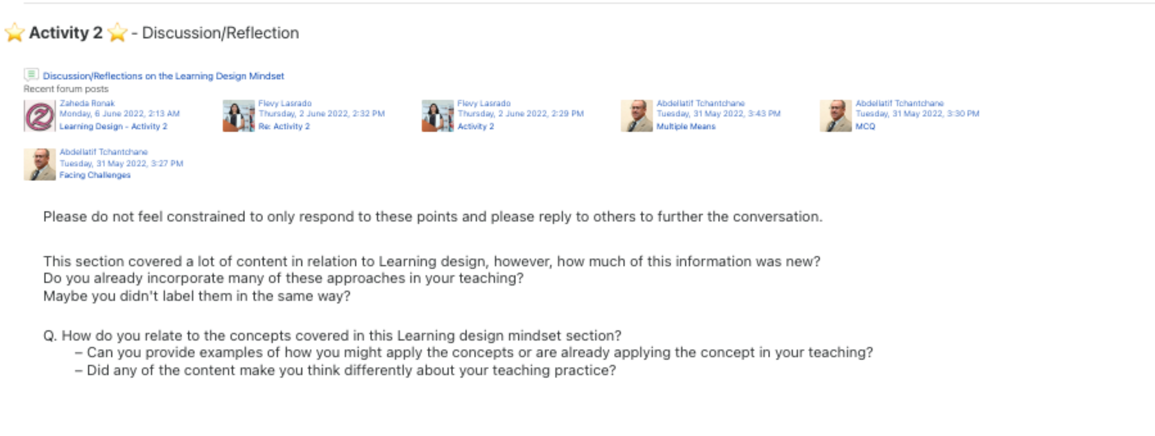
The following provides a selection of course activities to provide examples that highlight the relationship between TPACK and design conjectures. First, the creation of the educator video activity, shown in Figure 5.7, required participants to immediately access a user-friendly tool, Padlet (DC-A7), with minimal guidance to create and share an introduction to the cohort (DC-A2). This activity shows the presence of TK in creating content in Padlet and starts to foster an FLC (DC-A4) in the online learning environment.

Figure 5.7: *Educator video activity*



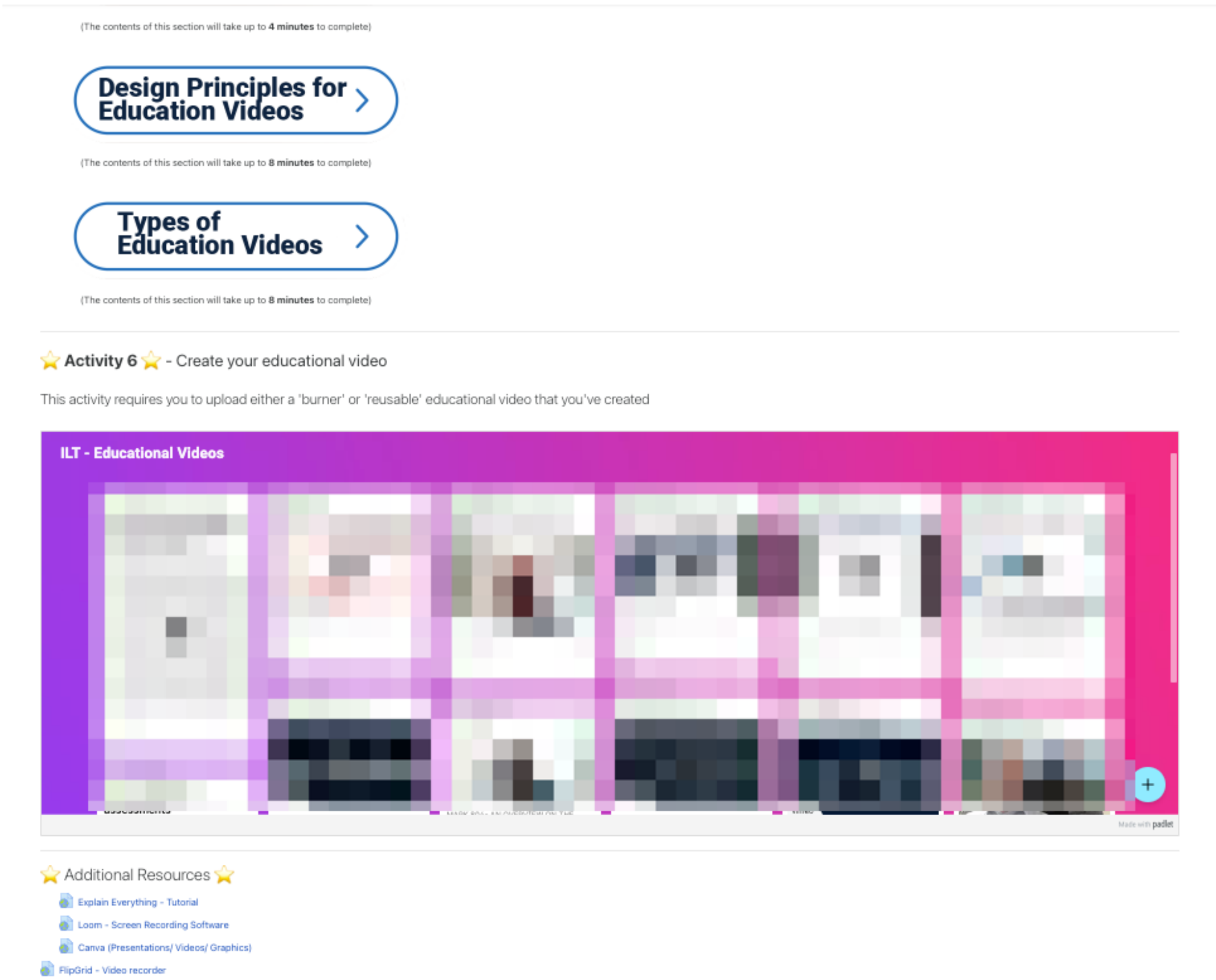
Contributions to the discussion forums, as shown in Figure 5.8, required participants to reflect on their teaching practices and the concept of learning design. This activity shows the presence of PCK and the application of DC-A3 and DC-A7 to engage with the participant community and utilise the Moodle tool.

Figure 5.8: *Examples of a discussion forum*



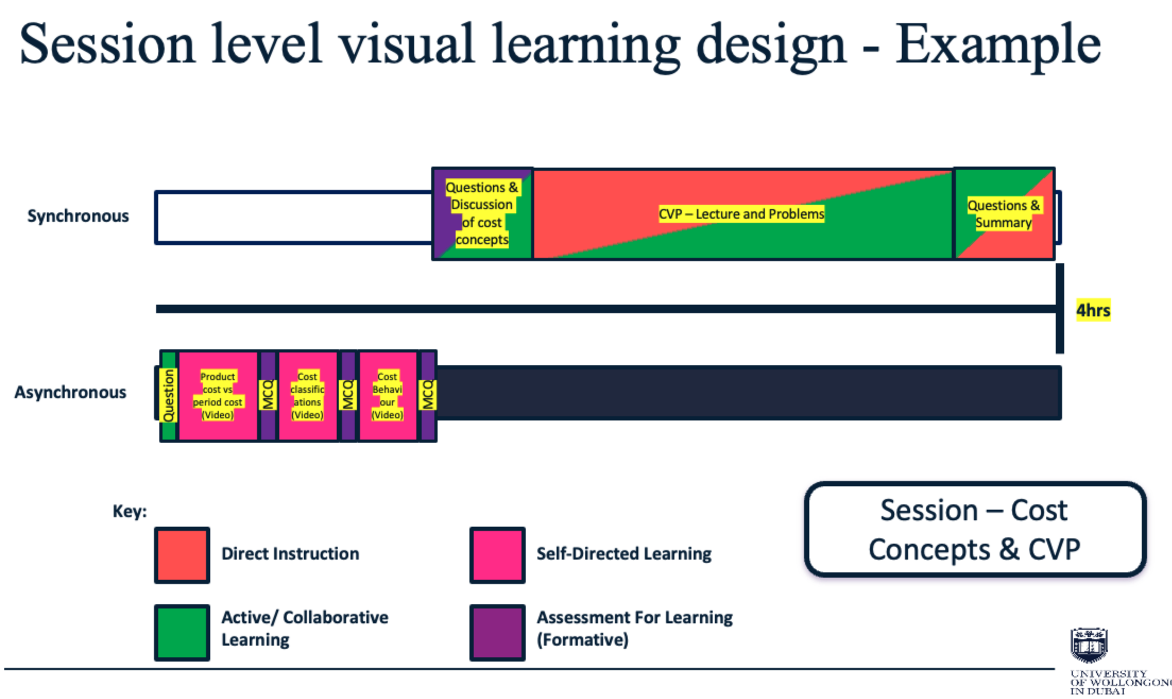
Creation of an educational video, shown in Figure 5.9, required participants' to synthesise design principles offered in the course (PK), develop a cohesive script relating to a concept in their teaching discipline (CK), identify an appropriate type of video for their script (TPK), select one technology tool (TK) and combine all together to create an educational video for their teaching context (TPACK) then share it with the cohort, this activity sequence relates to (DC-A2, DC-A3, DC-A4, DC-A5 and DC-A7).

Figure 5.9: *Educational video activity*



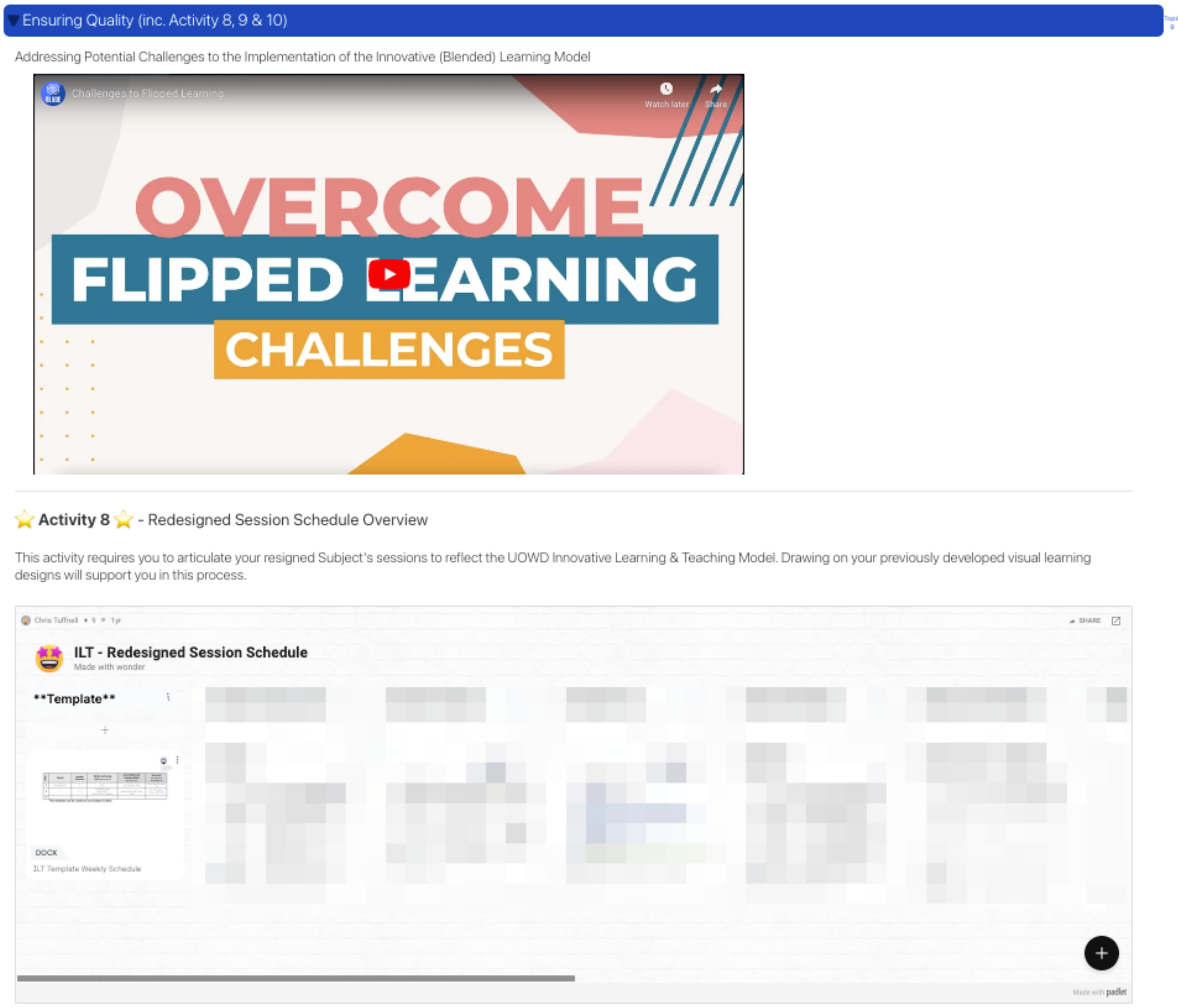
Development of session-level visual learning designs (VLD), as shown in Figure 5.10, followed by the development of PCK in accordance with DC-A2, DC-A3, and DC-A5 by crafting learning outcomes and identifying assessment activities. The participants were then required to engage with the learning content related to learning design approaches (PK) in relation to DC-A5 to consider how the learning content relates to their current teaching practice (PCK), and then follow the provided VLD template (VLD) to design 2-3 flipped learning sessions in accordance with DC-A5 and DC-A6 before uploading their VLD into the online learning environment to share with the community (DC-A4).

Figure 5.10: *Visual learning design example*



Building on the VLD activity, the course redesign activity (Figure 5.11) required participants to reflect, in accordance with DC-A3, on their previous learning activities of developing learning outcomes, assessments, and production of their VLD to combine their learning into a 10-week course syllabus template that prompted decisions on what was happening in the asynchronous and synchronous learning spaces, in line with DC-A6, on a weekly basis and what formative and summative assessments supported this process (PCK). The BL course designs were then uploaded to the online learning environment for peer feedback in accordance with DC-A3 and DC-A4.

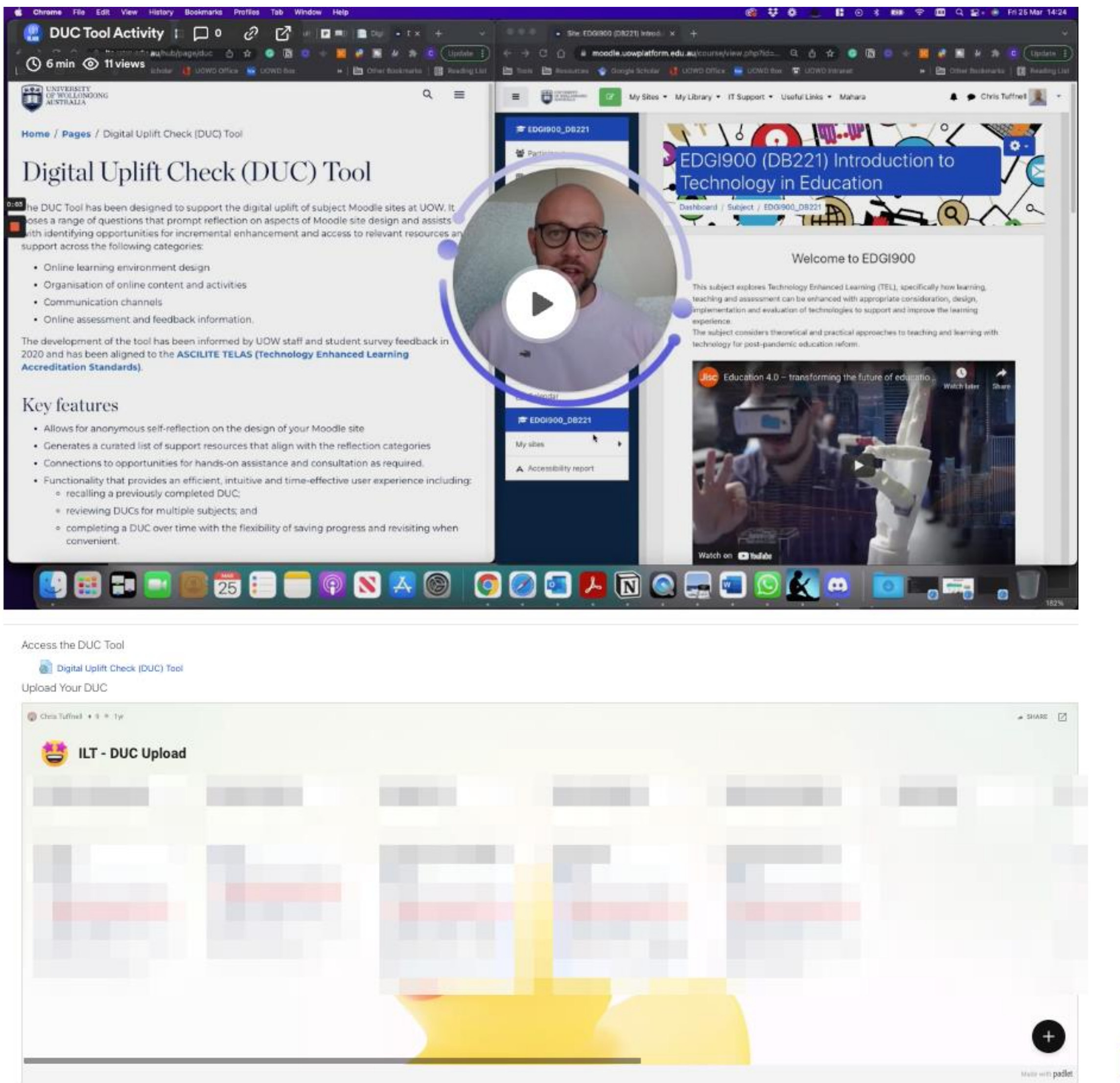
Figure 5.11: *Course syllabus redesign activity*



One of the activities towards the end of the course was for participants to set up their own online learning environment in the Moodle LMS, for their own BL course. They had to upload the course syllabus they had designed along with an educator introduction video and any other educational videos they created (TPACK), and carry out a self-assessment check on the digital environment, as shown in Figure 5.12. This activity combines DC-A2, DC-A3, DC-A5, DC-A6, and DC-A7.

The self-assessment tool was developed by the organisation and is based on the principles of CoI to inform the participants of the gaps in their online learning environment. Once the participants uploaded their results to the design interventions, online learning environment for the cohort to see, in line with DC-A3 and DC-A4.

Figure 5.12: *Digital learning environment self-assessment activity*



The final activity for the participants was to develop an action plan for further iteration before the launch of their courses, based on the report and previous peer feedback on their designs (TPACK).

5.3.5 Summary of Implementation phase for Cycle-A

The implementation of the design intervention for cycle-A is outlined. Course deployment has been discussed in terms of the course structure, mechanism of delivery (LMS), and in-person workshops. Support to which the participant's had access was provided. An overview of participants' monitoring, and engagement is presented and discussed, and examples of design artefacts from participants' portfolios are presented.

As the implementation stage of cycle-A concludes, the focus of the next section is to evaluate the effectiveness of the design intervention. The transition from implementation to evaluation is crucial to the iterative process. A thorough analysis is required to ensure that the DCs are not just theoretical constructs, but also actionable insights fostering real transformation in educators' BL design capabilities. The following evaluation section quantifies the success of cycle-A and provides invaluable insights for refining DCs for cycle-B.

5.4 Cycle-A: Evaluation

As discussed in section 4.6.4, the evaluation phase is critical for understanding the efficacy of the design intervention, eliciting insights that inform future iterations and extracting broader findings for the study's conclusive synthesis. This phase marks the culmination of cycle-A by transitioning into a reflective analysis, based on data collected following the completion of the design intervention course.

The course completion rate was 69% (n=9 /13) of participants who agreed to be part of cycle-A's design intervention course and agreed to be interviewed. The four participants who did not complete the course, P-A6, P-A8, P-A9, and P-A10, were contacted in an attempt to understand their challenges to completion, however, they either declined or did not respond, and their data were excluded from the evaluation.

The data available for this evaluation were taken from participants' portfolio artefacts (4.7.2) created during the design intervention and semi-structured interviews (4.7.3), in which participants engaged in reflective dialogue concerning their portfolio artefacts in addition to their overall experiential insights.

Interview questions were sent to the participants, as detailed in Appendix 1. The ensuing discussion is organised around the DCs in relation to the collated and analysed data. For each conjecture, the discussion is divided into sub-themes: one affirming the 'substantiation of the DC' and another contemplating 'further considerations for the DC'. This structure not only underscores any successful aspects of the conjectures but also highlights areas for refinement and enhancement.

5.4.1 DC-A1: A flexible, self-directed learning experience will increase participant engagement.

DC-A1 proposed a flexible, self-directed learning experience through a combination of information and resources in an LMS and scheduled on-campus workshops. When evaluating this DC, I aimed to understand whether this design supported participants' engagement in the course.

The data that were most relevant for the evaluation of DC-A1 were from the participants' portfolio artefacts, interview questions relating to their engagement in the course activities, and overall reflections on their experience in the course. Data from non-participating P-A6, P-A8, and P-A10 could have provided valuable insights into the barriers to engagement in the course, however, they were non-contactable.

5.4.1.1 Substantiating the Design Conjecture

The course completion rate was 69% (n=9/13). Course completion was measured by the completion of course activities that led to the creation of portfolio artefacts, which in turn aligned to course learning outcomes.

Participants commented on the positive aspects of flexible course design. Participants P-A2 and P-A12 underscored the benefits of adjusting their engagement in the course to accommodate busy periods.

Participant P-A3's statements reinforced this conclusion.

> *P3: "I adapted my session learning designs as I went" [helping to] "overcome time constraints allowing me to incrementally build skills and resources"*

This feedback indicated appreciation of the approach in allowing flexibility for managing time constraints, which in turn supported sustained engagement and skill development in order to complete the course. However, there were insufficient data, therefore, DC-A1 was partially validated for this cycle.

5.4.1.2 Further considerations for the Design Conjecture

Flexibility in course design has emerged as a positive factor for participant engagement. Based on the available data, it remains unclear whether flexibility is a factor for the non-participation of P-A6, P-A8, and P-A10.

However, the evaluation of DC-A1 has only been partially validated. I concluded that cycle-B should continue to explore whether a flexible, self-directed learning experience can support participant engagement.

5.4.2 DC-A2: Integration of content and activities to provide real-world relevance will increase engagement

DC-A2 focuses on the integration of real-world relevance in course content and activities. This is based on the understanding that contextual authenticity can enhance engagement with learning experiences.

The data that were most relevant to evaluating DC-A2 were participants' portfolio artefacts and participant responses to interview questions that reflected their portfolio artefacts and the development of teaching practice.

5.4.2.1 Substantiating the Design Conjecture

Five of the eight course activities (62.5%) were intended to mirror and foster transferable real-world skills. These activities included creating educational videos, developing learning outcomes, mapping out learning designs, and contributing to forum discussions related to the learning design mindset. Nine out of the 13 participants (69%) completed all five of these activities for their portfolios.

This led me to conclude that the inclusion of real-world relevance was a potentially positive factor for engagement. Subjectively, several participants shared their appreciation of the practical application of what they learned through real-world activities. This is highlighted by the comment from participant P-A2:

> *P-A2: "I gained valuable new insights into my teaching [practice] from this experience that will stick with me beyond the course"*

This comment, confirming the lasting impact of authenticity in the learning process, further underscores the merit of integrating real-world relevance. Overall, the integration of real-world relevance in the course content and activities was partially validated, and the rationale for this conclusion is discussed next.

5.4.2.2 Further Considerations for the Design Conjecture

Although of the nine participants who completed the course (n=9/13), 100% engaged in authentic activities, it was not without challenges, particularly concerning participants' PTK.

Several participants commented on the steep learning curve and time needed to produce and actively engage learners in asynchronous material. Participant P-A2 highlighted this, along with the challenge of engaging his students in an *asynchronous* learning environment:

> *P-A2: "I found difficulty in figuring out how to translate my regular lectures into interesting asynchronous material", adding, "I never realised how much work went into identifying and creating appealing learning content"*

The evaluation of DC-A2 has only been partially validated. However, there is compelling evidence that the DC's underlying principle of real-world relevance increases engagement. The complexities involved in participants' creation of engaging learning content should be considered in cycle-B.

5.4.3 DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension

DC-A3 aimed to incorporate reflective activities within the design intervention course to deepen the participants' comprehension of the learning content. Reflective activities ranged from discussion forums, reflection on teaching practices and current module design, reflection through giving and receiving peer reviews of BL designs, and quality assurance reflection tools focused on final BL designs.

The data that were most relevant to evaluating DC-A3 were participant responses to interview questions that reflected their portfolio artefacts and their overall reflection on their course experience.

5.4.3.1 Substantiating the Design Conjecture

Of the nine participants who completed the course (n=9/13), 100% completed reflection activities for their portfolios. Subjective support for the DC can be seen in participants' comments when discussing the impact of reflection on personal teaching practices:

> *P-A2: "I gained valuable new insights into my teaching from this experience that will stick with me beyond the course"*

In addition, when reflecting on their flipped learning designs,

> *P-A5: "I didn't fully get it until I actually tried designing a flipped session myself"*

Metacognitive reflections were also considered by participants', as highlighted by participant P-A5 who questioned: "Did this session flow as expected?".

Further underscoring the value of reflection in understanding and applying the flipped learning model to enhance design decisions, Participant P-A4 commented:

P-A4: "Taking time to review what worked well or not helped me continuously adjust my blended strategies"

Reflection was not limited to individual teaching practices but extended to the evaluation of all participants' design implementations. Participant P-A11 commented on the structured peer-reviewing exercises.

P-A11: "It empowered me to refine my blended learning design"

Therefore, it facilitates a reflective stance that contributes to the iterative refinement of BL design.

Overall, I found that the level of engagement in the activities and the supportive qualitative evidence gathered following course completion fully validated the DC.

5.4.3.2 Further Considerations for the Design Conjecture

Participants appear to recognise the importance of reflection related to the intricate balance of technology and pedagogy in their BL designs, such as when participant P-A5 commented:

P-A5: "I had to completely rethink how students would interact with the material and each other in the asynchronous components"

This speaks to the transformative impact of reflection on pedagogical approaches in the context of technological integration. Reflections on overcoming challenges, as communicated by the participants' P-A4 and P-A11, were vital for addressing and navigating practical obstacles during the design intervention.

This evaluation of DC-A3 was fully validated and reflective practices were demonstrated to be instrumental in deepening comprehension and fostering a thoughtful approach to both the design and execution of blended learning experiences. Future iterations of the design intervention should emphasise reflective exercises as a means of enhancing the pedagogical acumen of participants.

5.4.4 DC-A4: Providing collaborative opportunities will foster a faculty learning community

DC-A4 aimed to provide the participants with the opportunity to develop a supportive learning community. The premise is that cultivating a learning community of peers will help participants continuously develop and refine their blended learning practices.

The evaluation of this DC aimed to understand whether collaborative learning opportunities supported the development of a learning community. Collaborative opportunities came during in-person workshops and online discussion forums, however, participant interaction was mainly intended to be organically initiated and, therefore, challenging to quantify. However, data from interview questions related to participants' reflections on their collaborative experiences were useful.

5.4.4.1 Substantiating the Design Conjecture

Subjective supporting data for the DC evaluation came from the participants' P-A2, P-A5, and P-A7. They highlighted how collaborative efforts not only motivated them, but also fostered a more authentic learning experience. Specifically, participant P-A4 stated:

> *P-A4: "Hearing how a new strategy re-engaged students in another professor's module pushed me to keep trying when I faced setbacks. We motivated each other"*

Participant P-A5 articulated that mutual support from colleagues was invaluable:

> P-A5: *"My peers helped me adapt expectations and stay motivated when things got hectic by reassuring me, that we were in it together"*

The course's facilitation of a collective language and understanding, was acknowledged by participant P-A3 as a strength in the learning community:

> P-A3: "Reviewing definitions of concepts like 'active learning' and 'flipped classroom' really clarified things for me."

This was critical in cementing this sense of community as it allowed for shared knowledge and collective growth. Overall, the collaborative elements of the design intervention were partially validated through this evaluation.

5.4.4.2 Further Considerations for the Design Conjecture

There was a desire to share more explicit collaborative support mechanisms, such as online platforms, for sharing resources and addressing technological challenges.

An example of this can be seen in the comments of Participant P-A4:

> P-A4: *"An online forum to share tips and tricks or ask questions as we applied new technology skills would really boost my confidence"*

Such platforms can significantly enhance faculty confidence and competence in applying new teaching methodologies. This comment reflects broader feedback for sustained collaborative opportunities that extend beyond the confines of the timeframe for design intervention.

The evaluation of DC-A4 was partially validated. The evaluation highlights that providing collaborative opportunities can foster a faculty-learning community, however, participants indicate that future designs should look to provide more explicit collaborative opportunities, not just as a component of the course, but as an ongoing support system that reinforces the development of an FLC.

5.4.5 DC-A5: Learning design approaches will help guide intentional Blended Learning design for participants'

DC-A5 aims to include evidence-based learning design approaches in the course content to guide participants' blended learning design decisions. To evaluate this DC, I aimed to evaluate whether the selected learning design approaches, namely the backward design approach and CoI framework, provided sufficient guidance to the participants for their blended learning designs.

The data that were most relevant for the evaluation of DC-A5 were from interview questions related to participants' reflections on their experience in the course and specifically on their use of learning design approaches for their blended learning designs.

5.4.5.1 Substantiating the Design Conjecture

All nine of the participants' interviews commented that the intentional use of the learning design approaches was critical in shaping their understanding and guided them towards making purposeful design decisions.

Participant P-A1's comment underscores the impact of explicit models and frameworks to guide the conceptualisation of BL.

> P-A1: [I realised the approach] *"purposefully integrates asynchronous and synchronous elements for a coherent learning flow"*

In addition, participant P-A12 reflected on the evolving understanding of key concepts throughout the course, further exemplifying the importance of a common vocabulary in achieving intentional design.

The backward design approach provided a structured pathway for aligning learning outcomes, content, and activities, in which participants' P-A2 and P-A11 were highlighted as instrumental in making the design components more tangible and intentional. The CoI framework's inclusion emerged as a valuable tool, with participants such as P-A11 stating the following:

> P-A11: *"Mapping out how I would incorporate the different presences helped me take a more deliberate and thoughtful design decisions"*

Thus, it recognises its utility in facilitating deliberate and thoughtful design decisions. Overall, the inclusion of evidence-based learning design approaches was partially validated, and the rationale for this conclusion is discussed next.

5.4.5.2 Further Considerations for the Design Conjecture

While all the participants provided comments that supported the inclusion of the selected learning design approaches, participant P-A5's comments provided evidence of reflection:

> P-A5: "*considering the three CoI presences forced me to think about specific aspects of the learning experience, however I felt consideration of the student at the heart of the process was missing"*

This suggests that while learning design frameworks such as backward design and CoI can provide key elements of the design process, there is perhaps a more holistic approach to be considered when guiding the design of blended learning experiences.

Therefore, the evaluation of DC-A5 was partially validated. The advantage of a strong pedagogical foundation and structured design processes for BL environments is highlighted, while identifying that future iterations of the design intervention may consider a learner-centred approach to the design process to foster more coherent and effective BL experiences.

5.4.6 DC-A6: The flipped learning model will support participants' learning design decisions.

DC-A6 aimed to support participants' learning design decisions for BL by articulating a specific BL model, namely, the flipped learning model. When evaluating this DC, I aimed to understand whether the flipped learning model was clearly understood and whether it helped guide and build confidence in participants' learning design decisions.

The data that were most relevant for the evaluation of DC-A6 were from interview questions relating to participants' reflections on their portfolio artefacts, specifically their VLD, digital learning content, and redesigned course syllabus, in addition to their overall experience in the course.

5.4.6.1 Substantiating the Design Conjecture

All nine participants who completed the course (n=9/13), submitted artefacts in their portfolios, which demonstrated their understanding of the flipped learning model, ranging from their VLD, educational videos, redesigned course syllabus, and peer reviews received and given.

I derived from this evidence that the design intervention course provided clear articulation of the flipped learning model for BL design, which all engaged participants were able to implement.

A clear explanation of the key concepts, as previously mentioned in DC-A2, was identified as crucial for participants' design decisions. Supporting statements from participants' P-A3 and P-A5 commented on their initial misconceptions of flipped learning and their subsequent ability to apply the model effectively in their designs, following learning content from the design intervention.

> P-A5 stated: *"I didn't fully get it until I watched the explainer videos and actually tried designing a flipped session myself"*

This underscores the importance of hands-on practice in internalising the model for informed design decisions.

The VLD templates provided during the course proved to be significant tools for participants to further aid this process. This allowed participants, like P-A3, to translate the flipped model and transfer theory into practice more concretely. In addition, participant P-A2 commented that the use of templates helped him:

> P-A2: *"[…] map out and align my learning objectives, assessments, content, and activities,"*

This comment exemplifies how such tools can support and solidify the implementation of the flipped learning model. Overall, I found that the evaluation of the data sufficiently validated this DC.

5.4.6.2 Further Considerations for the Design Conjecture

Participants identified challenges in creating engaging asynchronous material and were encouraged to develop shorter lecture segments and iteratively adjust their designs. Participants P-A2 and P-A3's adaptability highlights the flipped model's potential to provide a flexible framework that accommodates and supports modifications in response to real-world teaching and learning contexts.

The evaluation of DC-A6 fully validated that the flipped learning model, when clearly articulated and complemented with supportive templates and examples, can effectively guide participants' learning design decisions. This suggests that future iterations should continue to utilise the flipped model to aid educators in learning design decisions for BL design.

5.4.7 DC-A7: The considered utilisation of technology will develop participants' technological experience and competence.

DC-A7 proposes that the considered use of technology in blended learning environments will develop participants' technological experiences and competence. When evaluating this DC, I aimed to understand if the design interventions, learning content, activities, and selection of technology tools helped participants to utilise and build confidence with the technology.

The data that were most relevant for the evaluation of DC-A7 were from interview questions related to participants' reflections on their experience in the course and digital learning content artefacts created during the course.

5.4.7.1 Substantiating the Design Conjecture

I found that of the nine participants who completed the course, 100% created digital learning content in the form of educational videos that were of a satisfactory level and followed the digital learning design principles offered in the course material.

In addition, participants felt that the design intervention's instructional support was pivotal in creating digital learning content. This instructional support was offered by me via scheduled weekly office hours. Over a 10-week course, four participants attended office hours for support. Participant P3 commented:

> P-A3 "[the instructional support] *helped me with everything from my course structure to content creation"*

This underscores the value of coaching and scaffolding in building creative confidence. Participants also acknowledged the effectiveness of experiential learning through hands-on projects, which is essential for building technological competence. Overall, the considered utilisation of technology is partially validated in this evaluation, and further rationale for this conclusion is discussed next.

5.4.7.2 Further Considerations for the Design Conjecture

A common theme among the participants' feedback was the need for more dedicated training on EdTech tools for content creation. The course included tools such as Padlet, Loom, and Jamboard based on their user-friendly interface and direct relevance to the participants' current education environment.

However, participant P-A1 voiced a need for; "protected time to actually experiment with the tools”, suggesting that structured time for practice is critical. Moreover, Participant P-A4 suggested an online forum for sharing “tech tips” and troubleshooting, indicating a desire for ongoing collaborative support mechanisms within the FLC, as discussed in DC-A4.

The design challenges in translating traditional lectures to engaging asynchronous content were also highlighted, as described by the participants’ P-A2:

> P-A2: “*figuring out how to translate my regular lectures into interesting asynchronous material was tough"*

This reinforces the necessity for more practical, application-focused training to bridge the gaps in technological skills.

Thus, the evaluation of DC-A7 was partially validated. The multifaceted approach needed to nurture technological competence in BL designs was highlighted. It was suggested that future iterations of the design intervention course should incorporate more structured training sessions, protected experimentation time, and collaborative support systems to ensure that educators not only understand the theoretical underpinnings of technology use in BL but are also proficient in its practical application.

5.4.8 Summary of Evaluation phase for Cycle-A

Overall, the evaluation of data relating to cycle-A’s design conjectures illustrates the multifaceted nature of PD for BL design. The importance of flexibility, authenticity, collaboration, reflective practice, intentional design, and technological proficiency has been substantiated through the analysis of participant data in relation to hypothesised DC’s.

The evaluation was distilled into a summary,Table 5.5, to provide a visual overview of validated and partially validated conjectures and to organise and reference future considerations for the next iteration. Future considerations identified from the evaluation of DCs will serve as a foundational basis for further development of DCs in Cycle-B of the design intervention.

Table 5.5: *Summary of Cycle-A: Evaluation of Design Conjectures*

TPACK Domain	Cycle-A's DCs	Summary of the Evaluation for Cycle-A (Key: ☑= validated ☒= not/partially validated)
Content Knowledge	DC-A1: A flexible, self-directed learning experience will increase participant engagement	☒ - *partially validated* The evaluation somewhat confirms that a flexible, self-directed learning experience can support participant engagement, although future designs should continue to explore flexibility to further examine the impact on participant engagement.
	DC-A2: Integration of content and activities to provide real-world relevance will increase engagement	☒ - *partially validated* Considerations for more effective scaffolding of participants' pedagogy and technological skills, to manage the demands of authentic, real-world learning should be considered for future iterations of the design intervention.
	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension	☑ – *validated* The evaluation confirms that reflective practices are instrumental in deepening comprehension and fostering a thoughtful approach to both the design and execution of blended learning experiences.

	DC-A4: Providing collaborative opportunities will foster a faculty learning community	☒ - *partially validated* Participants indicate that future designs should continue to provide collaborative opportunities, not just as a component of the course, but as an ongoing support system that reinforces the development of a FLC, encouraging resilience, motivation, and a shared commitment to pedagogical innovation.
Pedagogical Knowledge	DC-A5: Learning design approaches will help guide intentional Blended Learning design for participants'	☒ - *partially validated* This evaluation identified that future iterations of the design intervention may consider a learner-centred approach to the design process to foster more coherent and effective blended learning experiences.
	DC-A6: The flipped learning model will support participants' learning design decisions	☑ – *validated* The evaluation confirmed that the flipped learning model, when clearly articulated and complimented with supportive templates and examples can effectively guides participants' learning design decisions.
Technological Knowledge	DC-A7: The considered utilisation of technology will develop participants'	☒ - *partially validated*

	technological experience and competence	The evaluation highlighted the multifaceted approach needed to nurture technological competence in blended learning design. It was suggested that future iterations should incorporate more structured training sessions, protected experimentation time, and collaborative support systems to ensure that educators not only understand the theoretical underpinnings of technology use in blended learning but are also proficient in its practical application.

The insights gained indicate that participants benefit from a learning experience that is flexible, adaptive, collaborative, and reflective with structured support in technology use. These considerations will be further developed in the next iteration, cycle-B, which will aim to further refine DCs based on this evaluation.

5.5 Cycle-A: Conclusion

Cycle-A of this DBR project has systematically explored the intersection of educator PD with BL design, underpinned by the TPACK framework. Cycle-A explored the nuanced demands of designing engaging, technologically enhanced, and pedagogically sound PD experiences for educators. The cycle design intervention was developed on the basis of design conjectures grounded in evidence-based pedagogical strategies.

Through the implementation of the design intervention course, I observed a somewhat positive engagement in participants' design decisions, reflective practices, and collaborative efforts, resulting in their blended redesign of courses. The process highlighted the benefits of flexibility, authentic learning tasks, and strategic integration of technology to resonate with educators' professional realities.

The iterative nature of the proposed DBR approach provides insights for further development. Some design conjectures have been validated through evaluation whereas the majority have been partially validated with opportunities to further develop and refine them in the following cycle-B. Evaluation of the partially validated DC has identified the need for more exploration of flexibility in the design intervention course, deeper pedagogical scaffolding, additional avenues for peer collaboration, and further support for technology navigation.

The transition to Cycle-B aims to enhance design intervention by:

1. Continuing Exploration of Flexibility: Further exploring the role of self-directed, flexible learning experiences to optimise educator engagement.
2. Refining Real-world Relevance: Amplifying the authentic integration of content by refining scaffolding strategies that bridge the gap between theory and practical application.
3. Learner-centred Practices: Identifying learning design approaches that deliberately consider the learner in the design process.
4. Bolstering Collaborative Frameworks: Cultivating more explicit collaborative infrastructure, both within and beyond the course, to nurture a sustained faculty learning community.
5. Technological knowledge development: Confidence in the utilisation and integration of technology in the blended learning design process.

Cycle-B will iterate the conjectures of cycle-A with a focus on these themes, with the aim of improving the design intervention.

Chapter 6: Findings - DBR Cycle-B

This chapter presents the findings from the second iteration of the design intervention course, cycle-B. The *Analysis* section (6.1) presents an analysis of literature, specifically conducted to identify new key considerations to refine unvalidated design conjectures from cycle-A. The *Design* section (6.2) discusses the iterative development of design conjectures based on key considerations identified in the analysis section. The refined conjecture map based on the new design conjectures is presented along with details of the design intervention. The *Implementation* section (6.3) discusses the deployment of the second iteration of the design intervention course, in addition to how participants were supported in the course and their portfolio development. The *Evaluation* section (6.4) presents an analysis of participants' data produced during their experience of cycle-B's design intervention course, and the validity of design conjectures is discussed. The *Conclusion* section (6.5) wraps up cycle-B with a conclusion in preparation for cycle-C.

6.1 Cycle-B: Analysis

The analysis section for cycle-B differs somewhat from cycle-A because it focuses on identifying key considerations for iterative improvement of design conjectures rather than foundational building. Following cycle-A's evaluation phase (section 5.4), the design conjectures were either validated or partially validated. The 'fully validated' conjectures (DC-A3 and DC-A6) from cycle-A will remain part of the design intervention with no further investigation. Whereas the ‘partially validated’ DCs from cycle-A will be refined based on key considerations derived from the analysis literature.

The selection of literature for this analysis section will follow the same process discussed previously in section 4.6.1. A broad focus will remain on the design of PD and BL design. However, the literature will be identified based on specific issues identified from cycle-A’s evaluation of individual DC’s.

In line with the process previously outlined in section 4.6.1, as literature is presented, key considerations that emerge are identified with the letter ‘B’ representing cycle-B and then a corresponding number, that is, ‘B1’, ‘B2’ etc. A table summary of all the key considerations that are identified is presented in section 6.1.8.

6.1.1 DC-B1 Key considerations

DC-A1 proposed that a flexible, self-directed learning experience increases participant engagement. This conjecture was only partially validated in cycle-A’s evaluation, therefore, further development was deemed necessary.

6.1.1.1 Engagement through flexible, self-directed learning

In the evaluation of DC-A1 discussed in section 5.4.1, flexible access to the intervention course was identified as a positive factor for managing time constraints and workloads that could potentially inhibit course engagement. Therefore, a design intervention course needs to be further developed to offer flexible access and engagement.

To identify key considerations for DC-B1, I searched the OneSearch database to identify contemporary articles that could guide course redesign by identifying effective methods for flexible PD. Therefore, I focused on the keywords “designing”, “flexible”, “effective” “professional development”. The following discussion draws on seven relevant literature sources that discuss the design of flexible and effective PD. The sub-themes identified in the following discussion related to fully asynchronous online education for flexible access, engagement as a result of preparation for online success, and acknowledgement through digital badging emerged as imperative factors to consider for the design intervention.

6.1.1.2 Leveraging technology for flexible professional development

The literature analysis identifies key considerations that leverage the use of technology in the design of PD. Specifically, the three concepts of *asynchronous design*, *comprehensive online orientation*, and *digital badging* are identified and discussed below.

Researchers have discussed the benefits of d flexible, fully *asynchronous design* to align with contemporary changes in education provision (Blaschke, 2012; Rienties et al., 2023). Dancy et al. (2019) adds that the asynchronous online approach also works to accommodate educators’ busy schedules. In addition to the pragmatic advantages of asynchronous online PD studies, participants made substantial gains in knowledge and confidence through well-designed fully online PD, underscoring the importance of a carefully curated curriculum, using appropriate technologies to facilitate interaction and feedback, and offering opportunities for collaboration among participants (Dancy et al., 2019; Rienties et al., 2023). Therefore, the first key consideration for the redesigned intervention course (B1) is that fully online asynchronous PD programmes can increase flexible access and support time-constrained professionals.

According to Chitanana (2022), a *comprehensive orientation* to an online learning platform is a key consideration for participant success in the asynchronous online approach. This allowed participants to familiarise themselves with the course tools and layout, thereby enhancing their learning experience. Therefore, the second key consideration for the redesigned intervention course (B2) is that a comprehensive orientation to the digital environment should be provided to help support participant success

In terms of motivation for online PD, the inclusion of *digital badging* is said to serve as a significant motivational factor in online PD. Qian et al. (2018) identified the benefits of digital badges in recognising achievements and competencies, which in turn motivate learners by providing a tangible sense of progress and accomplishment. This is particularly relevant in online contexts where traditional forms of recognition may be less apparent. Therefore, the third consideration for the redesigned intervention course (B3) is that elements such as digital badging should be considered to motivate and engage participants'

In summary, the literature analysis identified the key considerations for DC-B1. The first consideration (B1) identified that fully online asynchronous PD programmes can increase flexible access and support time-constrained professionals. This differs from cycle-A's course design in that it consists of online content and activities, with no fixed learning path, in the LMS, and in-person workshops. The second key consideration (B2) is that a comprehensive orientation towards the digital environment should be provided to help support participants' success. This makes sense, particularly for fully online asynchronous. While a course overview was provided in Cycle-A, detailed orientation to the LMS did not occur. Finally, the third consideration (B3) is that elements such as digital badging should be considered to motivate and engage the participants. This did not occur in the previous design intervention, and it would be interesting to determine if it had an impact on engagement.

6.1.2 DC-B2 Key considerations

DC-A2 proposed that real-world content and activities would provide relevance and increase participants' engagement. This conjecture was partially validated in cycle-A's evaluation, therefore, further development was deemed necessary.

6.1.2.1 Development of pedagogical skills

The main issue identified in the evaluation of DC-A2, as discussed in section 5.4.2, was the development of participants' pedagogical skills. In addition, the development of technological skills was also identified for this DC. However, this will not be the focus, as this consideration will be given to technological development later in this section when looking at DC-B7.

In relation to pedagogical skills development, participants specifically expressed the need for more training on engaging in learning strategies, especially for asynchronous environments. This indicated a deficit in the pedagogical information provided during the design intervention and suggests a need for more extensive pedagogical development in cycle-B's design intervention.

To identify key considerations for DC-B2, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign by identifying effective methods for engaging learners in BL environments. I focused on keywords "designing" "active learning" and "blended learning environments". The following discussion draws upon 12 relevant literature sources that discuss active learning in the BL context. The sub-themes identified in the following discussion relate to active learning strategies, collaborative learning, and strategies that capitalise on collaborative teaching and learning technologies that emerged as imperative factors to consider for design intervention.

6.1.2.2 Active learning for blended learning design

The literature analysis identified key considerations that focused on the development of active learning in design interventions. Specifically, the three concepts of *active learning strategies*, *approaches*, and *technologies are* identified and discussed below.

Clark and Past (2021) define active learning as learner engagement in the process of knowledge acquisition and skill application through interactive activities, discussions, and discovery-based learning. This contrasts with passive learning, in which learners aim to listen to and retain information. Research has shown that the inclusion of active learning reduces failure rates, increases performance in assessments (Freeman et al., 2014), improves problem-solving (Kern, 2002) and critical thinking skills (Krajcik & Shin, 2023), and increases engagement and learner satisfaction (Lumpkin et al., 2015; Stockwell et al., 2015).

Active learning strategies are recognised as critical factors for enhancing educational outcomes. These strategies can range from activities such as questions, discussions, and quizzing to more fundamental shifts towards problem-solving (Clark & Past, 2021; Freeman et al., 2014; Marlor et al., 2022). Starr-Glass (2021) identifies that the effectiveness of active learning in BL designs is contingent upon the thoughtful integration and synthesis of these strategies in the synchronous and asynchronous learning environments. Therefore, the key consideration (B4) is that an understanding of active learning strategies is needed in the redesigned course.

In the realm of BL design, advocates propose *active learning approaches,* such as problem-based, project-based and team-based learning can be coupled with flipped learning models to enrich the learning experience (Li et al., 2021; Maxwell & Khatri, 2021). Gargano (2021) discusses the integration of active synchronous and asynchronous learning approaches in what is termed "active blended learning" and is said to foster deeper understanding and increase learner engagement. Therefore, the key consideration (B5) is building understanding and engagement through active learning approaches that are needed in the redesigned course.

In addition, according to Hoic-Bozic et al. (2009), *active learning technologies* can support active BL design by utilising collaborative technology for interactive activities, communication, reflection, and problem-solving. Maxwell and Khatri (2021) also propose that active learning approaches, such as project-based learning, are particularly useful for technologically enhancing active BL. Therefore, key consideration (B6) identifies that technologies can be used to support active learning approaches in the redesigned course.

In summary, the literature suggests that developing pedagogical knowledge for active BL requires an understanding of active learning strategies and activities (B4) and building understanding and engagement through active learning approaches (B5) supported by the utilisation of active learning technologies (B6). While there were content and activities related to active learning in cycle-A of the design intervention, the key considerations identified here will inform more deliberate integration through content and participation.

6.1.3 DC-B3 Key considerations

DC-A3 proposed that the incorporation of reflective exercises deepened the participants' learning comprehension. This conjecture, discussed in section 5.4.3, was appropriately validated during cycle-A and it was suggested that future iterations of the design intervention should continue to emphasise reflective exercises as a means of enhancing the pedagogical acumen of the participants.

Therefore, for cycle-B, there will be no additional changes to the reflective activities in the design intervention course, as the conjecture does not need further validation at this point.

6.1.4 DC-B4 Key considerations

DC-A4 proposed that providing collaborative opportunities would help foster a FLC. This conjecture was only partially validated in cycle-A's evaluation, therefore, further development was deemed necessary.

6.1.4.1 Designing collaborative learning opportunities

The main issue identified by participants in the evaluation of DC-A4, discussed in section 5.4.4, was that future designs should intentionally provide collaborative learning opportunities, not just as a component of the course, but as an ongoing support system that reinforces the development of faculty and encourages a shared commitment to pedagogical innovation.

To identify the key considerations for DC-B4, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign by identifying how to develop learning communities for participants. I focused on keywords such as "design", "collaborative learning", "educators", and "learning communities". The following discussion draws upon 12 relevant literature sources that discuss the design and development of collaborative learning communities. The sub-themes identified in the following discussion relate to the benefits of FLCs and guiding principles for designing FLCs as imperative factors to consider for design interventions.

6.1.4.2 Developing faculty learning communities

The literature analysis identified the key considerations that focused on the development of learning communities. Specifically, the two concepts of *FLC principles* and the use of a *collaborative online platform* are identified and discussed below.

Collaborative learning communities for educators, namely FLCs, have emerged as influential frameworks in the realm of PD, supporting faculty in engaging in scholarship and reflection, addressing student learning problems, and improving educational outcomes (Cox, 2013; Cox & McDonald, 2017; Sipple and Lightner, 2023). Seminal research by Cox and McDonald (2017) identifies two types of FLCs: topic-based and cohort-based. A topic-based FLC focuses on a particular topic, for example, designing BL, alternatively, cohort-based FLCs provide a platform for a group of academics to explore the same special interest area. Both types of FLC are based on collaborative efforts that not only share knowledge and expertise but also encourage faculty to explore innovative teaching methods and share ideas to co-create solutions that enhance educational expertise (de Carvalho-Filho et al., 2020; Kochhar et al., 2023).

When considering the design of FLCs for design intervention research, Wenger-Trayner and Wenger-Trayner's (2015) *FLC principles* can be followed. The principles include designing for evolution, promoting open dialogue, inviting diverse participation levels, and creating a rhythm for the community, all of which support a dynamic and evolving learning environment. Building on Wenger-Trayner and Wenger-Trayner's (2015) foundational principles, de

Carvalho-Filho et al.’s (2020) synthesis of the literature proposes actionable guidelines for designing and implementing FLCs, including initiating with a core group, clearly articulating goals, focusing on problem-oriented tasks, and ensuring inclusivity. They also emphasised the importance of facilitation, institutional support, sustainability, communication of successes, online engagement, and regular evaluation of the impact of FLC. Therefore, the key consideration (B7) aims to adopt the principles outlined in the redesigned course.

C*ollaborative online platforms* should be considered as delivery mechanisms for FLC. Dancy et al. (2019) research proposes that online FLCs broaden educators' knowledge horizons by linking them to a global network of educators with shared learning objectives, facilitating the exchange of resources and expertise. Additionally, online FLCs ensure sustained professional dialogue that is not bound by time or location to provide continuous peer support (Lantz-Andersson et al., 2018). The cross-institutional and international networking opportunities offered by online FLCs not only enable educators to learn from diverse colleagues, but also encourage reflection, self-efficacy, and the formation of connections with like-minded individuals (Barrot & Acomular, 2022; Howard, 2021; Lantz-Andersson et al., 2018). Therefore, the key consideration (B8) is to identify an appropriate online delivery platform that will foster collaboration in the FLC.

In summary, the literature suggests that when developing an FLC for cycle-B, the focus is on establishing a core group, setting clear objectives, tackling specific issues, and fostering an inclusive atmosphere (B7). Along with embracing an online platform (B8), it not only facilitates global collaboration but also ensures ongoing support and dialogue among faculty members, thus enhancing the overall professional development experience. This is a much more deliberate development of the FLC than in cycle-A, where it was left to organically develop.

6.1.5 DC-B5 Key considerations

DC-A5 proposed that evidence-based learning design approaches, such as backward design and the CoI framework, will help guide intentional BL design for participants. This conjecture was only partially validated in cycle-A's evaluation, therefore, further development was deemed necessary.

6.1.5.1 Designing for learner-centredness

The main issue identified by participants in the evaluation of DC-A5, discussed in section 5.4.5, was for the design intervention to include guidance for a design approach that purposefully considers the learner in the design process, as this was found to be lacking in the previous cycle.

To identify key considerations for DC-B4, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign by identifying learning design approaches that consider learners in the design process. I focused on keywords such as "learning design", "learner-centred design", and "instructional models". The following discussion draws upon nine relevant literature sources that discuss learner-centred learning design models. The sub-themes identified in the following discussion relate to human-centred pedagogy, iterative design approaches, and design thinking as learning design approaches for BL.

6.1.5.2 Identifying a learner-centred design approach

The literature analysis identified key considerations that focused on learner-centred design in design intervention. Specifically, the three concepts of *human-centred design pedagogy*, *iterative design*, and *design thinking methodology* are identified and discussed below.

Learner-centred education is increasingly recognised as a key instructional paradigm that places students at the heart of the educational process (Atlay, 2013). The adoption of a learner-centred approach would be instrumental when developing educational solutions, such as BL, centred on student experiences and needs (Luka, 2014; Shé et al., 2022).

Human-centred pedagogy could be a useful approach for designing learner-centred blended learning. Luka (2014) and Karakaya (2020) explored how educators could consider their students' needs, feelings, and challenges in their learning designs by adopting human-centred pedagogy. In relation, an *iterative design* approach could be complimentary, Bennett et al. (2017) identified that educators approach learning design iteratively, continually refining their methods in alignment with new insights into student needs and contextual factors. Therefore, the key consideration (B9) aims to adopt a human-centred pedagogical design approach, along with the key consideration (B10), an iterative design approach to BL design in the redesigned course.

Considering the two aspects of human-centred pedagogy and iterative design, leads to the consideration of methods such as *Design Thinking* (DT), an iterative design process, which advances through detailed cycles of development (Bennett et al., 2017), prioritising empathy and engagement (Shé et al., 2022). DT is consistent with the ways in which designers often engage with users, employing ethnographic methods, such as observation and interviewing, to integrate user needs into design features (Erman, Serpil-Altay, & Altay, 2004; McDonagh & Thomas, 2010). The iterative DT process involves redefining the educational experience by continuously adapting to the evolving needs of students and broader educational context (Karakaya, 2020).

DT is particularly effective in fostering an educational environment attuned to learners' experiences. This is in line with the human-centred approach advocated by Luka (2014) and Baran and AlZoubi (2020), which encourages instructors to empathise deeply with learners, allowing tailored learning experiences that address individual needs within BL environments. DT's iterative stages—empathy, define, ideate, prototype, and test—are crucial in developing and refining learning experiences that not only meet educational goals but also meaningfully engage learners (Shé et al., 2022). In the context of HE, the application of DT has shown the potential to create authentic learning experiences that resonate with the learners. Shé et al. (2022) illustrates how DT can be integrated into instructional design to achieve empathy with learners, enhance student engagement, and facilitate successful attainment of learning outcomes. Therefore, the key consideration (B11) aims to adopt a design-thinking methodology in the redesigned course.

In summary, the literature suggests that cycle-B’s key considerations should consider adopting a human-centred design pedagogy (B9) along with an iterative design mindset (B10) to support the design of learner-centred BL. Specifically, the design thinking methodology (B11) is suggested as an approach that combines both human-and learner-centred considerations with an iterative design process that can be followed. This approach will require rethinking the overall course structure for cycle-B, this can be further explored in section 6.2.

6.1.6 DC-B6 Key considerations

DC-A6 proposed that the flipped learning model would support the participants’ learning design decisions. This conjecture, discussed in section 5.4.6, was appropriately validated during cycle-A, and it was suggested that future iterations should continue to utilise the flipped model to aid educators in learning design decisions for BL design.

Therefore, for cycle-B, there will not be any change in the content and activities in the design intervention course related to the flipped learning model, as the conjecture does not need further validation at this point.

6.1.7 DC-B7 Key considerations

DC-A7 proposed that the considered utilisation of technology will develop participants’ technological experience and competence. This conjecture was only partially validated in cycle-A’s evaluation, so further development was deemed necessary.

6.1.7.1 Developing PD for TK

The main issue identified by participants in the evaluation of DC-A7, discussed in section 5.4.7, was the need for educators to develop an understanding of the theoretical underpinnings of technology use in blended learning and become proficient in its practical application.

To identify key considerations for DC-B7, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign to develop participants' TK and TPK. I focused on keywords "designing", "professional development", "educators" and "technological knowledge". The following discussion draws upon nine relevant literature sources that discuss designing PD for educators' technological development. The sub-themes identified in the following discussion relate to the types of PD delivery, inclusion of evidence-based approaches, and consideration of cognitive overload in technological training.

6.1.7.2 Developing educators' technological knowledge

The literature analysis identified key considerations that focused on the development of educators' technological knowledge in design interventions. Specifically, the three concepts of *approaches to training*, *evidence-based coaching*, and *cognitive load* are identified and discussed below.

Contemporary research argues that the development of educators' TK has become increasingly critical in education provision, particularly following the Covid-19 pandemic, which has shifted attitudes and prompted a greater willingness for educators to move beyond disciplinary content mastery and include technological proficiency in their teaching practices (Schwartz, 2020; Cain et al., 2022; Ginting & Linarsih, 2022). However, Nilsson and Lund's (2022) research identified that the rise in the use of technology in education presents both challenges and opportunities.

Dancy et al. (2019), research identifies that there is a steep learning curve for educators to successfully adopt technologies to enhance and improve their online and face-to-face teaching practices. VanUitert et al. (2019) argue that educators must understand the strengths and limitations of various educational tools and align technology with subject matter and instructional methods effectively. In addition, Liu and Szabo (2009) warned that cognitive overload, which is typical of time constraints, energy commitment, and pressure to keep up with rapidly evolving technology, can impede the learning of new technologies.

Therefore, when designing PD programmes to improve educators' proficiency in technology, it is necessary to consider various factors. The *approach to training* can be a consideration, Pantic and Cain (2022) state that educators acquire technology skills through formal, informal, and peer-supported learning approaches. Several authors have proposed that PD programmes should incorporate hands-on learning strategies to actively engage educators and promote technology integration through practice and peer support to achieve competence in delivering agile teaching in blended or fully online modes (Pantic & Cain, 2022; Liang & Law, 2023). Therefore, the key consideration (B12) is to adopt a variety of PD approaches in the redesigned course for participants' technological development.

In addition, VanUitert et al. (2019) proposed a PD that embraces *evidence-based practices*, customisable curriculum materials, and personalised data-driven coaching for continuous improvement. The authors also advised that PD should aim to avoid *cognitive overload* by providing manageable learning experiences distributed over multiple sessions, allowing educators to assimilate new concepts, experiment with new technologies, and access peer support during implementation (Liu & Szabo, 2009; Pantic & Cain, 2022). Therefore, the key consideration (B13) aims to adopt evidence-based practices in the redesigned course, including but not limited to considerations related to cognitive overload.

In summary, the literature suggests that a combination of PD approaches will support the technological development of educators (B12). This is in line with considerations DC-B4 including more peer or collaborative learning experiences. In addition, PD should be evidence-based, customisable, and incorporate data-driven coaching (B13). Reflecting on the cycle-A design intervention, evidence-based approaches were always a key component, and more data-driven interventions could be explored for cycle-B. Finally, B14's key consideration came from the literature that proposed PD for educators' technological development should consider cognitive load. The suggestions for breaking up the training in chunks allow participants' processing time and hands-on experimentation with technology is something to explore in cycle-B.

6.1.8 Summary of Analysis phase for Cycle-B

This literature analysis resulted in several key considerations being identified in correlation with issues identified in cycle-A's partially validated DCs. The identified key considerations have been distilled the summary Table 6.1, to organise and reference the key considerations. These considerations will serve as a foundational basis for refining DCs and developing new aspects of the design for cycle-B's design intervention.

Table 6.1: *Key considerations - Cycle-B*

TPACK Domain	Cycle-A's DCs	Key area	Key considerations for Cycle-B's DCs
Content Knowledge	DC-A1: A flexible, self-directed learning experience will increase participant engagement	**Flexible, self-directed learning for improved engagement**	B1. Consider fully online intervention course to increase flexible access and support time constraints of participants. B2. Include a comprehensive orientation to the digital environment should be provided. B3. Consider Digital badging to motivate and engage participants.
	DC-A2: Integration of content and activities to provide real-world relevance will increase engagement.	**Active blended learning**	B4. Include content on active learning strategies and activities B5. Develop collaborative learning approaches. B6. Consider collaborative teaching and learning technologies.
	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension.	**n/a**	No additional considerations for this iteration.

Pedagogical Knowledge	DC-A4: Providing collaborative opportunities will foster a faculty learning community	**Developing faculty learning communities**	B7. Consider identified principles for establishing a FLC i.e. core group, clear objectives, inclusive atmosphere, tackling specific issues (blended learning design) B8. Utilise an online platform to enhancing the reach of the FLC
	DC-A5: Learning design approaches will help guide intentional BL design for participants'	**Human-centred pedagogical design**	B9. Consider a human-centred design pedagogy B10. Consider an iterative design approach to blended learning design B11. Utilise a design thinking methodology to combine learner-centred considerations and an iterative design process
	DC-A6: The flipped learning model will support participants' learning design decisions.	**n/a**	No additional considerations for this iteration.
Technological Knowledge	DC-A7: The considered utilisation of technology will develop participants' technological experience and competence.	**Developing educators' technological knowledge**	B12. Consider a mix of formal, informal and peer-supported approaches to technology training B13. Consider PD that is evidence-based, customisable and data-driven coaching B14. Consider cognitive load in tech PD, distributed over multiple sessions, allowing educators to assimilate new concepts, experiment with new technologies, and access peer support

6.2 Cycle-B: Design

This section focuses on developing the second iteration of the design intervention and further refining the identified DCs based on key considerations culminating for section 6.1.

Building on the DC discussion, a revised design conjecture map is presented, section 6.2.2, to visualise the explicit linkage between design conjectures that inform embodiments, mediating processes and intended outcomes for the design intervention. The section concludes with a discussion related to the components of the design conjecture map to provide more detailed insight into the design decisions for cycle-B's design intervention course.

6.2.1 Design Conjectures for Cycle-B

As discussed in section 4.6.2, following an analysis of the literature and identification of key considerations (section 6.1), an iterative ideation technique was employed to refine the DCs.

The outcome of the ideation process for cycle-B resulted in the refinement of Dcs, derived from key considerations and underpinned by TPACK, to inform the second design intervention.

Table 6.2 shows cycle-A's DCs (left column), the key consideration from cycle-B's analysis phase (middle column) and the refined DCs for cycle-B (right column).

Table 6.2: *Design Conjectures - Cycle-B*

TPACK Domain	Cycle-A's DCs	Key considerations	Refined DCs for Cycle-B
Content Knowledge	DC-A1: A flexible, self-directed learning experience will increase participant engagement	B1. Consider fully online intervention course to increase flexible access and support time constraints of participants. B2. Include a comprehensive orientation to the digital environment should be provided. B3. Consider Digital badging to motivate and engage participants.	DC-B1: An online, asynchronous PD learning experience will increase participant engagement
	DC-A2: Integration of content and activities to provide real-world relevance will increase engagement.	B4. Include content on active learning strategies and activities B5. Develop collaborative learning approaches. B6. Consider collaborative teaching and learning technologies.	DC-B2: Integration of active blended learning strategies will develop participants' PK
	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension.	No additional considerations for this iteration.	No change

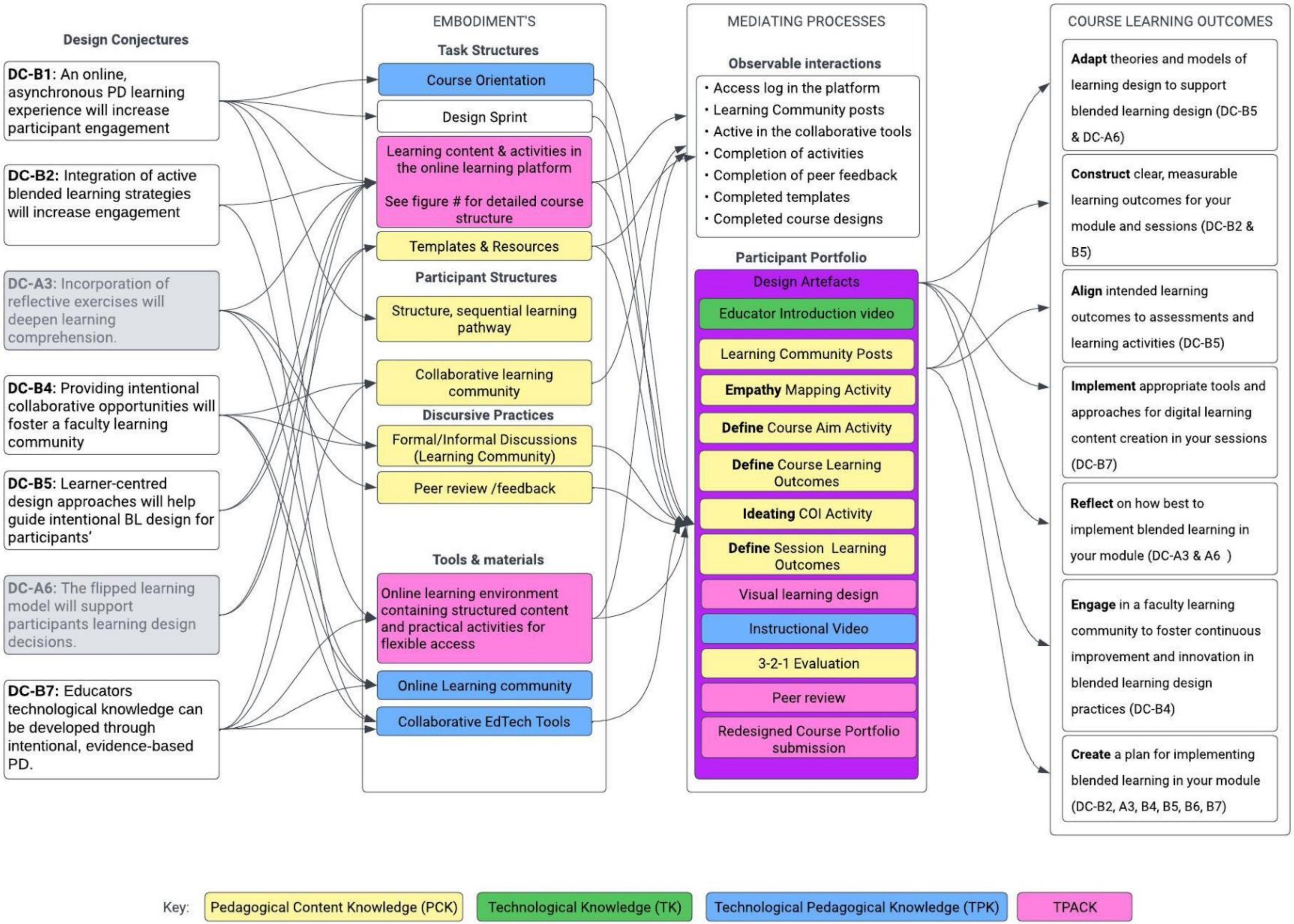
	DC-A4: Providing collaborative opportunities will foster a faculty learning community	B7. Consider identified principles for establishing a FLC i.e. core group, clear objectives, inclusive atmosphere, tackling specific issues (blended learning design) B8. Utilise an online platform to enhancing the reach of the FLC	DC-B4: Providing intentional collaborative opportunities will foster a faculty learning community
Pedagogical Knowledge	DC-A5: Learning design approaches will help guide intentional BL design for participants'	B9. Consider a human-centred design pedagogy B10. Consider an iterative design approach to blended learning design B11. Utilise a design thinking methodology to combine learner-centred considerations and an iterative design process	DC-B5: Learner-centred design approaches will help guide intentional BL design for participants'
	DC-A6: The flipped learning model will support participants' learning design decisions.	No additional considerations for this iteration.	No change
Technological Knowledge	DC-A7: The considered utilisation of technology will develop participants' technological experience and competence.	B12. Consider a mix of formal, informal and peer-supported approaches to technology training B13. Consider PD that is evidence-based, customisable and data-driven coaching B14. Consider cognitive load in tech PD, distributed over multiple sessions, allowing educators to assimilate new concepts, experiment with new technologies, and access peer support	DC-B7: Educators technological knowledge can be developed through intentional, evidence-based PD.

6.2.2 Developing the Design Conjecture Map for Cycle-B

As discussed in section 4.6.2.2, the design conjecture map builds on the identified design conjectures to provide a visual blueprint for design intervention. Cycle-B's conjecture map is an iteration of cycle-A's, and elements from cycle-A that remained unchanged are represented, however, they are greyed out to indicate that the conjecture/element is present in cycle-B, however, it remains unchanged from cycle-A.

The conjecture map for cycle-B is presented below in Figure 6.1, followed by a more detailed discussion relating to the map.

Figure 6.1: *Cycle-B – Design Conjecture map*



6.2.3 Components of the conjecture map for Cycle-B

As discussed in section 4.6.2.2, the goal of the design conjecture map is to provide a better understanding of the relationships between the different components of the intervention course. The following sections discuss the four components of *design conjectures, intended learning outcomes, embodiments, and mediating processes* in relation to cycle-B.

6.2.3.1 Design Conjectures

As shown in the first column of Figure 6.1, the DCs for cycle-B consist of

- DC-B1: An online, asynchronous PD learning experience will increase participant engagement
- DC-B2: Integration of active blended learning strategies will develop participants' PK
- DC-B4: Providing intentional collaborative opportunities will foster a faculty learning community
- DC-B5: Learner-centred design approaches will help guide intentional BL design for participants'
- DC-B7: Educators technological knowledge can be developed through intentional, evidence-based PD

In addition, DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension and DC-A6: The flipped learning model will support participants' learning design decisions from cycle-A and are greyed out on the conjecture map for cycle-B as the aspects of the design intervention that relate to these DCs remain unchanged for this cycle.

6.2.3.2 Intended learning outcomes

The intended learning outcomes of the design intervention course were reviewed to assess their suitability. They remained the same as those discussed in section 5.2.3.2. The rationale for this was that the intended learning outcomes represent the key competence criteria for designing BL experiences, this had not changed. However, the achievement of the outcomes is measured by the completion of course activities, these are now mapped to the current set of DCs, as shown in the right-hand column of Figure 6.1.

6.2.3.3 Embodiments

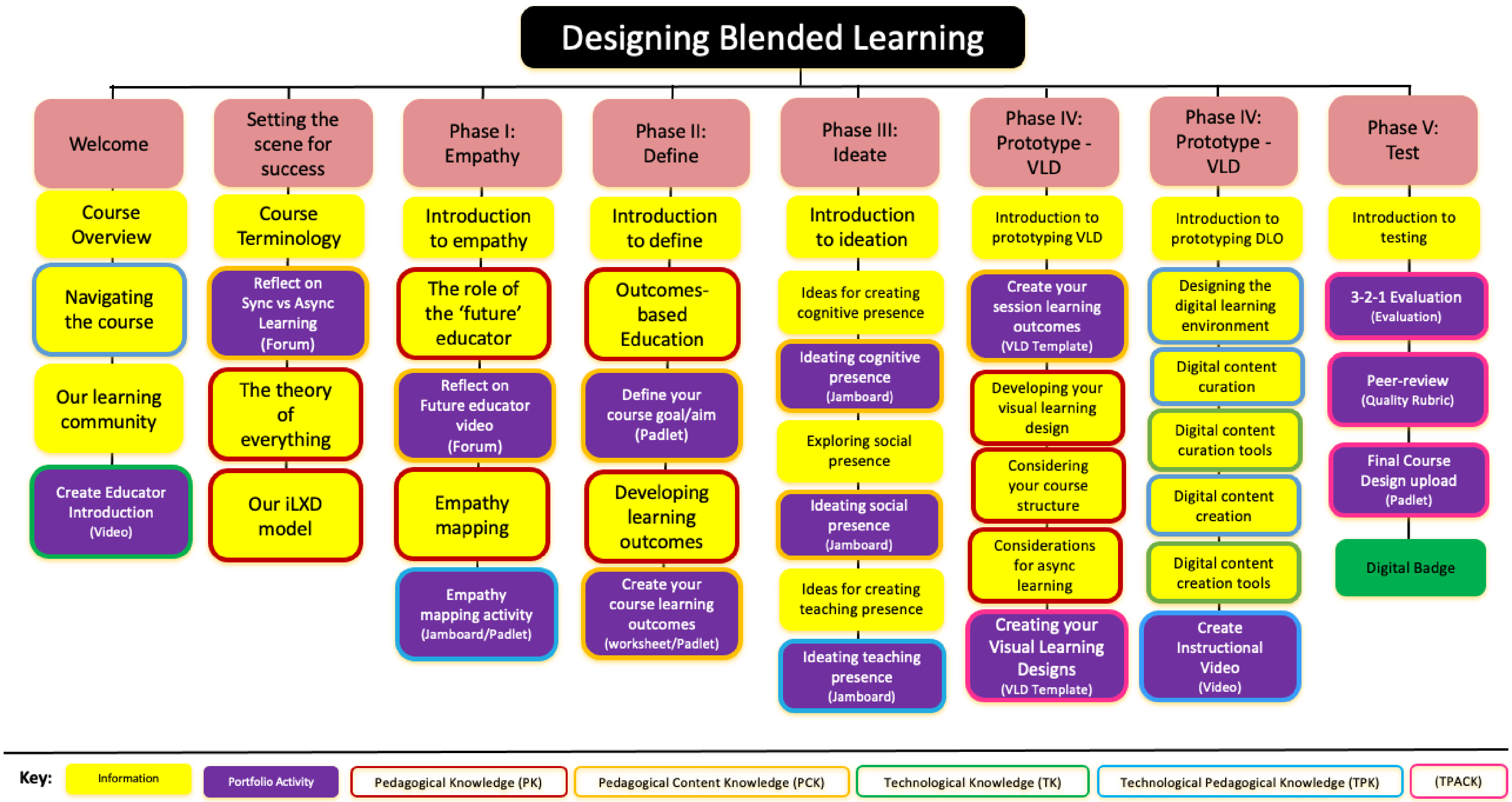
The conjecture map embodiment component shown in the second column of cycle-B's conjecture map (section 6.2.2) refers to the concrete mechanisms or tangible aspects of the design intervention relating to the DCs. The sub-components of embodiments, consisting of *task structures*, *participant structures*, *discursive practices*, and *tools and materials* involved in cycle-B's design of the intervention course, are discussed in more detail below.

The task structures for cycle-B's conjecture map were iteratively developed based on DCs. The biggest change in the task structure of the redesigned intervention course for cycle-B was informed by DC-B1 and DC-B5.

In relation to DC-B1, the course structure, content, and activities were redesigned to be fully asynchronous online, with a fixed learning pathway for participants to follow, although still aligned with the original intended learning outcomes. Additionally, a new learning platform was selected based on its functionality and perceived usability to build and deliver a fully asynchronous online course.

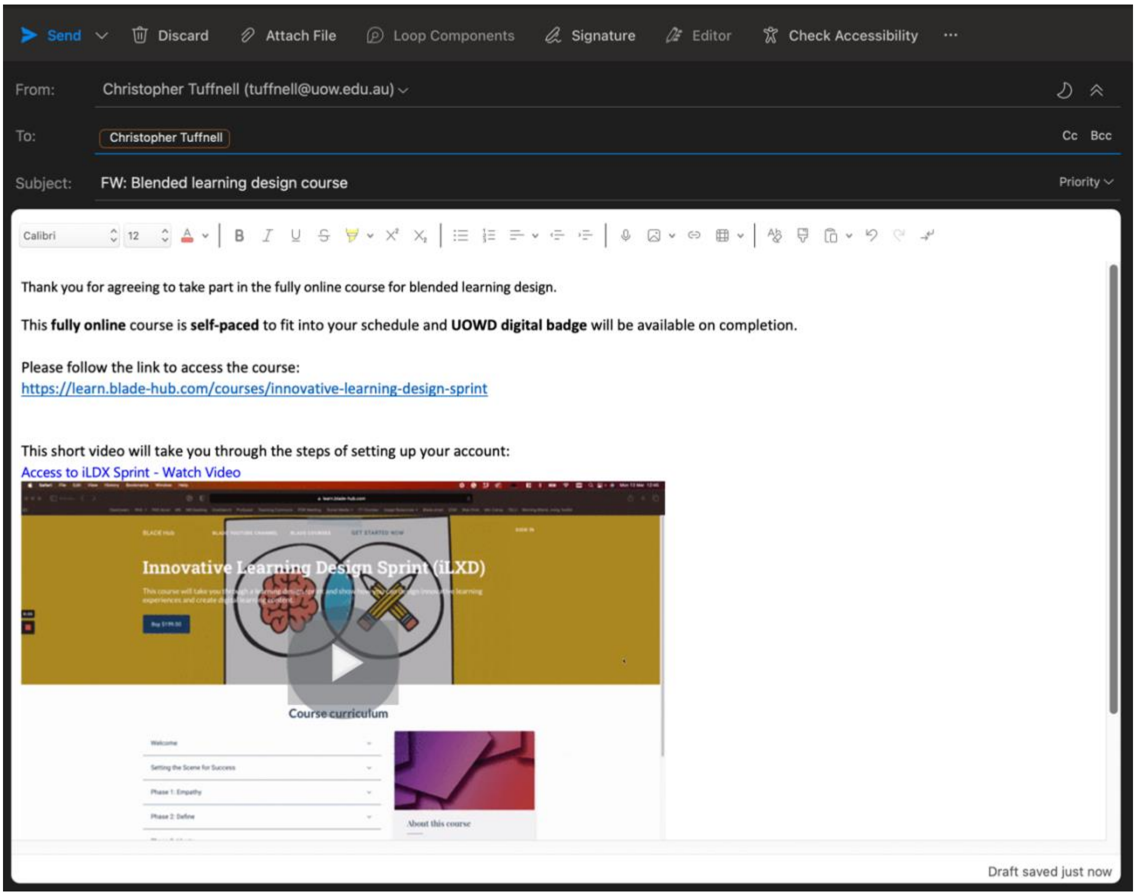
In relation to DC-B5, a design thinking (DT) methodology was suggested as the key consideration, with the aim of guiding participants in a learner-centred design. I decided that the best way to show the benefits of the DT methodology for learning design was to incorporate the approach into the structure of the redesigned intervention course. I specifically opted for a ‘design sprint’ approach to reduce the time required for participants to complete the course. In addition, I structured the content and activities of the course to align with the stages of the design sprint, a visual overview of the redesigned course structure, aligned to a DT model is shown below in Figure 6.2. The figure shows the sequential elements of the course, where participants’ assessment/portfolio activities and elements of the whole design aligned to the TPACK framework are addressed in the course content and activities.

Figure 6.2: *Cycle-B – Asynchronous Online Course structure*



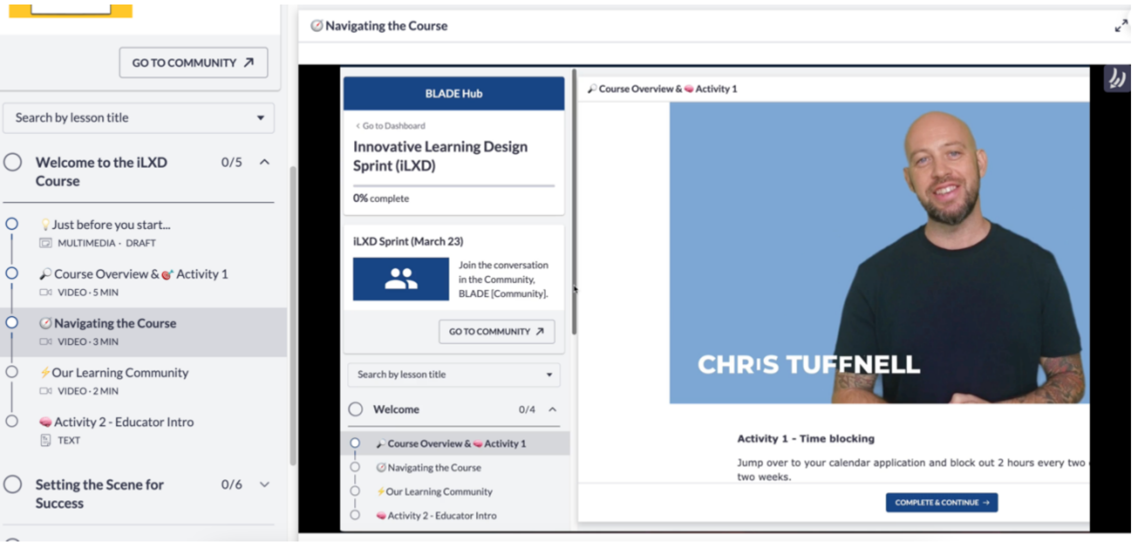
The new course design and delivery mechanism lends strong justification to a course orientation in the task structure, as identified from the key considerations for DC-B1. The intention of the orientation is to introduce participants to the course intentions and familiarise them with the learning platform to help increase engagement and course completion. The course orientation started with sign-up instructions emailed to the participants, as shown in Figure 6.3, which included an access link and video instructions for obtaining access.

Figure 6.3: *Course access email*



Once participants had access to the course the first ‘Welcome’ section provided a course overview, an orientation of the course platform and information on the learning community as shown in Figure 6.4 below.

Figure 6.4: *Course orientation section*

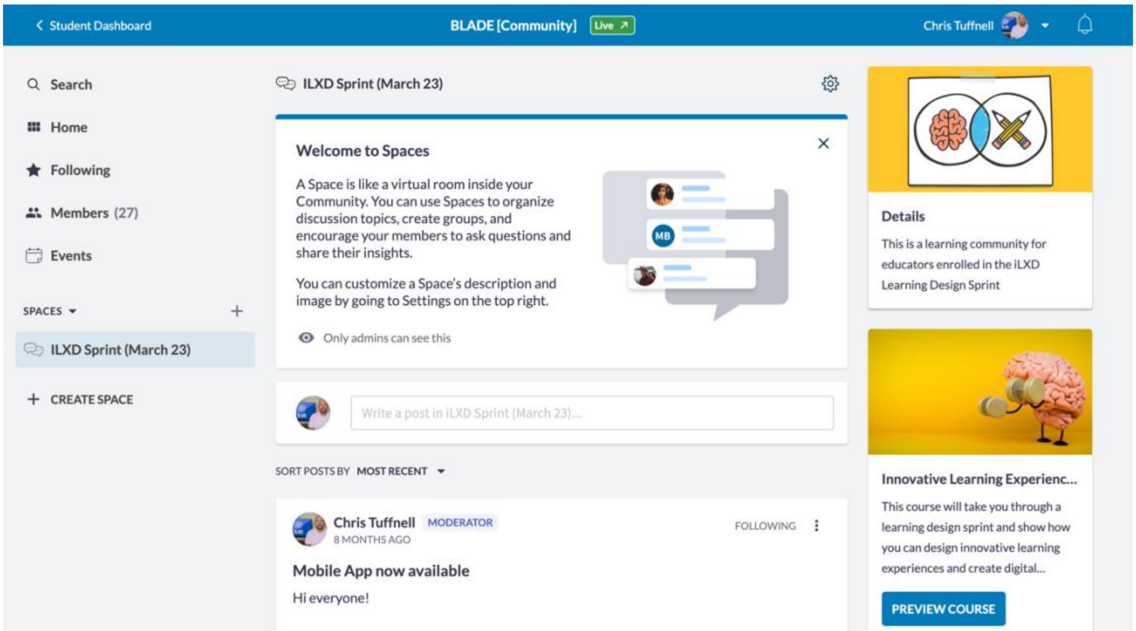


Finally, the task structure of templates and resources was included as an integral component of the redesigned intervention course to support and guide the participants during their learning experience.

Participant structures for cycle-B’s redesign of the intervention course relate to DC-B1 and the need to increase the flexible access and support time constraints of participants. Therefore, as discussed above, the course was redesigned to be fully asynchronous online to allow participants’ flexible interaction. As shown previously in Figure 6.2, the course has also been redesigned to follow a structured, sequential learning path to guide participants’ as they follow a ‘design sprint’ approach that intends to shorten the time needed to complete the course.

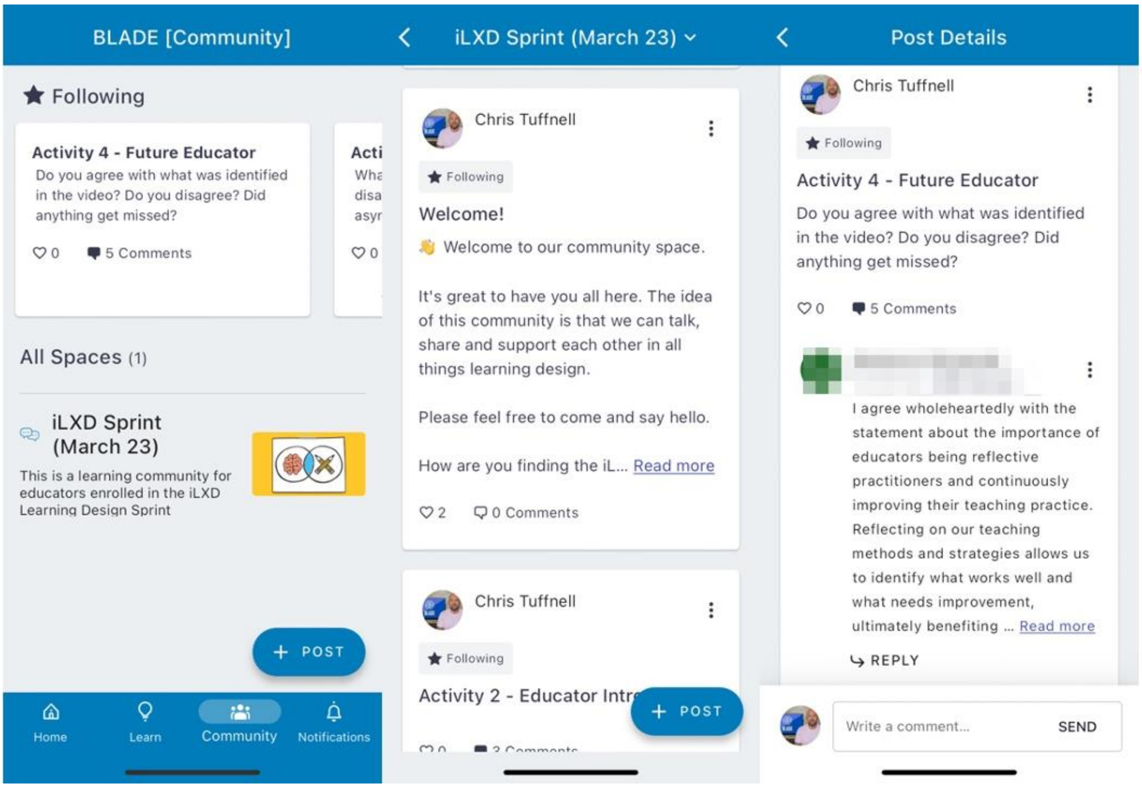
In addition, in relation to DC-B5, participant structures that support collaboration and community-building activities are provided through access to an online collaborative learning community independent of the design intervention course, as shown in Figure 6.5.

Figure 6.5: *Collaborative learning community*



Discursive practices for cycle-B refer to the peer review and feedback element of the course, informed by the unchanged DC-A3, remains a vital component. To address DC-B4's aim of developing intentional collaborative learning opportunities to foster FLC, formal and informal communication has been encouraged through a dedicated online learning community. The online learning community interaction is driven by 'formal' activities in the design intervention course from which participants' go to the online community to contribute. As the community platform is separate from the course platform (see Figure 6.6 below), participants can also informally access and engage in the community whenever they choose, and importantly, beyond the course delivery timeline.

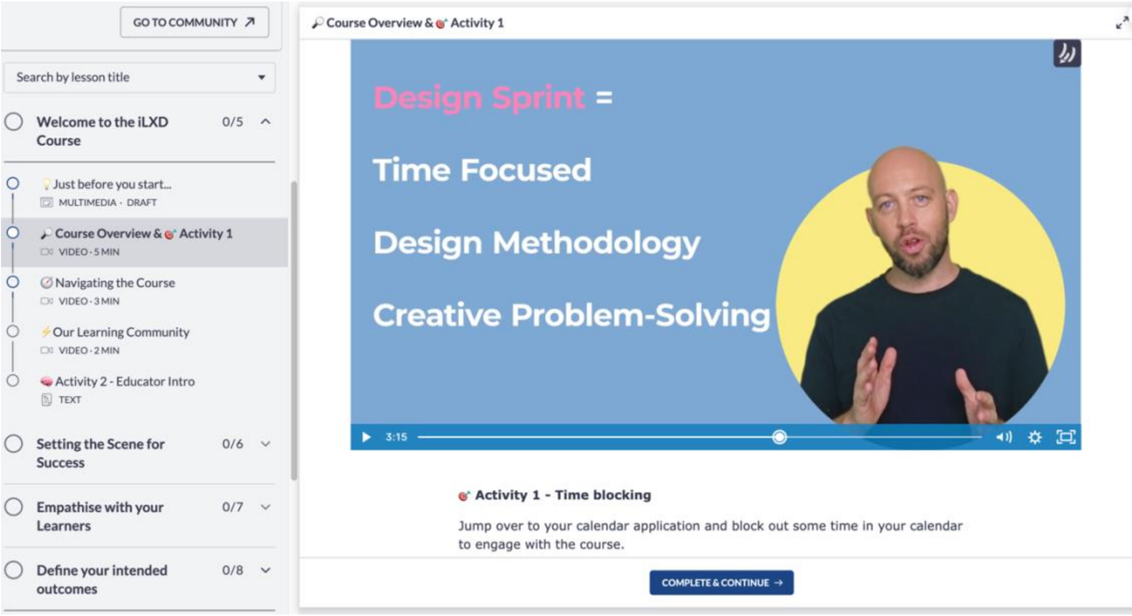
Figure 6.6: *Online learning community*



The tools and materials for cycle-B's redesigned intervention course consisted of an online course delivery platform (Thinkific), an online learning community (Thinkific), and collaborative technology tools (Padlet and Google Jamboard).

The biggest change from cycle-A's design intervention was moving away from the Moodle LMS and selecting the Thinkific learning platform. The rationale for this move was that the I felt the Moodle LMS had a repository feel from which participants could access content and resources in no particular sequence. This was appropriate for the self-directed intent of cycle-A, and in-person workshops often helped clarify what participants needed to do. However, for cycle-B's fully asynchronous online approach, I wanted a learning environment that was very intuitive to use, as there would be no 'live' facilitator support and from which content and activities could be sequenced and 'drip-fed' to participants, that is, releasing section 2 only after section 1 was completed and so on. In addition, I wanted to try a learning platform that was neutral to the research site and could potentially allow for scalability of the course beyond the organisation and this study in the future. Figure 6.7 shows the course landing page in Thinkific with navigation down the left-hand side and the course content on the right.

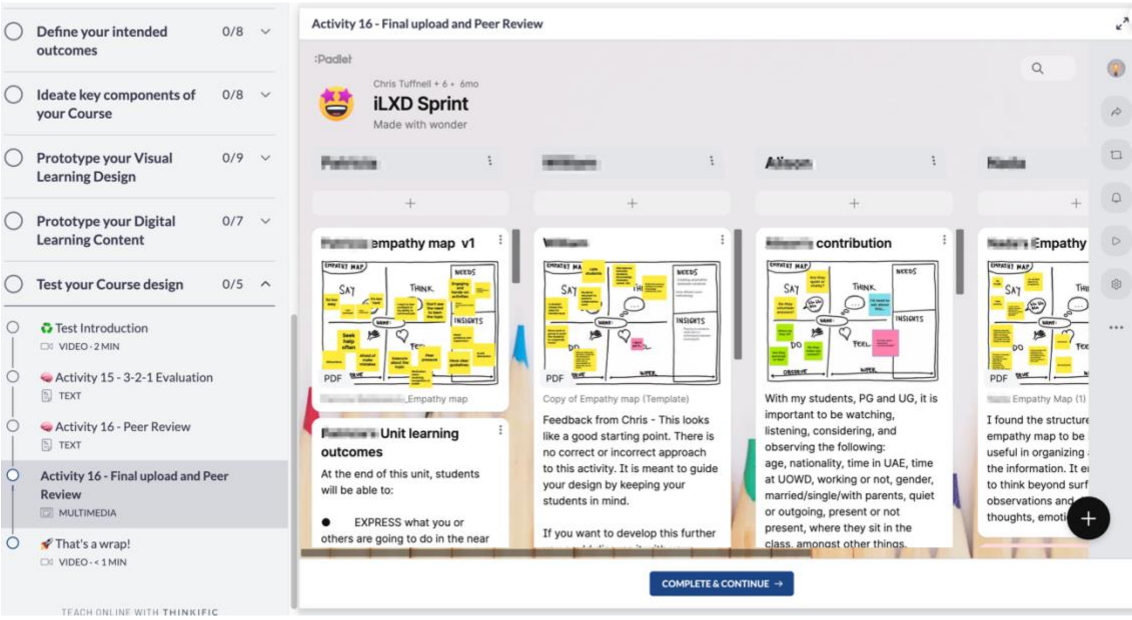
Figure 6.7: *Course landing page in Thinkific*



The participants' online learning community (Figure 6.6) was provided by Thinkific. However, a key factor in its selection was that it was independent of course. This allows participants to access the learning community whenever they decide without having to access the course first. Access to the learning community can therefore be given beyond the endpoint of a course, and there is potential to grow the community to include community members beyond the current cohort or organisation in the future.

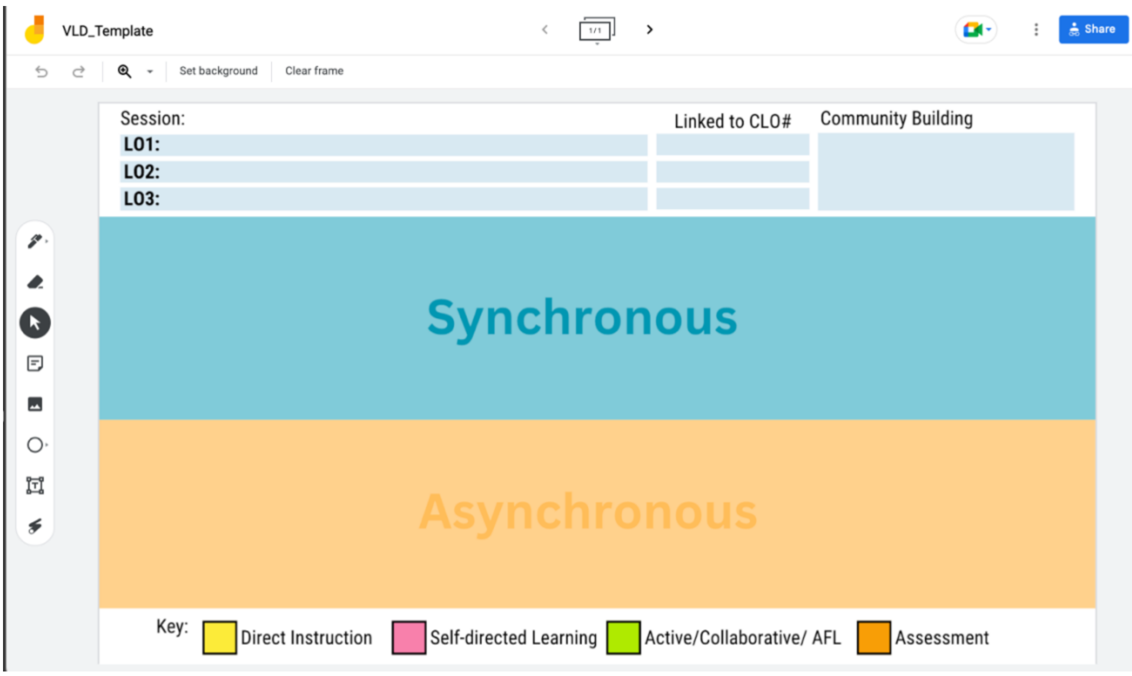
Finally, technology tools were selected. Padlet's inclusion allowed for seamless collaboration in the course. It was embedded in the online course; therefore, the participants did not leave the online learning environment (see Figure 6.8 below). It also allows users to easily add multiple forms of digital content, and the course design allows for collaboration to occur in this tool.

Figure 6.8: *Padlet integration into Thinkific*



Similarly, Google Jamboard is an online whiteboard tool that is user friendly and embedded in an online course (see Figure 6.9 below). Participants were able to create and share their designs in this tool based on the customised templates I provided.

Figure 6.9: *Google Jamboard example*

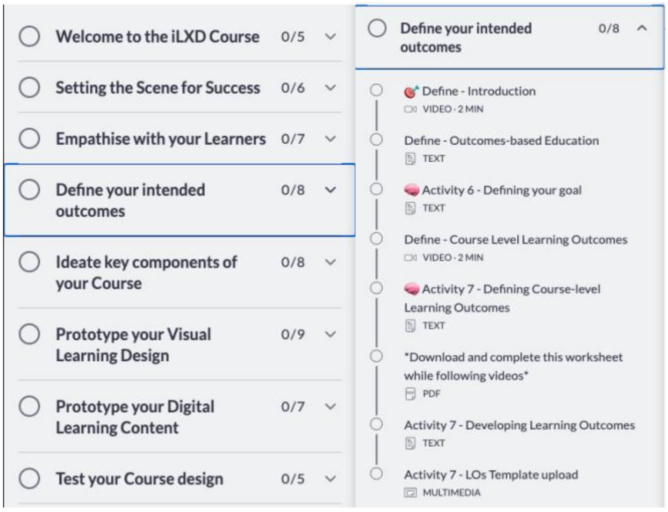


6.2.3.4 Mediating Processes

The mediating processes for cycle-B's design intervention are shown in the third column from the left in Figure 6.1. They consist of ‘observable interactions’ and ‘participant artefacts.

The observable interactions differed only slightly from those in cycle-A’s design intervention. This slight difference is mainly due to the refined course design and online platform selection. The project-based approach from cycle-A remains, however, it has been further refined. One of the biggest changes in how the participants are observed interacting with the course is the design sprint approach with underlying DT methodology. This means that the course duration has been shortened to 4-weeks and there is a fast pace to the delivery of information as participants are notified when a new section is open and the requirements for that section on a weekly basis. The DT informed structure of the course, shown in Figure 6.2, shows the alignment to the stages of DT, there is an Empathise, Define, Ideate, Prototype, and Test stages, as shown in Figure 6.10. This course structure steps the participants through a deliberate DT approach.

Figure 6.10: *Course section overview with Define section expanded*



The restructuring of the project means that some of the artefacts required to be produced by the participants changed from cycle-A. New artefacts for this cycle include an empathy map, a defined course aim, and evidence from an ideation activity that requires participants to brainstorm how they will show CP, SP, and TP, in relation to the COI framework, in their course designs, examples shown later in section 6.3.4.

6.2.4 Summary of the Design Phase for Cycle-B

The design approach for cycle-B in this study has been outlined, emphasising both a systematic and iterative design approach. First, in the refinement of design conjectures, which were informed by key considerations from the literature analysis phase.

Second, the redesigned conjecture map helped to visualise the key elements of the design of the intervention that had changed in this cycle. The four key steps of the process–design conjectures, intended learning outcomes, embodiment details, and mediating processes–are discussed in this section.

The development of the conjecture map and subcomponents ensures that the design intervention is aligned to conjectures and theory and that each component is thoughtfully crafted to contribute to the overall learning outcomes. The design was then made actionable, allowing for the implementation of the redesigned intervention course, which is discussed in the following section.

6.3 Cycle-B: Implementation

The implementation phase moves beyond the development of the design intervention course by delivering it to the study participants.

This phase provided an opportunity to observe participants' real-world engagement with cycle-B of the design intervention. As with cycle-A, data are collected from the participants' engagement with cycle-B's redesigned intervention course to inform the evaluation phase, section 6.4, and ultimately to understand the degree of impact of the design intervention.

This section covers the deployment of cycle-B's design intervention course, the facilitation and support provided, the monitoring of participants' engagement in the course, and the development of the participant's portfolio of design artefacts.

6.3.1 Deployment of Training Course

As discussed in section 6.2.3.3, the course was delivered on the Thinkific Learning Platform with eight section topics, as shown in Figure 6.2. The course required participants to follow a sequential learning pathway, with each section building on the previous. The course delivery took the form of a design sprint, a time-restricted learning experience that followed a design thinking methodology to provide a solution to a challenge, namely ‘how might we…design a BL course’?’

As much of the course content was in the form of a pre-recorded videos to be accessed asynchronously, I was able to calculate the amount of engagement time from participants by adding the instructional video time for each section along with an estimation of the time needed to complete the sections’ activities. I calculated that the course could be completed in 4-weeks if participants engaged for approximately 2-3 hours per week. The time pressure element aimed to force prioritisation of time management for the participants, with the advantage that the course would be completed in just 4-weeks and the added motivation of a digital badge, all linking to key considerations from DC-B1.

Each section of the course required participants to demonstrate their understanding of the course content through the completion of activities that would contribute to the completion of their design portfolio, documenting their design journey for BL course design and digital learning content creation.

6.3.2 Facilitation and Support

As cycle-B’s redesigned intervention course was fully asynchronous online, facilitation and support were asynchronous to allow flexibility of when and where the participant was engaged with the course.

An email was sent to the participants, as mentioned in section 6.2.3.3, to provide access to the course. Every week thereafter, for a four-week duration, email ‘mailshots’ were sent to remind participants of what phase of the course was now open. The intention of these mailshots was to provide a facilitator presence’ for the asynchronous online course and help participants prioritise their time to engage with the course.

Once in the course, a ‘Welcome’ section, discussed in the Design phase (section 6.2), provided an overview video to set expectations, a course navigation video to guide participants in the use of the learning platform, an introduction to the learning community, and a time blocking task (activity 1).

Following the ‘Welcome’ section of the course, participant's’ were guided to the ‘Setting the scene for success’ section. Support was offered here via a series of videos that covered course terminology, an explanation of the theoretical underpinning, and an overview of the learning design model that participants would follow to guide their own BL designs.

Finally, support in the form of a collaborative online learning community was provided with participants’ prompts to access formal course-related activities in addition to the possibility of informal interactions between fellow peers.

Thanks to the learning analytics of the software, I was able to see who was completing the course content and activities, and who was not. An overview of the participant completion is discussed in the following section.

6.3.3 Monitoring Participant Engagement

As discussed in section 4.5, the participant selection criteria let to fourteen educators agreeing to participate in cycle-B of the design intervention course.

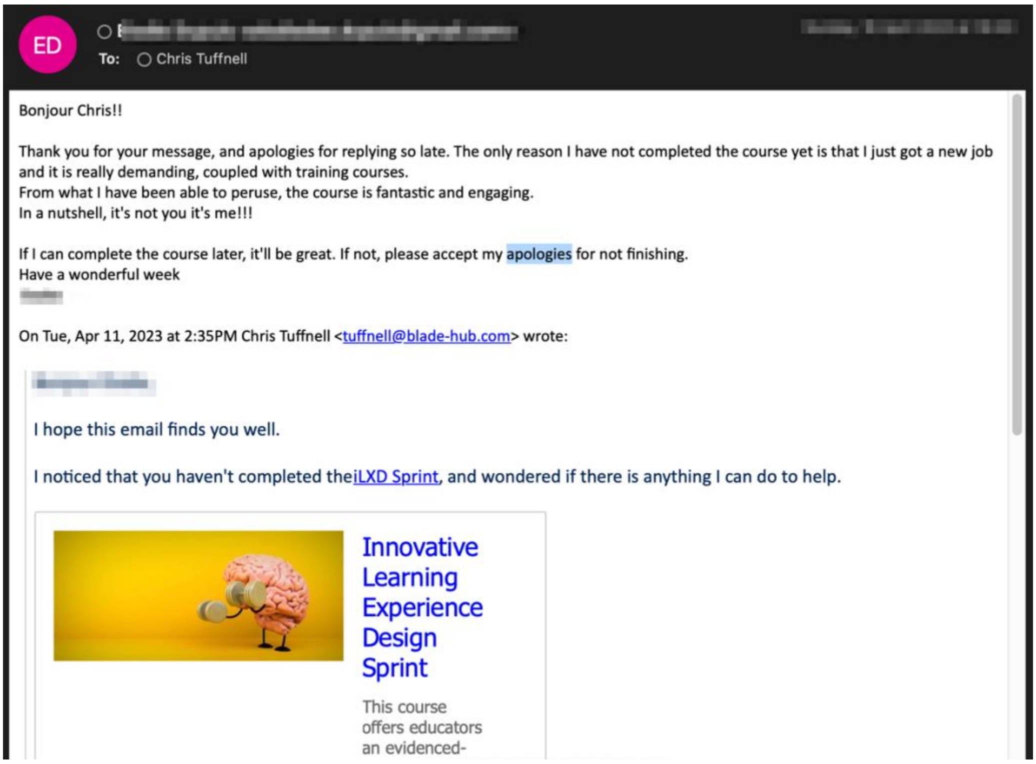
Each participant was assigned a code consisting of a P-B plus a sequential number to anonymises the data presentation.

Participants’ engagement in the course was tracked by the percentage of content viewed on the learning platform and the completion of a portfolio. As shown in Table 6.3, less than half of the participants (n=6/14) completed the entire course. From this, only n=5/14 completed in the 4-weeks’ timeframe, followed by a further n=1/14 during an extension of 1-week that was granted. The remaining n=8/14 did not complete the course. Participants P-B7 to 14 were contacted and offered time extension or further support to help them complete the course. P-B8 verbally responded that he felt that he no longer had time to complete the course as the teaching term had started, and P-B9 responded by outlining a time constraint, as shown in Figure 6.11.

Table 6.3: *Participant course completion – Cycle-B*

Particpant	First Name	Last Name	% Viewed	% Completed	Welcome to the iLXD Course	Setting the Scene for Success	Empathise with your Learners	Define your intended outcomes	Ideate key components of your Course	Prototype your Visual Learning Design	Prototype your Digital Learning Content	Test your Course design
P-B1	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B2	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B3	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B4	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B5	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B6	[redacted]	[redacted]	100	100	100	100	100	100	100	100	100	100
P-B7	[redacted]	[redacted]	43	34	100	100	86	0	0	0	0	20
P-B8	[redacted]	[redacted]	72	69	100	100	100	100	100	44	0	0
P-B9	[redacted]	[redacted]	44	44	100	100	100	75	0	0	0	0
P-B10	[redacted]	[redacted]	13	11	100	33	0	0	0	0	0	0
P-B11	[redacted]	[redacted]	17	4	25	17	0	0	0	0	0	0
P-B12	[redacted]	[redacted]	20	11	75	17	0	0	0	0	0	40
P-B13	[redacted]	[redacted]	11	9	100	17	0	0	0	0	0	0
P-B14	[redacted]	[redacted]	9	8	100	0	0	0	0	0	0	0

Figure 6.11: *Email response from non-completing participant*


ED

[redacted]

To: Chris Tuffnell

[redacted]

Bonjour Chris!!

Thank you for your message, and apologies for replying so late. The only reason I have not completed the course yet is that I just got a new job and it is really demanding, coupled with training courses.
From what I have been able to peruse, the course is fantastic and engaging.
In a nutshell, it's not you it's me!!!

If I can complete the course later, it'll be great. If not, please accept my apologies for not finishing.
Have a wonderful week
[redacted]

On Tue, Apr 11, 2023 at 2:35PM Chris Tuffnell <tuffnell@blade-hub.com> wrote:

[redacted]

I hope this email finds you well.

I noticed that you haven't completed theiLXD Sprint, and wondered if there is anything I can do to help.

Innovative Learning Experience Design Sprint

This course offers educators an evidenced-

6.3.4 Participants' Portfolio development

As discussed in section 4.6.3, participants' engagement with course activities produced learning artefacts. These artefacts formed a design portfolio for the participants, which was crucial for understanding design decisions, providing evidence for the achievement of outcomes, and identifying practical implications related to the development of DCs and TPACK to inform the necessary adjustments for the next iteration of the course.

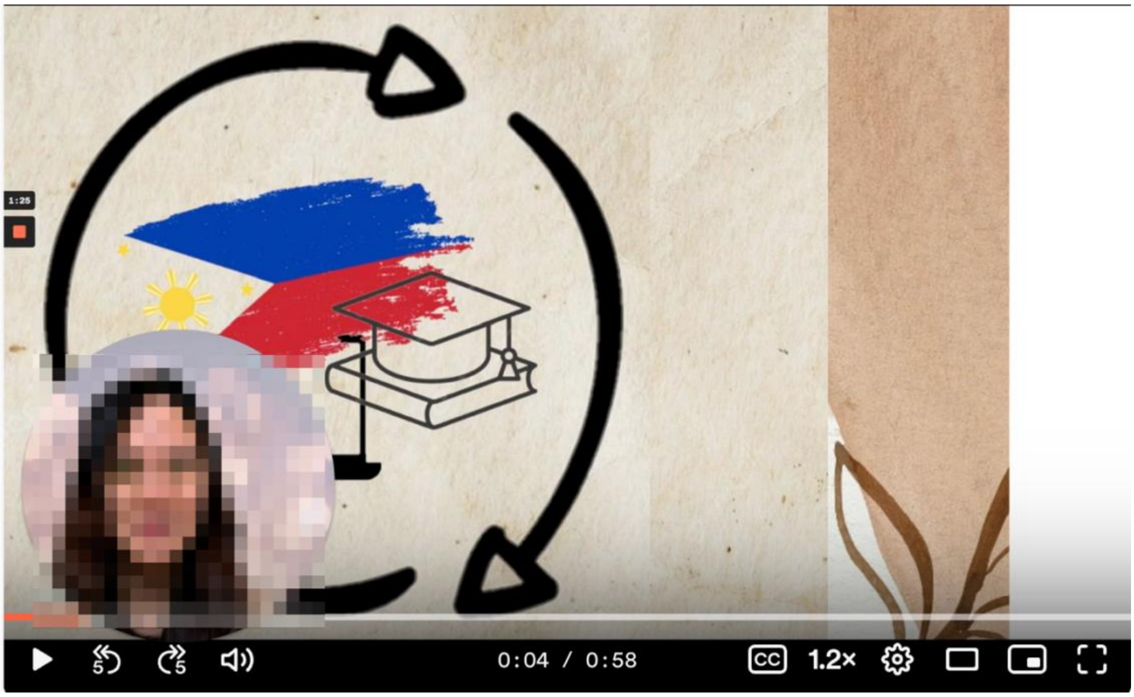
The design portfolio of learning artefacts also demonstrates participants' grasp of the course content and domain knowledge in relation to the aspects of the TPACK framework.

The following provides a selection of course activities from the redesigned cycle-B course and examples that highlight the relationship between TPACK and design conjectures, as shown previously in Figure 6.2.

6.3.4.1 Activity 2: Educator Introduction video

Activity 2 was the first portfolio contribution, following Activity 1's time-planning activity. The intention of this activity was to develop participants' TK and confidence in low-stakes and structured video creation. Participants were directed to review a software video tutorial and example, then go to the collaborative learning community space (DC-B4) at a time of convenience (DC-B1) and create an introduction video (DC-B7), as shown in Figure 6.12. This activity had the dual purpose of introducing participants to the learning community and gaining confidence in creating a digital learning asset that could be reused in their own asynchronous teaching (DC-B2).

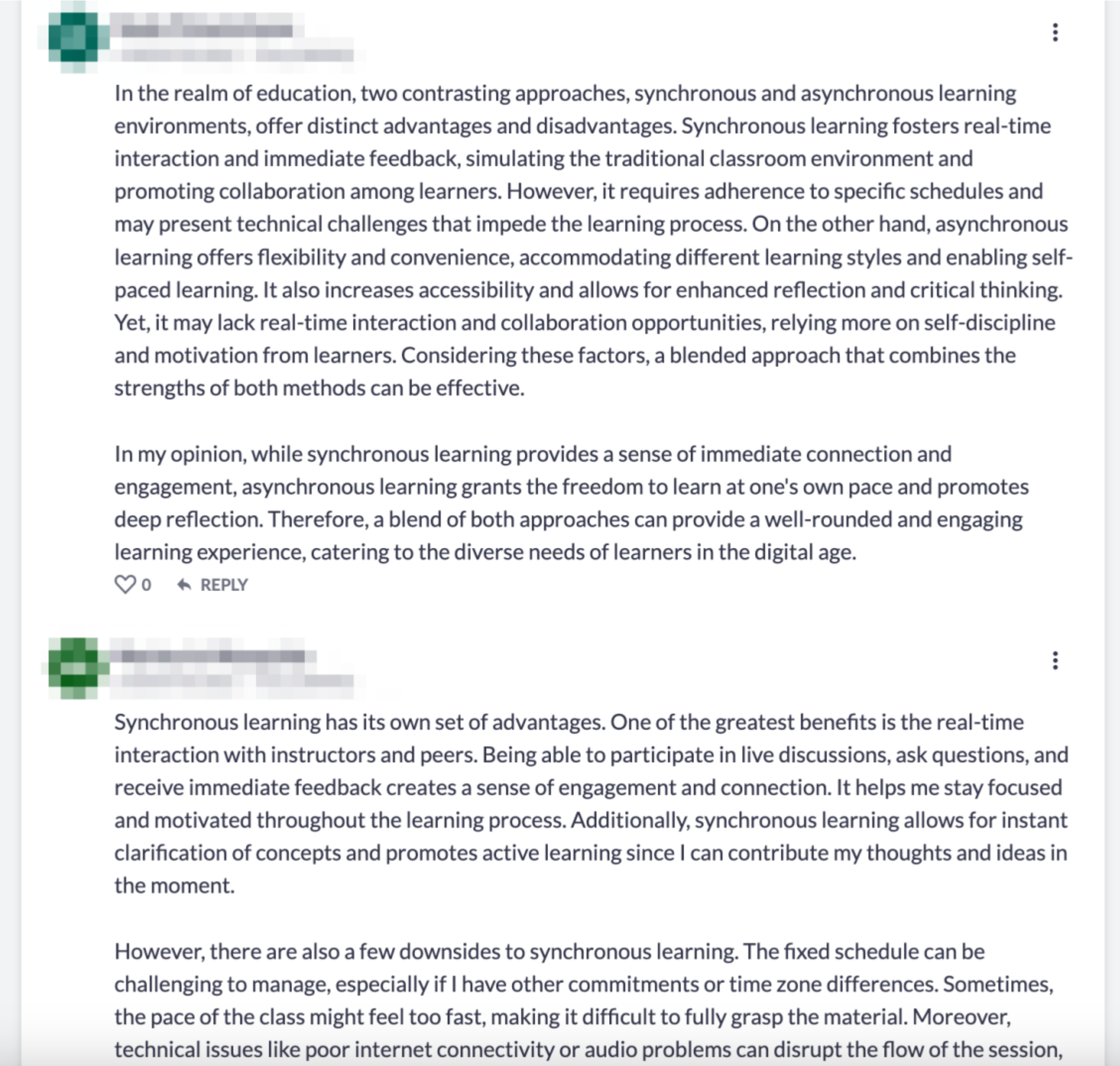
Figure 6.12: *Activity 2: Educator Introduction video*



6.3.4.2 Activity 3 and 4: Discussion Forum posts

Activities 3 and 4 took the form of reflective forum posts with the aim of developing the participants' PCK (DC-B2 and DC-B4). First, participants were shown content regarding aspects of synchronous and asynchronous learning and discussed the future role of the educator. After each content delivery, participants were prompted to share their thoughts in the learning community and contribute to other posts, as shown in Figure 6.13.

Figure 6.13: *Activity 3 and 4: Discussion Forum Post*



In the realm of education, two contrasting approaches, synchronous and asynchronous learning environments, offer distinct advantages and disadvantages. Synchronous learning fosters real-time interaction and immediate feedback, simulating the traditional classroom environment and promoting collaboration among learners. However, it requires adherence to specific schedules and may present technical challenges that impede the learning process. On the other hand, asynchronous learning offers flexibility and convenience, accommodating different learning styles and enabling self-paced learning. It also increases accessibility and allows for enhanced reflection and critical thinking. Yet, it may lack real-time interaction and collaboration opportunities, relying more on self-discipline and motivation from learners. Considering these factors, a blended approach that combines the strengths of both methods can be effective.

In my opinion, while synchronous learning provides a sense of immediate connection and engagement, asynchronous learning grants the freedom to learn at one's own pace and promotes deep reflection. Therefore, a blend of both approaches can provide a well-rounded and engaging learning experience, catering to the diverse needs of learners in the digital age.

0 REPLY

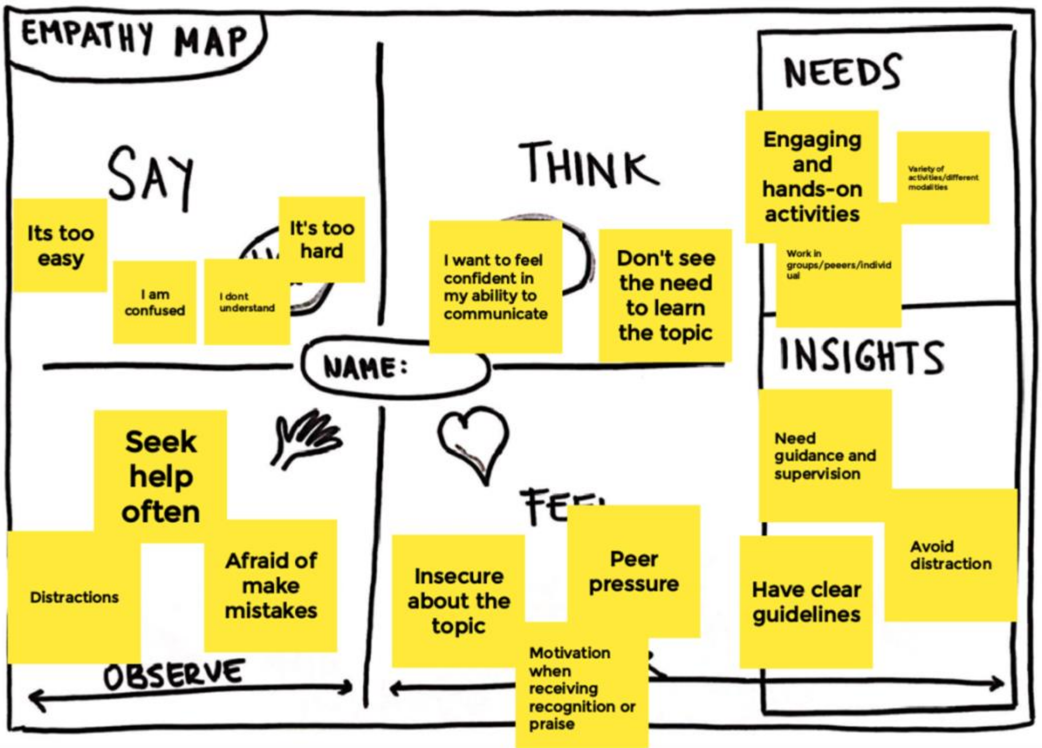
Synchronous learning has its own set of advantages. One of the greatest benefits is the real-time interaction with instructors and peers. Being able to participate in live discussions, ask questions, and receive immediate feedback creates a sense of engagement and connection. It helps me stay focused and motivated throughout the learning process. Additionally, synchronous learning allows for instant clarification of concepts and promotes active learning since I can contribute my thoughts and ideas in the moment.

However, there are also a few downsides to synchronous learning. The fixed schedule can be challenging to manage, especially if I have other commitments or time zone differences. Sometimes, the pace of the class might feel too fast, making it difficult to fully grasp the material. Moreover, technical issues like poor internet connectivity or audio problems can disrupt the flow of the session,

6.3.4.3 Activity 5: Empathy Map

Activity 5 was the first to link directly to DT and aimed to develop PK in the approach (DC-B5 and DC-B7). A series of contents was provided that introduced the concept of empathy in a human-centred design context and empathy mapping. A whiteboarding tool (Google Jamboard) was provided that contained a custom background, as shown in Figure 6.14, which allowed the participants to carry out the activity with their learners and share a record of the experience in their portfolios.

Figure 6.14: *Activity 5: Empathy map*



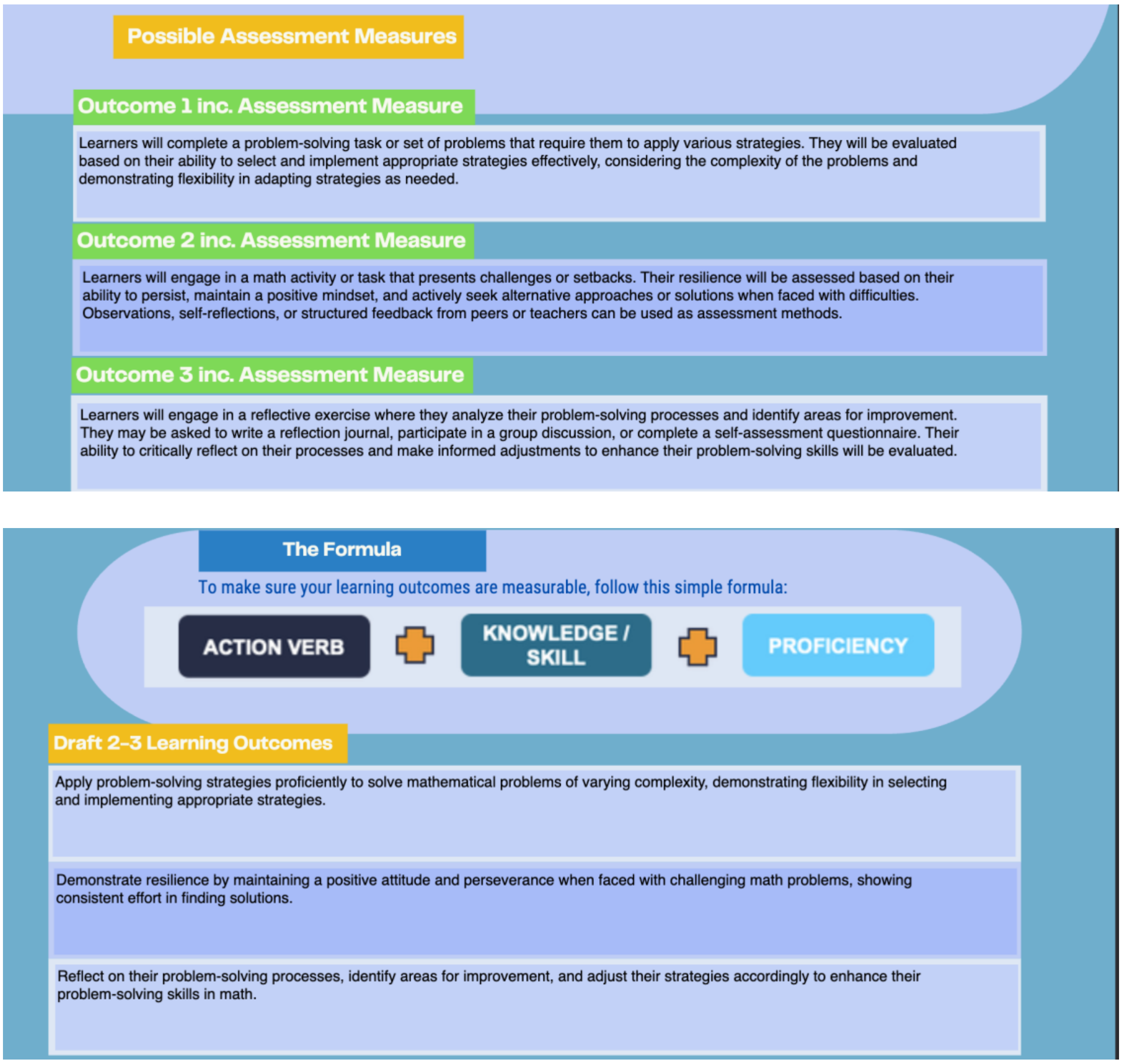
6.3.4.4 Activity 6 and 7: Define Course Goal and learning outcomes

The second stage of the DT approach required participants to draw from their empathy maps (Activity 5) and PK to define a clear course goal using the CK. Therefore, PCK should be fostered to identify the holistic intention of the course overall, as shown in Figure 6.15 (DC-B5 and DC-B7).

Figure 6.15: *Activity 6: Defining Course Goal*

One a course goal had been defined the next step was to define course learning outcomes and potential assessments (Activity 7). The process of learning outcome development and assessment mapping was comprehensive. There was a lot of content focused on this, and a digital worksheet (Figure 6.16) was provided to guide participants in the activity (DC-B2).

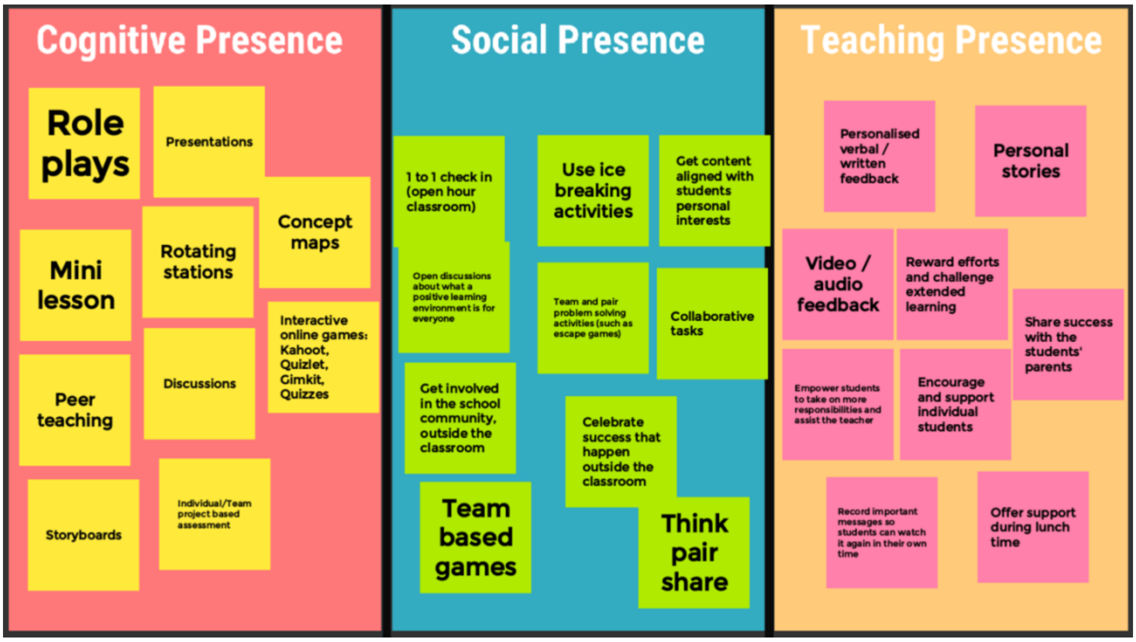
Figure 6.16: *Activity 7: Define Course-level Learning Outcomes*



6.3.4.5 Activities 8, 9 and 10: Ideating Cognitive, Social and Teaching Presence

Activities 8, 9, and 10 were built upon each other and were part of an ideation phase of the DT approach (DC-B5 and DC-B7). Learning content was provided in various ways: cognitive, 'social', and 'teaching presence could be shown in a BLdesign', developing PK. Activity 8 prompted participants' to ideate, or brainstorm, what 'cognitive presence would look like in their designs (PCK) using the online whiteboard tool with a custom background (Google Jamboard). Activities 9 and 10 follow the same approach, as shown in Figure 6.17.

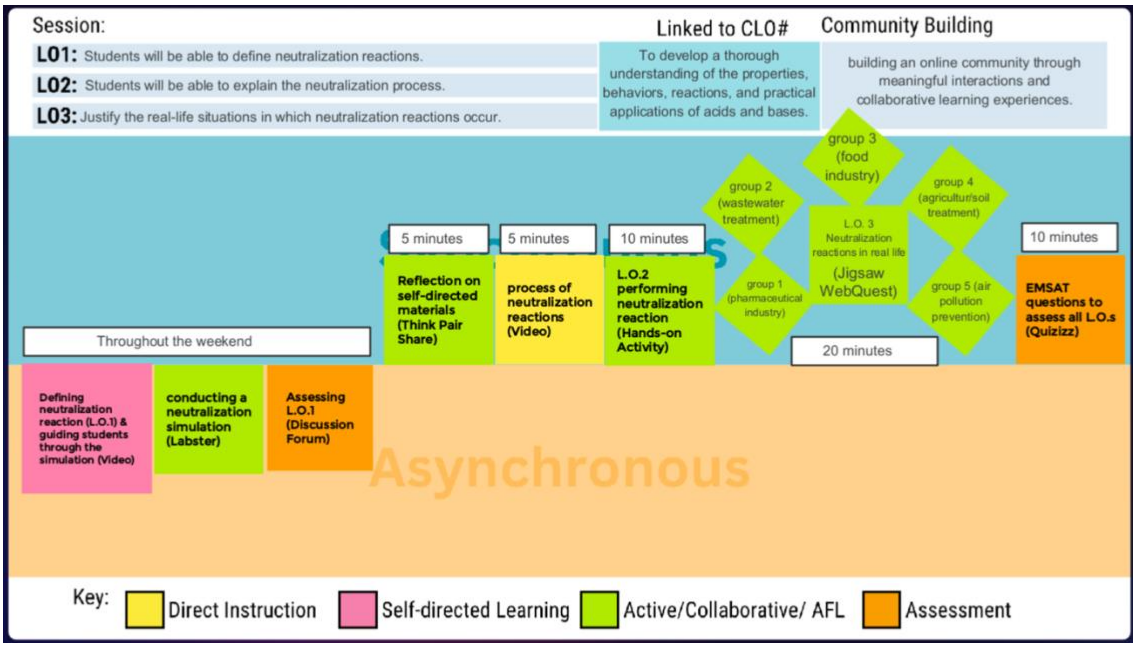
Figure 6.17: *Activity 8, 9 and 10: Ideating Cognitive, Social and Teaching Presence*



6.3.4.6 Activity 11, 12 and 13: Prototype the visual learning design

Activities 11, 12 and 13, also built upon each other, resulting in participants developing TPACK by creating session-level visual learning designs for their blended learning course (DC-B5 and DC-B7), as shown in Figure 6.18. They were guided in developing session-level learning outcomes linked to course-level learning outcomes (Activity 11) and were then prompted to consider the components of each session and how they related to the session outcome (Activity 12). Finally, they were asked to consider which components would be best delivered in which environment, synchronous or asynchronous. This process was repeated for at least 3 sessions of their course.

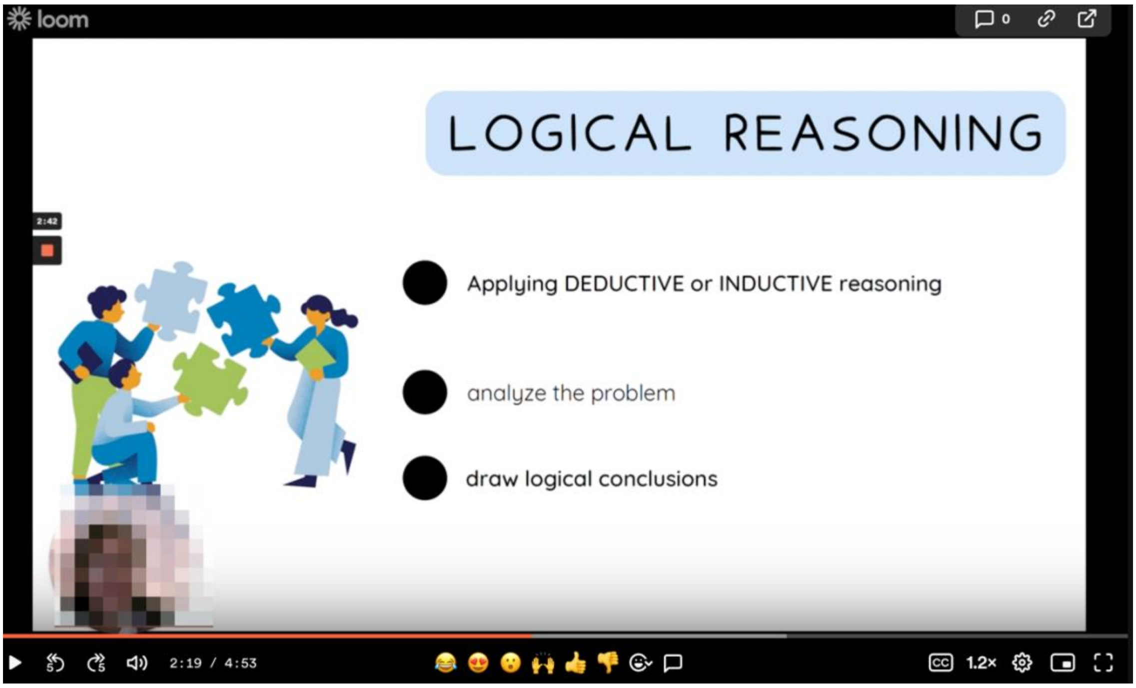
Figure 6.18: *Activity 11, 12 and 13: Prototype the visual learning design*



6.3.4.7 Activity 14: Instructional Video Creation

Building on the confidence and experience of Activity 2 (TK), Activity 14 asked participants to select an asynchronous component from their visual learning design and create an educational or instructional video to develop the TPK (DC-B2 and DC-B7), as shown in Figure 6.19.

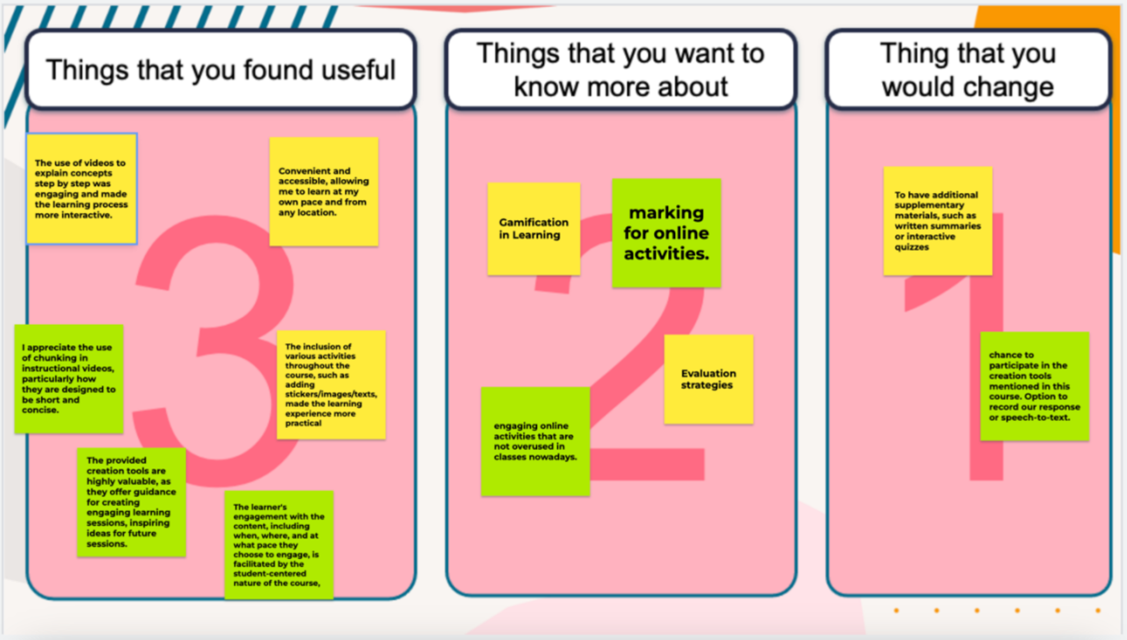
Figure 6.19: *Activity 14: Instructional video*



6.3.4.8 Activity 15: Course Evaluation

Activity 15 embodied the learner-centred approach of being fostered in the course by asking participants to provide feedback while they were still in the course setting (DC-B2). The 3-2-1 activity prompted reflections (PK) on their experiences, as shown in Figure 6.20.

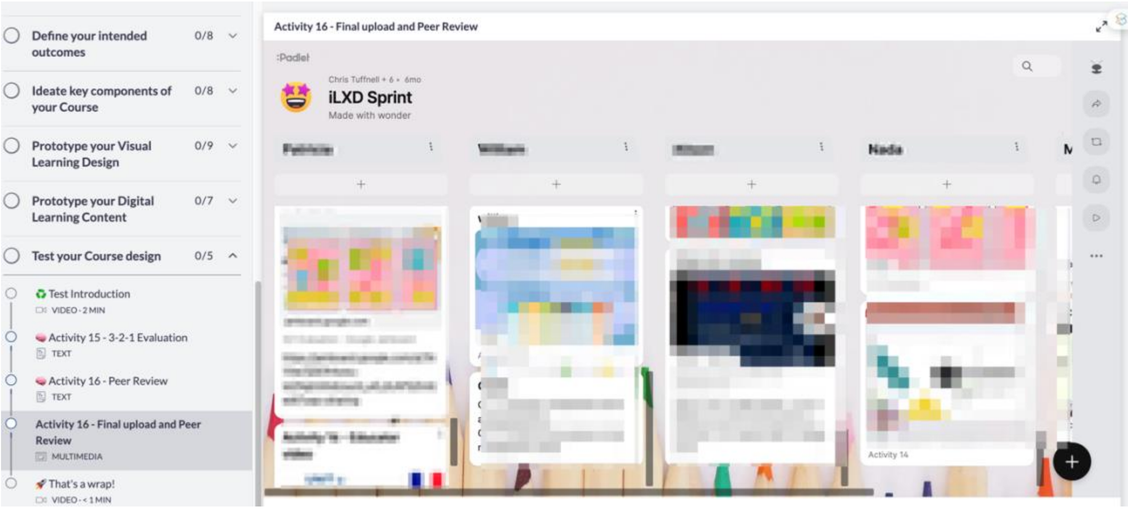
Figure 6.20: *Activity 15: Evaluation*



6.3.4.9 Activity 16: Peer review and final upload

Activity 16 was the final component of the participants' portfolios and continued with a reflective mindset around TPACK. For this activity, participants were asked to review a peer portfolio hosted in Padlet software (DC-B4 and DC-B7), as shown in Figure 6.21. The activity had the dual aim of providing feedback to the peer being reviewed and prompting internal reflection for the reviewer on elements they could improve in their own portfolios (TPACK).

Figure 6.21: *Activity 16: Peer review and final upload*



6.3.5 Summary of Implementation phase for Cycle-B

The implementation of the design intervention for cycle-B has been outlined. The course was structured sequentially on an asynchronous online learning platform (Thinkific), emphasising a time-restricted, DT approach. Engagement was tracked by viewed content and portfolio completion, although less than half completed the course. Participants created portfolios of learning artefacts, demonstrating their understanding of the content and TPACK framework. The phase involved activities, such as video creation, forum discussions, empathy mapping, curriculum mapping, brainstorming, visual learning design prototyping, and culminating in peer review.

The following evaluation section quantifies the success of cycle-B and provides invaluable insights for refining DCs for cycle-C.

6.4 Cycle-B: Evaluation

Following the same format as section 5.4, this evaluation phase of cycle-B is critical for understanding the efficacy of the design intervention, eliciting insights that inform future iterations, and extracting broader findings for the study's conclusive synthesis. This phase marks the culmination of cycle-B by discussing each of the DCs in turn, presenting a reflective analysis based on data collected following the design intervention course completion to identify substantiating aspects of the DC and identifying further considerations for cycle-C.

6.4.1 DC-B1: An Online, Asynchronous PD Learning Experience Will Increase Participant Engagement

DC-B1 proposed that an online asynchronous PD learning experience would increase participant engagement. When evaluating this DC, I aimed to understand whether a format that offers flexibility and convenience will lead to the engagement of adult learners, particularly in a PD context.

The most relevant data for the evaluation of DC-B1 were participant course completion and engagement data taken from the learning platform, participants' portfolio artefacts, interview questions related to their engagement in the course activities, and all reflections on their experience.

6.4.1.1 Substantiating the Design Conjecture

The course completion rate was 42% (n=6/14), as described in section 6.3.3. This was 27% lower than the completion rate for cycle-A's design intervention course. Figure 6.11, along with a verbal discussion, also documented in the same section, gives some insight into time constraints on some participants that affected their engagement with the course. There was a further 42% (n=6 /14) of participants who agreed to participate in the course, however, did not complete, with varying rates between 8-69% progression. Several attempts to contact non-completing participants to gain insight into their constraints have been unsuccessful.

Of the 42% of the participants who completed the course, 33% (n=2/6) expressed appreciation for the asynchronous nature of the course, which allowed them to engage with the material at times that suited them. Participants P-B2 and P-B1 remarked on this aspect: P-B2 said "*I appreciated the short, concise videos*", Additionally, Participant P-B1 commented: "*I like that I could access the online course at my convenient time*". This highlights the advantage of the asynchronous format, suggesting that for some, the format and delivery of the course content were pivotal in maintaining engagement.

However, the participants expressed dissatisfaction with the course's length and distribution of content. Participant P-B3 noted:

P-B3: "*It could have been spread out a little bit longer, 4 weeks was a bit short for the amount of work involved*"

Along with Participant P-B4, who stated,

P-B4: "*The course was really long, 8 hours or 12 hours, depending on how fast you want to replay your videos*".

This was despite cycle-B's course being offered as a 4-week 'sprint' as opposed to cycle-A's 10-week offering. An alternative opinion came from participant P-B2, who found the course duration appropriate.

P-B2: "*The length of the course is what it should be, it's not too short and it's not too long*".

These comments indicate a divergence in perceptions relating to the pacing and structure of the course, which affected participant engagement.

Therefore, DC-B1 was only partially validated in the present study. There are too many remaining questions to fully understand the engagement factors of participants in an asynchronous online PD format. The following section offers some considerations for further development of this DC.

6.4.1.2 Further considerations for the Design Conjecture

Although the fully asynchronous approach offered some benefits, multiple areas for improvement were identified. Even with the facilitation and support outlined in section 6.3.2, participant P-B5 had some confusion about the expectations of the course, commenting "*There was a bit of confusion about how the course was going to be run*". This lack of clarity could hinder engagement, therefore, further consideration should be given to the email, videos, and course orientation.

Additionally, participant P-B4 identified technical difficulties that hampered their experience as he experienced disruptions with "*Some videos were taking too long to buffer*", this could indicate an issue with the participant's own internet connection speed, however, it is a consideration for asynchronous online learning.

Participants P-B3 and P-B1 had differing expectations regarding the video content topic. While participant P-B3 felt “*there were too many videos*”, alternatively participant P-B1 requested "more videos” along with “more discussions and more debates" implying a need for a richer interactive component within the asynchronous framework.

Navigation through the course content also emerged as a consideration for future iterations, with participant P-B1 advocating for a nonlinear approach to learning:

> P-B1: "*I think you need to give people the freedom of learning movement as you might not even go through in a linear way, you might kind of flick through and go back*"

This suggests the benefit of a more flexible structure that allows participants to control their own learning paths, rather than the sequential building approach. The need for a robust redesign for cycle-c should be considered to cater to diverse learner preferences and minimise technical barriers, ensuring that the PD experience is both accessible and compelling.

6.4.2 DC-B2: Integration of Active BL Strategies Will Develop Participants’ PK

DC-B2 proposes that the integration of active BL strategies will develop PK in participants. This conjecture is grounded in the belief that a mix of active blended instructional methods for course delivery combined with active learning strategies in course content will develop participants' PK.

The data that were most relevant to evaluating DC-B2 were participants' portfolio artefacts and their responses to interview questions that reflected on their portfolio artefacts and their experience in the course.

6.4.2.1 Substantiating the Design Conjecture

The active BL strategies in the course were directly linked to an overall project approach, therefore, all six participants (100%) who completed the course engaged in the project approach and completed their course portfolio artefacts. Several participants provided insight into the effectiveness of the active BL strategies used in the course. Participant P4:

> P-B4: "*It was great to get ideas about how I could use active learning in my course by experiencing it within the course I was doing…it was like practicing what you preach approach*"

Along with participant P-B5's comments,

> P-B5: "*I liked the discussion forums, it was a good place to go and have a conversation with my peers, it also highlighted how active learning can happen online*"

This feedback from the participants highlights the benefit of integrating active learning approaches into course delivery. Participant P3 underscored the importance of balancing a mix of active learning activities when designing blended courses:

> P-B3: "*It's all about making sure that the classes have the right balance of activities*"

This suggests that various approaches are key contributors to engagement. Therefore, DC-B2 is validated in this study. Participant feedback suggests that active BL strategies have the potential to increase engagement, and feedback also indicates that when BL strategies are well-executed and balanced, they can significantly enhance the learning experience. The following section offers some considerations for further development of this DC.

6.4.2.2 Further considerations for the Design Conjecture

While the six participants who engaged in active learning strategies were all supportive of the approach, areas for improvement were identified. For example, participant P2 suggested the need for more interactive content,

> P-B2: "*Maybe more live discussions or more debates with the rest of the cohort would be beneficial*"

This indicates the desire for a more synchronous active learning experience in future iterations.

6.4.3 DC-B4: Providing Intentional Collaborative Opportunities Will Foster a FLC

DC-B4 suggests that intentional collaborative opportunities will cultivate a strong FLC. This conjecture is based on the premise that collaboration and community building are key to enhancing the PD experience.

The data that were most relevant to evaluating DC-B4 were participant responses to interview questions that reflected their activity in the community space and peer-review activities.

6.4.3.1 Substantiating the Design Conjecture

Participants' insights highlighted the impact of collaborative opportunities on building a learning community. All six participants who completed the course engaged in discussion forums and peer-review activities. Participant P-B6 noted the advantages of forum space.

> P-B6: "*Discussion forums were a good place to go and have a conversation with people to get their perspectives*"

In relation to the collaborative software used (Padlet) that allowed all participants to see the development of each person's portfolio artefacts, participant P-B5 commented: "*It's nice to see what others are doing and get ideas*". Participant P-B1 discussed how she used the collaboration space to see that others work as a reflective guide for her own artefact development:

> P-B1: "*It was like a map, I'd go to check others work and then I'd go back to mine and change it if needed*"

This demonstrates the benefits of asynchronous collaboration and idea sharing, allowing for the reflection and adaptation of one's own practice.

In terms of developing a sense of community, I was able to observe in the learning community space that of the six participants who completed the course, four were active in the learning community beyond the requirements of the course activities. Participant P-B6 spoke about the feeling of connection in the online environment.

> P-B6: "*when people are engaging, you read their comments, you learn more and that gives me the connection, even though it's online*"

This was something the design intervention course purposefully aimed to foster, as it was seen as key for successful online learning experiences.

The community approach also motivated the participants. Participants P-B4 commented about being part of a learning community: "*It gives you a push to join, just to be part of the community*"

Participant P-B1 discussed how she was motivated by a fellow participant (P-B3) through collaborative activities and space.

> P-B1: "*I would check on (P-B3) as I knew that she was doing the course with me. At first, I was prodding her a little bit since she felt unmotivated at the beginning, but when I started seeing (P-B3) commenting, I became more motivated. I'm like, okay, let me post this, let me do this*"

This feedback highlights an unintended aspect of the community-building approach related to cohort-based learning, which can be explored further in cycle-C.

Therefore, DC-B4 is validated in this study. The feedback outlines the success of the design intervention course in creating a sense of community among participants through purposeful collaborative activities and the provision of a learning community that could be flexibly engaged with and lead to the motivation of fellow participants. The following section offers some considerations for further development of this DC.

6.4.3.2 Further considerations for the Design Conjecture

While providing overall positive feedback, some participants expressed a need for more in-person interaction, as highlighted by participants P-B6 and P-B3.

> P-B6: "*I think that you can't beat in-person collaboration as it's easier to work together, suggesting room for improving how collaborative activities are facilitated*"

and

> P-B3: "*I think more people would have engaged in the collaborative activities if we were together in the same room*"

While acknowledging that there is room for improvement in terms of the structure and modality of delivery, the core intent of this conjecture has been achieved. However, an area of future exploration has emerged from feedback in the form of a cohort-based learning approach.

6.4.4 DC-B5: Learner-Centred Design Approaches Will Help Guide Intentional BL Design for Participants

DC-B5 proposes that employing learner-centred approaches for blended learning design will effectively guide participants’ design decisions. This conjecture is grounded in the belief that focusing on learners' needs, preferences, and experiences leads to more effective BL experiences.

The data that were most relevant to evaluating DC-B4 were participant course completion and engagement data, participants’ portfolio artefacts, and participant responses to interview questions that reflected their portfolio artefacts and experience in the course.

6.4.4.1 Substantiating the Design Conjecture

The participants' feedback provided insights into how learner-centred design approaches impacted their experience in the design intervention course. The participants followed a DT approach to learning design that prompted them to *empathise* with their learners, *define* learning outcomes and assessments, *ideate* active learning and collaboration in their course designs in addition to how their educator presence will be felt, *prototype* VLD templates, and *test* through peer evaluation. Reviewing the course completion and engagement data (Table 6.3), it is apparent that n=9/14 participants completed the empathy section of the course, n=8/14 completed the define section, n=7/14 completed the ideate section and n=6/14 completed the prototype and test section, therefore completing the course. The reasoning behind participant attrition was not identifiable from the current data. While personal time constraints have been provided as a factor for two of the participants' drop-off in engagement, further insights from the non-completing participants are needed to fully identify contributing factors.

This iterative, incremental approach to the course was highlighted as a positive aspect by the participants.

> P-B1: "*I liked how we stepped through each phase…* [empathy, define, ideate, prototype and test] *…as it gave me a clear pathway to follow*"

In addition, the iterative structure provided confidence to some participants.

> P-B6: *"I really valued that I didn't have to get everything done in the first design, I followed the stages of the model with the understanding that the next time round I will improve my design, this concept was really liberating and help my confidence"*

However, for some participants, the novel approach may have been an inhibiting factor for engagement. Participant P-B4 commented,

> P-B4: "*My biggest challenge was trying to understand the concept of designing a learning experience*"

This challenge speaks to the mindset shift required for participants to transition from educators to designers of learning experiences, a key goal of the intervention course. Therefore, more exposure and support of DT methodology are needed in the future.

The empathy section of the course, completed by n=9/14, emphasised how to engage with learners as an important stakeholder in the design process, participant P-B3 highlighted the importance of this stage:

> P-B3: "*It's about how you reach the students...make them involved in the design process*"

In addition, Participant P-B1 noted that the empathy mapping activity

> P-B1: "…helped me create a deeper understanding of my student's needs and experiences"

The participants appeared to appreciate the role of empathy in a learner-centred design.

The defined section of the course, completed by n=8/14, prompted participants to complete a template to map out learning outcomes and assessments. Participant P-B1 commented on this process.

> P-B1: "*It made me think more deliberately about my learning outcomes and creatively about picking the right assessment*"

This comment, along with the portfolio evidence, indicates that the intention to encourage constructive alignment was successful.

The ideate section of the course, completed by n=7/14, prompted participants to brainstorm where the cognitive presence (active learning) would occur in their course design, where the social presence (collaborative opportunities) would occur, and what their teaching presence would look like in asynchronous and synchronous environments. Participant P-B4 commented that the activity prompted him to consider wider aspects of his course design:

> P-B4: "*I probably wouldn't have thought about the collaboration elements of the blended learning design if not prompted by the course and template*"

This indicates that supportive resources prompted deeper thinking about engagement in the course design.

The prototyping and test sections, completed by n=6/14, were evident in the participants' portfolios and reflected a good grasp of the DT approach for learner-centred design.

Therefore, DC-B5 was validated in this study. The feedback from the participants indicated that the DT approach was beneficial in guiding learner-centred blended learning designs. The empathise section helped to keep learners at the heart of the design decisions. Further refinement of the delivery and support of the DT approach is provided in the next iteration of the course. While drop-off in participant engagement needs further investigation, I believe this will be addressed by the refinement of DC-B1, covering the course design and delivery modality. The following section offers some considerations for further development of this DC.

6.4.4.2 Further considerations for the Design Conjecture

The main challenges that participants faced with this approach were technical difficulties with the technology tools (Padlet, Google Jamboard), which will be explored in more detail as part of the evaluation for DC-B7, as the tools appear to have caused a challenge for some, as outlined by participants' P-B6's comment:

> P-B6: "*I found it difficult to go back and find my brainstorming template because when I clicked the link it created a new Jamboard instead of taking me to mine*"

This indicates a misassumption regarding the integration of collaborative tools. Although instructions were provided, a more user-friendly approach should be considered for the next iteration of the DC.

6.4.5 DC-B7: Educators' TK Can Be Developed Through Intentional, Evidence-Based Professional Development

DC-B7 asserts that educators' TK and competencies can be effectively enhanced through carefully planned evidence-based PD. This conjecture is based on the understanding that targeted PD can address specific technology-related needs and gaps in educators' skillsets.

The data that were most relevant to evaluating DC-B4 were participants' portfolio artefacts and their responses to interview questions that reflected on their portfolio artefacts and their experience in the course.

6.4.5.1 Substantiating the Design Conjecture

Feedback from participants offers insights into the impact of PD on technological knowledge and skills. The second activity in the course, discussed in section 6.3.4.1, aimed to develop participants' confidence in creating digital learning content. Explainer videos, a final example video, and access to a user-friendly video creation tool were provided. As shown in Table 6.3, n=9/14 initial participants completed this activity. This activity was generally well-received with participant comments, such as participant P-B2:

> P-B2: "*I liked that you showed us how to do it, it's not like, okay, this is the tool now you figure it out to yourself*"

This indicates that explainer videos are a useful scaffolding approach to technology training.

Participants' feedback showed growing confidence in technology integration in their BL designs, specifically with the user-friendly technology tools (Padlet, Jamboard, Loom) that were utilised in the course. Participant P-B3 commented,

> P-B3 "*I'm getting pretty good at using the tools...I'm interested to learn more, and I know the students like [using] them*"

This indicates that the course effectively bolstered her technological ability. In addition, some participants communicated technological confidence before engaging with the course. Participant P-B4 shared that "*I'm more comfortable with the technological side of things than the pedagogy*", indicating that he could have gained more from the PK development focus from DC-B2.

When discussing their use of technology tools, Participant P1 commented on discipline-specific considerations, as a Maths educator she found:

> P-B1: "*I had to use a combination of tools like an online whiteboard and other graphic tools to show the equations and special characters*"

This demonstrated the development of PTK based on her CK to select the appropriate tool and approach.

When discussing evidence-based approaches to digital learning content creation, participant P-B4 shared his impression of the content:

> P-B4: "*Understanding the research and applying best practices was really useful for me, for example the bit about cognitive load and making sure that graphics are simple, and narrative is concise was really useful and will stick with me*"

This indicated that content and approaches to the creation of digital learning content by following evidence-based best practice resonated with participants.

DC-B7 was partially validated in this study. The feedback from participants indicates that while PD has contributed to the development of educators' TK and TPK, there is a need for more comprehensive and tailored technological training and support, which is discussed further in the following section.

6.4.5.2 Further considerations for the Design Conjecture

Although the course intended to scaffold participants’ TK and TPK by providing, “how to” explainer videos, examples, evidence-backed approaches for designing digital learning content and integrating user-friendly technology tools, participants identified challenges to consider for the next iteration of the design intervention.

Some participants' faced difficulties in utilising to the course technology tools Participant P-B2 commented that she is "*not really a techie person*". Some participants did not see themselves as technologically competent despite the incremental scaffolded approach and completion of TK activities.

As discussed in section 6.4.4.2 of DC-B5, some participants faced technical difficulties with the technology application Google Jamboard, an online whiteboard tool that was set up with various template backgrounds to guide participants planning and design. Participant P-B6 commented on an issue echoed by several participants:

> P-B6: "*I found it difficult to go back and find my brainstorming template because when I clicked the link it created a new Jamboard instead of taking me to mine*"

This flaw could have been mitigated with clearer instructions, and perhaps a demonstration, or perhaps a more user-friendly approach, should be considered. Therefore, the importance of not only introducing new tools, but also ensuring that educators are comfortable and proficient in using them should be considered in the development of this conjecture.

6.4.6 Summary of Evaluation phase for Cycle-B

This section provides an in-depth evaluation of the DCs for cycle-B. It discussed the five DCs based on participants' engagement, course approach, community building, learner-centred design, and technological knowledge development. The evaluation indicates the validation of three DCs, partial validation of two DCs, and recognition of areas for improvement for future iterations, notably in enhancing engagement, interactivity, and technological competency.

The evaluation was distilled into a summary table (Table 6.4), to provide a visual overview of validated, partially validated, and not validated conjectures, and to organise and reference future considerations for the following iteration. Future considerations identified from the evaluation of DCs will serve as a foundational basis for further development of DCs in cycle-C of the design intervention.

Table 6.4: *Summary of Cycle-B: Evaluation of Design Conjectures*

TPACK Domain	Cycle B's DCs	Summary of the Evaluation for Cycle-B (Key: ☑= validated ☒= not/partially validated)
Content Knowledge	DC-B1 An Online, Asynchronous PD Learning Experience Will Increase Participant Engagement	☒ - *partially validated* There are too many remaining questions to fully understand the engagement of participants in an asynchronous online, PD format. The need for a robust redesign for cycle-c should be considered to cater to diverse learner preferences and minimise technical barriers, ensuring that the PD experience is both accessible and compelling.
	DC-B2: Integration of Active Blended Learning Strategies Will Develop Participants' PK	☑ – *validated* The participant feedback suggested that active blended learning strategies have the potential to increase engagement, the feedback also indicates that when blended learning strategies are well-executed and balanced, they can significantly enhance the learning experience.

	DC-B4: Providing Intentional Collaborative Opportunities Will Foster a Faculty Learning Community	☑ – *validated* The evaluation found that intentional collaborative opportunities have been effective in fostering an FLC. While acknowledging that there is room for improvement in terms of the structure and modality of delivery, the core intent of this conjecture has been achieved. An area for future exploration has emerged from the feedback in the form of a cohort-based learning approach.
Pedagogical Knowledge	DC-B5: Learner-Centred Design Approaches Will Help Guide Intentional BL Design for Participants	☑ – *validated* The feedback from participants was that the DT approach was beneficial in guiding their learner-centred blended learning designs. The empathise section helped to keep learners at the heart of the design decisions. There were some technical issues identified that will be tackled in the development of DC-B7.
Technological Knowledge	DC-B7: Educators' TK Can Be Developed Through Intentional, Evidence-Based PD	☒ - *partially validated* The feedback from participants indicates that while the PD has contributed to the development of educators' TK and TPK, there is a need for more comprehensive and tailored technological training and support. The importance of not only introducing new tools but also ensuring educators are comfortable and proficient in using them was also highlighted.

6.5 Cycle-B: Conclusion

Cycle-B of this DBR project continued the systematic exploration of educator professional development for blended learning design underpinned by the TPACK framework. The analysis section of this cycle explored the supporting literature for each of cycle-A's partially validated DCs to identify key considerations that would inform the refinement of the DCs for this cycle. The key considerations identified approaches for increased participant engagement, development of an FLC, learner-centred design approaches, and technological knowledge through PD as the main considerations to inform the development of new DCs in the design section. The implementation section describes the delivery of a redesigned intervention course outlining participant engagement in a fully asynchronous online learning environment, the application of a DT approach for BL design, a project approach with artefact creation, and the stand-alone online FLC. The concluding section of this cycle evaluated the new DCs based on data analysis to validate or identify which DCs need further development in cycle-C.

The transition to cycle-C aims to enhance the design intervention by:

1. Continuing Exploration of learner engagement: Further exploring the modality of delivery, that is asynchronous, synchronous, and the role of design thinking to optimise educator engagement.
2. Technological knowledge development: Confidence in the utilisation and integration of technology in the blended learning design process.

Cycle-C will iterate upon the conjectures of cycle-B with a focus on these themes, with the aim of improving the design intervention.

Chapter 7: Findings - DBR Cycle-C

This chapter presents the findings from the third iteration of the design intervention course, cycle-C. The *Analysis* section (7.1) presents an analysis of literature, specifically conducted to identify new key considerations to refine unvalidated DCs from cycle-B. The *Design* section (7.2) discusses the iterative development of DCs based on the key considerations identified in the analysis section. The refined conjecture map based on the new DCs is presented along with details of the design intervention. The *Implementation* section (7.3) discusses the deployment of the third iteration of the design intervention course, in addition to how participants were supported in the course and their portfolio development. The *Evaluation* section (7.4) presents an analysis of participants' data produced during their experience of cycle-C's design intervention course, and the validity of design conjectures is discussed. The *Conclusion* section (7.5) wraps up cycle-C.

7.1 Cycle-C: Analysis

The analysis section for cycle-C follows the same process as discussed in section 4.6.1. Following cycle-B's evaluation phase (section 6.4), DCs were either validated or partially validated, with further refinement and development identified for partially validated DCs in this cycle-C. The 'fully validated' conjectures of DC-A3, DC-A6, DC-B2, and DC-B4 from the last two cycles will remain a part of the design intervention with no further investigation.

Therefore, cycle-C's analysis section will only focus on the next iteration of 'partially validated' DCs from cycle-B, identifying key considerations from the analysis of literature to inform a new conjecture.

The selection of literature for this analysis section followed the same process as discussed in section 4.6.1. However, the literature will be identified based on issues identified from cycle-B's evaluation of individual DC's.

In line with this process, as the literature is presented, key considerations that emerge are identified with the letter 'C' representing cycle-C and then a corresponding number, that is, 'C1', 'C2' etc. Section 7.1.4. presents Table 7.1, a table summary of all the key considerations that are identified.

7.1.1 DC-C1 Key considerations

DC-B1 proposed that an online asynchronous learning experience increases participant engagement. This conjecture was only partially validated in Cycle-B's evaluation, therefore, further development is deemed necessary.

7.1.1.1 Considering modality of delivery

In the evaluation of DC-B1, as discussed in section 6.4.1, there were unanswered questions relating to whether the lack of engagement from some participants was related to the asynchronous online PD format. Therefore, the design intervention course needs to be further developed.

To identify key considerations for DC-C1, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign by identifying challenges to the online modality and the effective modalities of course design. Therefore, I focused on the keywords “participation challenges in online learning” and “modalities for educator PD”. The following discussion draws upon 17 relevant literature sources that discuss the design of flexible and effective PD. Sub-themes in the following discussion relate to challenges in online learning, and the selection of an effective educational model for PD was identified as imperative factors to consider for the next iteration of the design intervention.

7.1.1.2 Understanding challenges in the online modality

The literature analysis focused on the challenges in online learning modalities that could affect participant engagement. The discussion has been categorised into three concepts: l*ack of social interaction*, *lack of collaboration, and lack of practical application*.

The most notable challenge in the literature is the *lack of social interaction*. Several articles emphasise the lack of social or peer interaction as an inhibiting factor for engagement in the online modality (Aziz et al., 2022; Hindaryatiningsih, 2023; Bali & Liu, 2018). Hindaryatiningsih (2023) specifically highlighted the limited opportunities for spontaneous conversation and learner immersion as challenges in online learning. Thamri et al. (2022) presented downsides identified from students’ perceptions of online learning, including issues of isolation and digital fatigue.

The *lack of collaboration* has also been identified as a challenge to engagement in the online modality. Specifically related to online PD, Wynants & Dennis

(2018) discussed the disadvantages of attempted online collaboration as opposed to face-to-face interactions, emphasising the lack of real-time feedback and social dynamics for interaction. Wynants and Dennis (2018) further elaborated on these challenges, noting the difficulty in creating meaningful collaboration in online PD due to restrictions in interpreting body language and social cues. Leo et al. (2004) adds to this by underscoring the importance of active, intensive, and sustained collaborative learning for engaging educators to adopt instructional practices that yield improved student outcomes. Therefore, the first key consideration (C1) is that despite convenience and flexibility, many online PD programmes suffer from reduced engagement, which is due to a lack of social interaction, meaningful collaboration, and practical application.

When identifying further key considerations for *lack of social interaction and lack of collaboration* as challenges to engagement in the online modality, the validation of DC-B4 from cycle-B was noted to provide collaborative opportunities to participants. However, cycle-C measures must be taken to further increase engagement. Therefore, further key considerations highlighted are (C2) mitigating feelings of isolation by improving social dynamics, and (C3) reducing digital fatigue and increasing real-time feedback for cycle-C.

An additional challenge to the online modality identified in literature is the *lack of practical applications*. Several authors have compared online and face-to-face learning, highlighting performance issues in the fully online mode due to a lack of practical or hands-on learning experiences (Aziz et al., 2022; Bali & Liu, 2018). In addition, discipline-specific studies also shared challenges to engagement in the online modality because of acquiring practical skills for social work students, lack of real-time interaction and practical exposure to online counselling education, and lack of engagement in the online format for maritime education, due to the practical nature of the discipline (Saikia, 2023; Sunami, 2023). Again, while acknowledging cycle-A's DC-A2 for integration of real-world relevance, the adapted DC-B2 from cycle-B was validated for integrating active learning. Therefore, key considerations for the redesign of cycle-C include (C4) increased real-time interaction and (C5) hands-on learning experience to increase participant engagement.

7.1.1.3 Identifying an effective modality for delivery

In response to the above-mentioned challenges, a more effective modality for delivery that emphasises social interaction, practical application, and collaboration needs to be identified for cycle-C's course redesign.

Reverting to the previously discussed analysis, the literature from section 5.1.2.2 acknowledges that the "flipped learning" modality for BL is particularly useful when integrating 'flexible' asynchronous (online) and 'collaborative' synchronous (in-person) learning environments (Bergmann & Sams, 2014; Lee & Choi, 2018; Moskal et al., 2013; Zhao & Song, 2022). Furthermore, in cycle-A's evaluation section 5.4.6, the design conjecture DC-A6 which stated that the flipped learning model (introduced to participants taking the PD course) will support participants' learning design decisions, was fully validated.

Furthermore, contemporary literature on flipped learning for PD is supported by authors such as Zawilinski et al. (2020), who highlighted the effectiveness of flipped learning modalities in Educator PD. The author discusses how the flipped learning approach facilitates deeper reflection and interactive learning experiences. In addition, several authors have identified the adaptability of flipped learning modalities, underlining the versatility of the method to be applied across different disciplines, even in more active and experiential fields (Kwon & Park, 2023; Recino et al., 2022). Karatsiori et al. (2021) discuss the application of collaborative learning in flipped educator PD. Their study indicated that flipped learning fosters a more interactive and cooperative learning environment, enhancing professional competencies among groups of participants. Therefore, the final key consideration (C7) is the adoption of the flipped learning modality for the design and delivery of cycle-C's redesigned course.

In summary, the literature analysis to identify key considerations for DC-C1 identifies that (C1) the online modality suffers from reduced engagement, therefore, the redesign of the intervention course for cycle-C aims to adopt a (C6) flipped learning modality to (C2) improve the social dynamic, (C3) reduce digital fatigue, (C4 and C5) increase real-time feedback and interaction, and (C5) increase hands-on learning experiences.

7.1.2 New Conjecture (DC-C8) Key considerations

Cycle-B's conjecture, DC-B4, proposes that the provision of intentional collaborative opportunities would foster an FLC. While this conjecture was fully validated, as discussed in section 6.4.3, the concept of cohort-based learning (CBL) emerged from participant feedback as a future consideration for increasing participant engagement in cycle-C. Therefore, a new conjecture will be hypothesised (DC-C8) in relation to this concept and informed by key considerations derived from the following literature analysis.

7.1.2.1 Designing a cohort-based approach

To identify the key considerations for CBL and DC-C8, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign. Therefore, I focused on the keywords “designing”, “cohort-based learning” and “professional development”. The following discussion draws upon 10 relevant literature sources that discuss the design of flexible and effective PD. The sub-themes identified in the following discussion relate to *increasing learner engagement and pedagogical advantages* as imperative factors to consider for design interventions.

7.1.2.2 Increasing learner engagement with cohort-based learning

CBL is recognised as a critical factor for *increasing learner engagement* and enhancing educational outcomes. According to Imel (2002), CBL should have five characteristics:

1. A defined, membership who commence and complete together,
2. Sharing a common goal that can best be achieved when members are academically and emotionally supportive of each other,
3. Engaging in a common series of learning experiences,
4. Following a highly structured, intense meeting schedule
5. Forming a network of synergistic learning relationships developed and shared among members.

Several authors highlight the advantage of CBL in enhancing community spirit, fostering a sense of belonging, and mutual support, while offering flexibility and peer support among learners, which is crucial for enhancing their professional growth (Leland et al., 2020; Reilly, 2023; Shanahan & Sheehan, 2020). Lupton's (2019) study shows how CBL allows educators to engage in collaborative, reflective practices in PD. Lei et al. (2011) provided a balanced view, acknowledging both the benefits and drawbacks of academic cohorts, noting that the sense of community and shared learning experiences outweigh the challenges.

7.1.2.3 Pedagogical advantages of cohort-based learning

When considering *pedagogical advantages of CBL*, the authors highlight the benefits of cohorts for collaborative learning environments that develop a shared understanding and enhanced proficiency among learners (Choy et al., 2015; Umekubo et al., 2015). Rausch (2012) presented cohorts as communities of enquiry, emphasising their role in fostering collaborative learning and future educational development. Zhao & Song (2022) study on measuring the learning experience of cohorts highlights the importance they play in understanding diverse learning experiences. A study by Guerra et al. (2023) emphasised the enhancement of PBL with a cohort-based approach, providing collaborative learning and real-world problem-solving skills among university educators.

Therefore, key considerations for the development of DC-C8 include (C6) considering the characteristics of CBL in the course design, and (C7) using CBL to enhance real-world problem-solving skills in Cycle-C.

7.1.3 DC-C7 Key considerations

DC-B7 proposed that educators' TK could be developed through intentional, evidence-based PD. This conjecture was partially validated in cycle-B's evaluation, therefore, further development was deemed necessary.

7.1.3.1 Comprehensive PD for technological competency

In the evaluation of DC-B7 discussed in section 6.4.5, the feedback from participants indicated that there is a need for more comprehensive and tailored technological training and support. This finding highlights the importance of ensuring that educators are comfortable and proficient in using technology.

To identify key considerations for DC-C7, I searched the OneSearch literature database to identify contemporary articles that could guide course redesign by identifying effective methods for developing a more comprehensive PD to build participants' technological competency. Therefore, I focused on the keywords "educator professional development", "technological competence", "technological confidence" and "technology-enhanced learning". The following discussion draws upon eight relevant literature sources that discussed designing PD to bolster technological confidence and competence in educators. Sub-themes identified in the following discussion related to *building confidence in technological usage* and *approaches to technology proficiency* as imperative factors to consider for design intervention.

7.1.3.2 Developing Technological Proficiency and Confidence

The rapid integration of digital technologies in education requires educators to be confident and competent in their use for effective teaching. The following explores various strategies and interventions aimed at developing educator confidence in TEL environments.

The following studies highlight the critical role of *confidence in technological usage*. Saubern et al. (2020) and Shriner et al. (2010) both discuss the development of educators' confidence in using digital technology, linking greater confidence with increased proficiency and underscoring the need for continuous skill development as a confidence-building measure. In addition, Kamalodeen et al. (2019) provide insight into the development of technological competence and confidence, emphasising the global need for confidence-building measures in TEL across different educational and cultural contexts. Woodlands and Dart (2023) emphasised the importance of training educators in both synchronous and asynchronous teaching environments. Similarly, Greener and Wakefield (2015) discussed the development of confidence in digital tool usage through tailored PD efforts.

In relation to *approaches to technology proficiency*, Francom and Moon's (2018) study illustrated how providing individual coaching can significantly enhance educators' confidence in using educational technology. Providing a practical approach to hands-on learning and confidence-building in real-world settings. Martinez-Lopez, Yot, and Sacchini (2017) explore how educators' attitudes towards the design of learning activities using technology can influence their confidence levels. This study highlights the importance of positive attitudes and beliefs regarding the effective use of technology in teaching. Similarly, Meace, et al. (2022) pointed out that encouraging a risk-taking approach to technology usage is an effective strategy for promoting educator confidence in technology integration. This suggests that creating a supportive culture that encourages experimentation and learning from failure is crucial for building technological confidence among educators.

Therefore, key considerations for the development of DC-C7 include (C8) providing technology coaching to improve educators' confidence, and (C9) fostering a risk-taking attitude towards the design of learning activities using technology to develop technological competence.

7.1.4 Summary of Analysis phase for Cycle-C

This literature analysis resulted in several key considerations being identified in correlation with issues identified in cycle-B's partially validated DCs. The identified key considerations have been distilled into a summary table, shown in Table 7.1, to organise and reference the key considerations. These considerations will serve as a foundational basis for refining DCs and developing new aspects of the design for cycle-C's design intervention.

Table 7.1: *Key considerations - Cycle-C*

TPACK Domain	Cycle-B's DCs	Key area	Key considerations for Cycle-C's DCs
Content Knowledge	DC-B1: An Online, Asynchronous PD Learning Experience Will Increase Participant Engagement	**Identifying an effective educational model**	C1. Consider that online PD programmes suffer from reduced engagement C2. Consider how to improve the social dynamic C3. Consider how to reduce digital fatigue C4. Consider how to increase real-time feedback and interaction C5. Consider the adoption of the flipped learning model for delivery
	N/A	**Cohort-based learning**	C6. Consider the characteristics of CBL in the course design C7. Consider how to use CBL to enhance real-world problem-solving skills
Technological Knowledge	DC-B7: Educators' TK Can Be Developed Through Intentional, Evidence-Based PD	**Developing educators' technological confidence and componence**	C8. Consider providing technology coaching to improve educators' confidence C9. Consider fostering a risk-taking attitude for developing technological competence

7.2 Cycle-C: Design

This section focuses on developing the third iteration of the design intervention and further refining the identified DCs based on key considerations culminating from the analysis in section 7.1.

As with previous design sections, 5.2 and 6.2, this section presents the DC discussion, followed by a revised design conjecture map in section 7.2.1. The mediating processes and intended outcomes of the design intervention were discussed. The section concludes with a discussion related to the components of the design conjecture map to provide more detailed insights into the design decisions in the design intervention for cycle-C.

7.2.1 Design Conjectures for Cycle-C

As discussed in section 4.6.2, following the analysis of the literature and identification of key considerations (section 7.1), an iterative ideation technique was employed to refine the design conjectures.

The outcome of the ideation process for cycle-C resulted in the refinement of design conjectures, derived from key considerations and underpinned by TPACK, to inform the third design intervention.

Table 7.2 shows cycle-B's design conjectures (left column), the key consideration from cycle-C's analysis phase (middle column) and the refined design conjecture for cycle-C (right column).

Table 7.2: *Design Conjectures - Cycle-C*

TPACK Domain	Cycle-B's DCs	Key considerations	Refined DCs for Cycle-C
Content Knowledge	DC-B1: An online, asynchronous PD learning experience will increase participant engagement	C1. Consider that online PD programmes suffer from reduced engagement C2. Consider how to improve the social dynamic C3. Consider how to reduce digital fatigue C4. Consider how to increase real-time feedback and interaction C5. Consider the adoption of the flipped learning model for delivery	DC-C1: A flipped learning course design will increase participant engagement
	DC-B2: Integration of active blended learning strategies will develop participants' PK	No additional considerations for this iteration.	No change
	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension.	No additional considerations for this iteration.	No change

	DC-B4: Providing intentional collaborative opportunities will foster a faculty learning community	No additional considerations for this iteration.	No change
	N/A	C6. Consider the characteristics of CBL in the course design C7. Consider how to use CBL to enhance real-world problem-solving skills	*DC-C8: A CBL approach will increase participant engagement *In the sequence of development this DC was the last (#8). However, it is presented here in the table due to its relevance to the CK section.
Pedagogical Knowledge	DC-B5: Learner-centred design approaches will help guide intentional BL design for participants'	No additional considerations for this iteration.	No change
	DC-A6: The flipped learning model will support participants' learning design decisions.	No additional considerations for this iteration.	No change

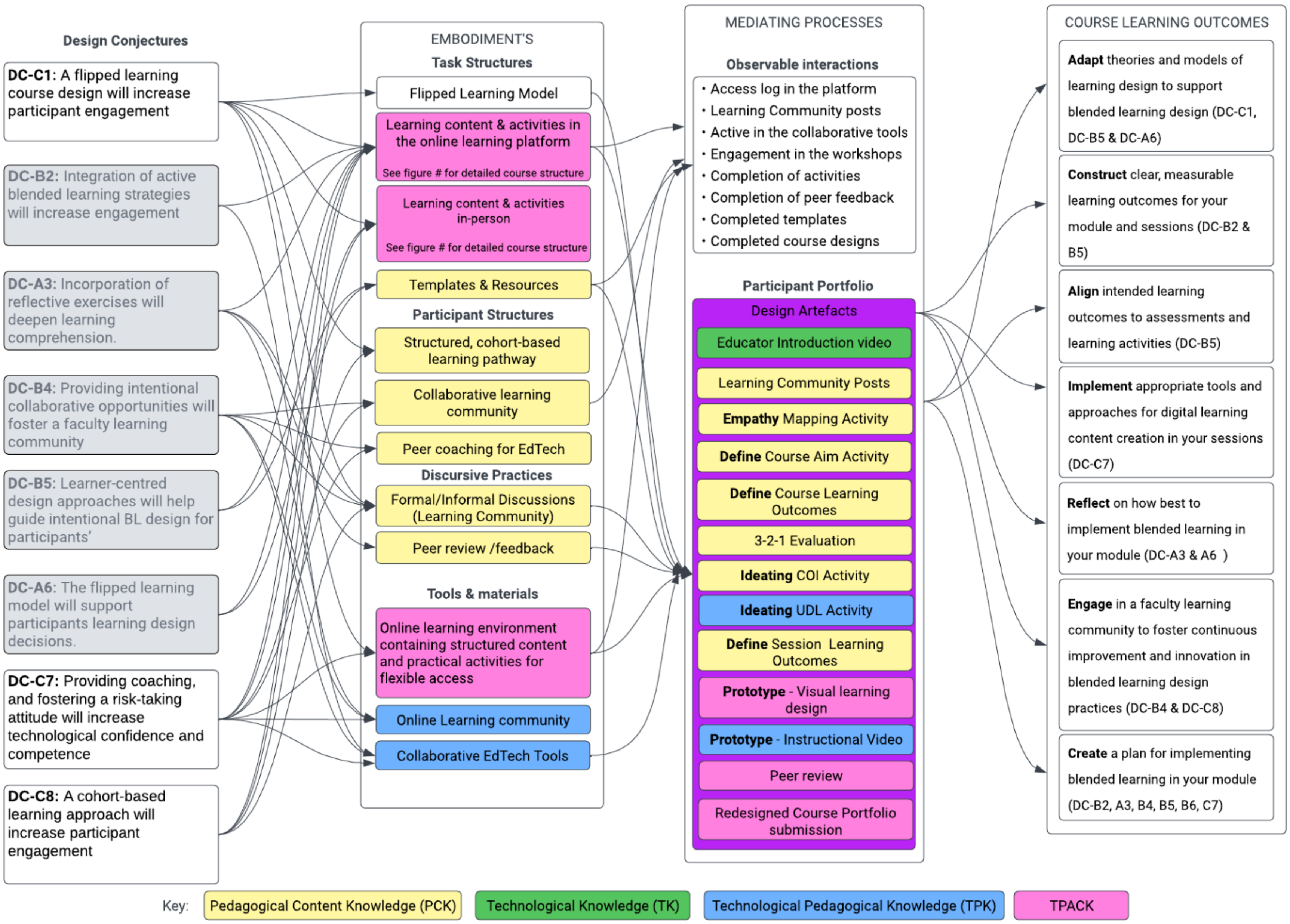
Technological Knowledge	DC-B7: Educators technological knowledge can be developed through intentional, evidence-based PD.	C8. Consider providing technology coaching to improve educators' confidence C9. Consider fostering a risk-taking attitude for developing technological competence	DC-C7: Providing coaching, and fostering a risk-taking attitude will increase technological confidence and competence

7.2.2 Developing the Design Conjecture Map for Cycle-C

As discussed in section 5.2.2, the design conjecture map builds on the identified design conjectures to provide a visual blueprint for design intervention. Cycle-C's conjecture map is an iteration that contains elements from cycle-A and cycle-B, they are greyed out to indicate that the conjecture/element is present and remain unchanged.

The conjecture map for cycle-C is presented in Figure 7.1, followed by a more detailed discussion of this map.

Figure 7.1: *Cycle-C – Design Conjecture map*



7.2.3 Components of the conjecture map for Cycle-C

As with the previous cycles, the following sections discuss the four components of *design conjectures, intended learning outcomes, embodiments, and mediating processes* in relation to cycle-C.

7.2.3.1 Design Conjectures

As shown in the first column of Figure 7.1, the DCs for cycle-C consist of:

- DC-C1: A flipped learning course design will increase participant engagement
- DC-C7: Providing coaching, and fostering a risk-taking attitude will increase technological confidence and competence
- DC-C8: A CBL approach will increase participant engagement

7.2.3.2 Intended learning outcomes

As this is the third iteration of design intervention, the focus is on the refinement of the design rather than on alternative learning outcomes that would fundamentally impact the design. Therefore, the ILOs of the design intervention course were reviewed and remained the same as those discussed in section 5.2.3.2. The rationale is that learning outcomes represent key competence criteria for designing BL. The mapping of the current outcomes was updated to align with the current set of DCs, as shown in the right-hand column of Figure 7.1.

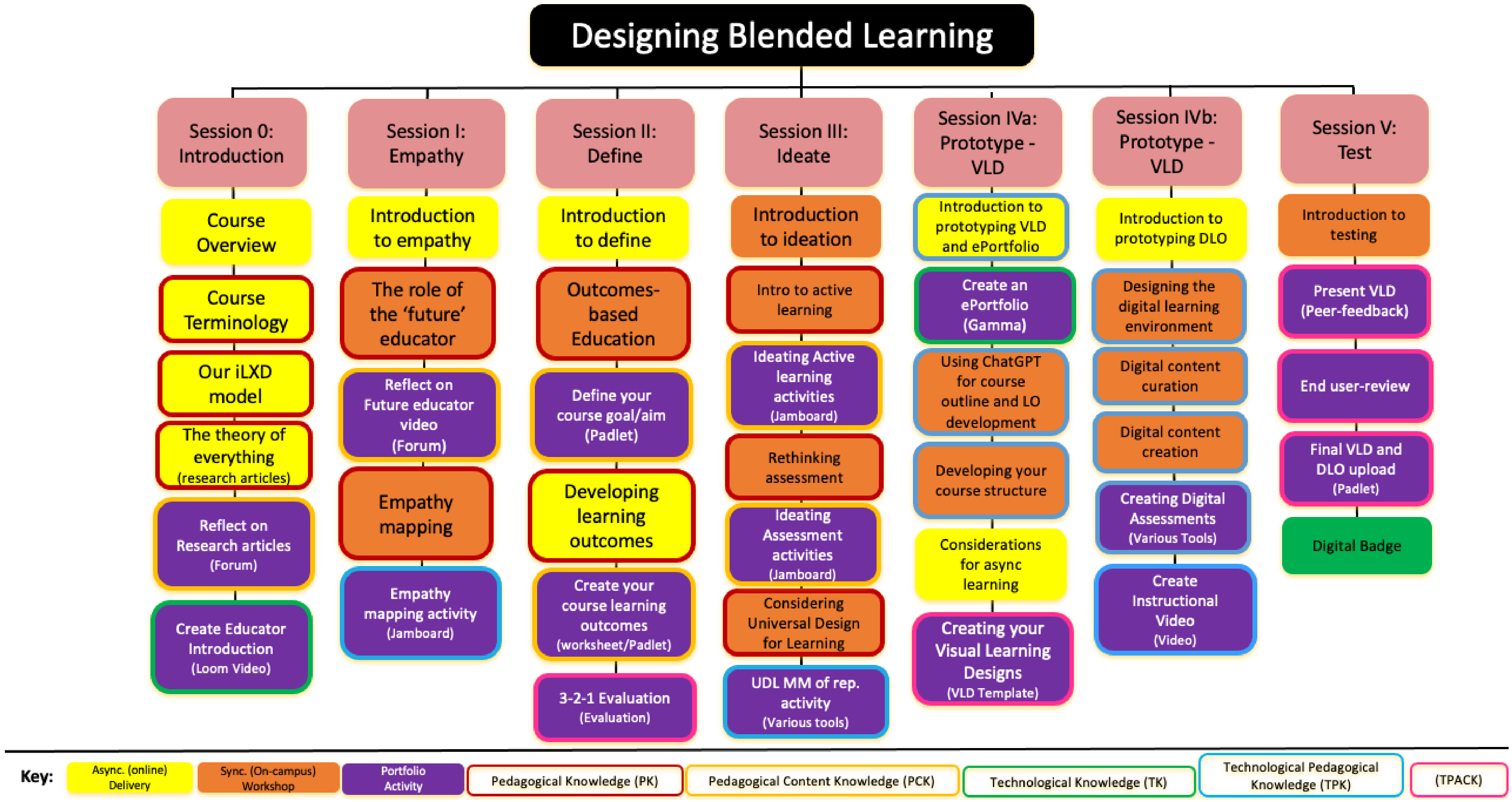
7.2.3.3 Embodiments

The conjecture map embodiments component for cycle-C are shown in the second column of the conjecture map (section7.2.2). The sub-components of embodiments consisting of *task structures*, *participant structures*, *discursive practices*, and *tools and materials* involved in cycle-C's design of the intervention course are discussed in more detail below.

The task structures for cycle-C's conjecture map were developed based on the DCs for cycle-C. The largest change in the task structures was due to the course redesign informed by DC-C1.

In relation to DC-C1, the course structure, content, and activities were redesigned to follow a flipped learning model as opposed to the previous asynchronous online approach from cycle-B. For flipped delivery, asynchronous learning content was selected based on its suitability for the online learning environment, and synchronous learning experiences were created based on the suitability of being delivered to a group of learners and supported by a facilitator, as shown in Figure 7.2. Both the asynchronous and synchronous learning contents were aligned with the course learning outcomes and assessments.

Figure 7.2: *Cycle-C – Flipped Course structure*



Participant structures for cycle-C's redesigned intervention course, related to DC-C8, informed a cohort-based approach for course delivery. As discussed in section 7.1.2, this meant that all participants started at the same time and shared the common goal of designing BL for their own courses. All participants had a common series of structured learning experiences in both asynchronous and synchronous learning environments.

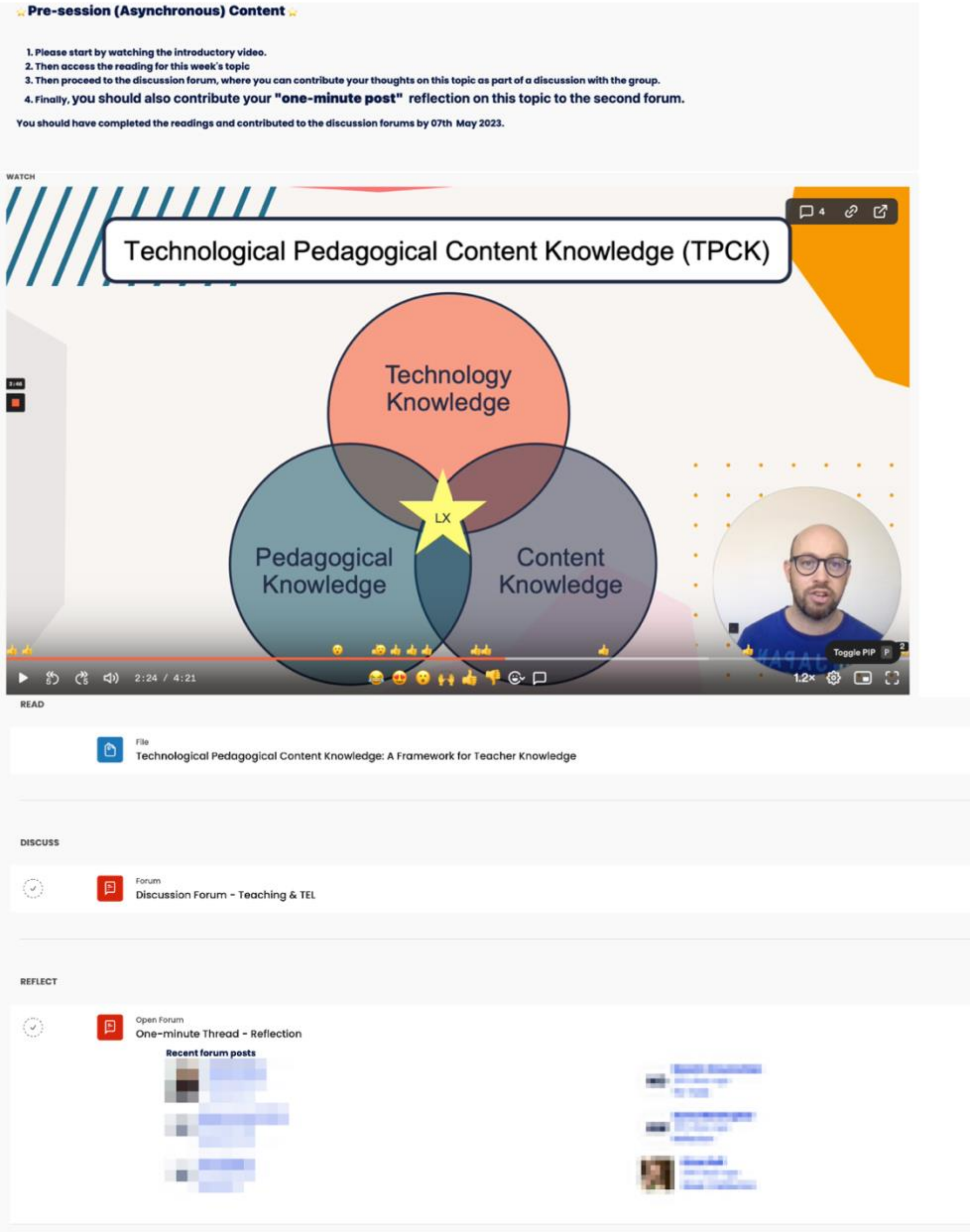
In a move to leverage the collaborative learning community, developed by DC-B4, and build on the supportive approach between peers that CBL affords (DC-C8), user-friendly technology tools were introduced to participants during synchronous (in-person) sessions, they were encouraged to experiment and then support each other's technological confidence and competence (DC-C7) by demonstrating and troubleshooting the tools together.

Discursive practices for cycle-C refer to the peer review and feedback element of the course, informed by the unchanged DC-A3 and DC-B4, which remained a vital component. However, the delivery tools have changed for the learning community, as discussed below.

Tools and materials selected for cycle-C's redesigned intervention course range from the *learning management system, online collaboration* tools, dedicated *portfolio* tools, and *online learning community* applications.

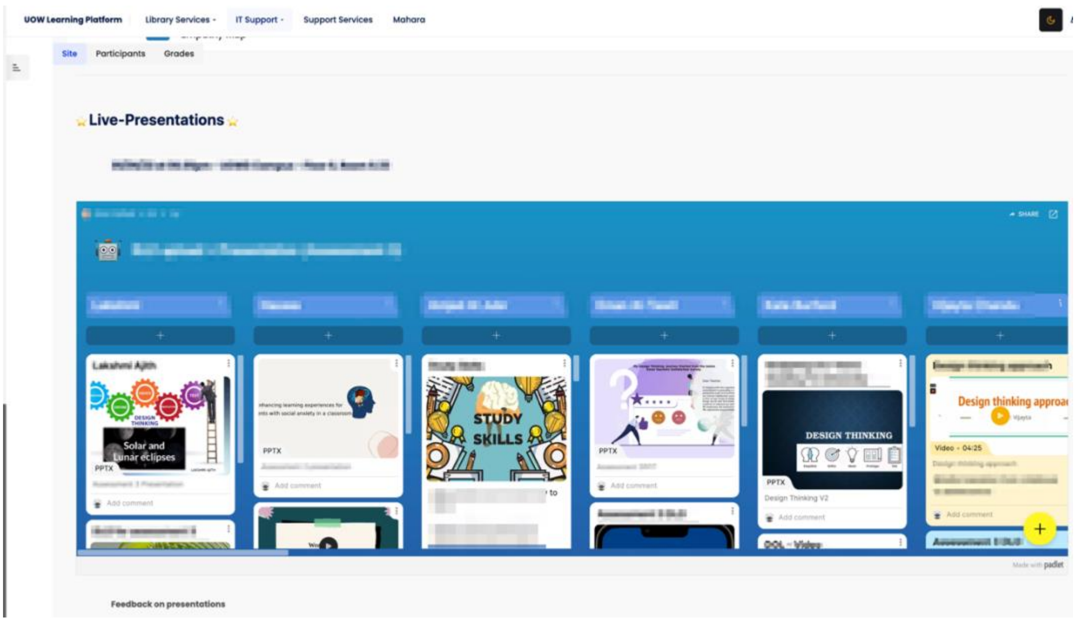
Due to the flipped learning and cohort-based approach, the *learning management system* decision was to move back to the institutions of Moodle LMS, as with cycle-A. The advantage of the Moodle LMS was that the PD course could directly model the approach to BL that participants aimed for in their own course designs. Figure 7.3 below shows a layout from the course that signposts the ‘pre-session’ flipped content in terms of watching a video, reading articles and contributing to discussion forums and reflection forums before attending the ‘in-person’ group session.

Figure 7.3: *Pre-session – Asynchronous section of Moodle site*



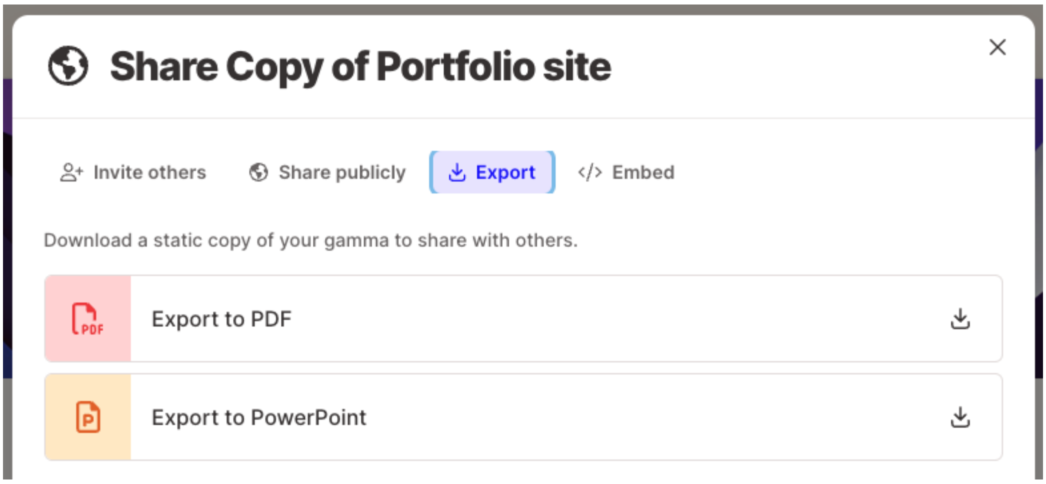
When considering *online collaboration* tools, despite the technical difficulties identified with Padlet and Google Jamboard, discussed in, section 6.4.5, the decision was to keep both tools for cycle-C. The rationale for this decision was that they remained the most appropriate tools for the tasks. Both tools are leading online collaboration tools in the education sector and benefit from substantial research and development on usability. In addition, one is free (Google Jamboard), and one has an institutional licence (Padlet), and therefore can be utilised by participants beyond the design intervention course. In addition, the tools were embedded seamlessly into the Moodle LMS, as shown in Figure 7.4, therefore, previous navigation issues, highlighted in cycle-B, will no longer be relevant. Finally, hands-on, in-person support for the tools will be available from both peers and the synchronous session facilitator throughout course delivery.

Figure 7.4: *Padlet embedded into the Moodle LMS*



In the previous cycle, the *portfolio* tool was Padlet, which was used to gather portfolio artefacts for sharing and final submission. However, the downside of this tool is that all content is open to being viewed and potentially edited by other participants. It was also less likely that participants would revisit and continue to develop their portfolios after finishing the course because they sat in the Padlet collection. Therefore, an alternative tool for the portfolio component was introduced in cycle-C. The free to use tool Gamma allows participants to build a portfolio consisting of several diverse types of digital artefacts. It also allows the creation of an easily sharable webpage, PDF document, or presentation file by clicking a button, as shown in Figure 7.5.

Figure 7.5: *Gamma portfolio sharing options*



The participants' *online learning community application* was also changed for cycle-C because of the different course delivery platforms being used. Therefore, formal collaboration activities were supported in the Moodle LMS, and for informal community building, participants were made aware of the WhatsApp group that they could join. Only their cohort peers had access to the group. I did not intervene in the space to avoid affecting the flow of communication. If questions emerged from the group, a nominated participant was identified to let me know, and then I would respond to the question during in-person sessions.

7.2.3.4 Mediating Processes

The mediating processes for cycle-C's design intervention are shown in the third column from the left in Figure 7.1. They consist of ‘observable interactions’ and ‘participant artefacts.

The observable interactions differed only slightly from those in cycle-B’s design. One difference is due to the change in delivery platform, as Thinkific (cycle-B) had more analytics for tracking completion, whereas Moodle has an access log that does not show the individual task details. A second change is that, as the delivery for cycle-C has an in-person session component, participants’ interaction and engagement can be more transparently observed.

The restructuring of the course led to an additional artefact for this cycle in the form of an extra ideation activity based on peer exploration of technology tools for UDL (DC-C7).

7.2.4 Summary of the Design Phase for Cycle-C

The design approach for cycle-C in this study is outlined, emphasising both a systematic and iterative design approach. First, in the refinement of design conjectures, which were informed by key considerations from the literature analysis phase.

Second, the redesigned conjecture map helped to visualise the key elements of the design of the intervention that had changed in this cycle. The four key elements of DCs, ILO, embodiment details, and mediating processes are discussed in this section.

The development of the conjecture map and subcomponents ensures that the design intervention is aligned to conjectures and theory and that each component is thoughtfully crafted to contribute to the overall learning outcomes. The design was then made actionable, allowing for the implementation of the redesigned intervention course, which is discussed in the following section.

7.3 Cycle-C: Implementation

The implementation phase moves beyond the development of the design intervention course by delivering it to the study participants. This section covers the deployment of cycle-C’s design intervention course, the facilitation and support provided, the monitoring of participants’ engagement in the course, and the development of the participant's portfolio of design artefacts.

7.3.1 Deployment of the Training Course

Cycle-C’s redesigned course was delivered over a 6-week period, each week aligned to a stage of the DT model (section 7.2.3.3), which required a cohort of participants to follow a sequential learning pathway, with each section building on the previous one.

The flipped learning design provided approximately 30-45 minutes of asynchronous learning content and activities to be completed per section per week before attending an in-person, synchronous, group workshop lasting between 60-90 minutes per-week.

As with previous designs, a project-based approach required participants to show their understanding of the course content through the completion of activities that would contribute to their design portfolio, documenting their design journey for blended learning course design and digital learning content creation.

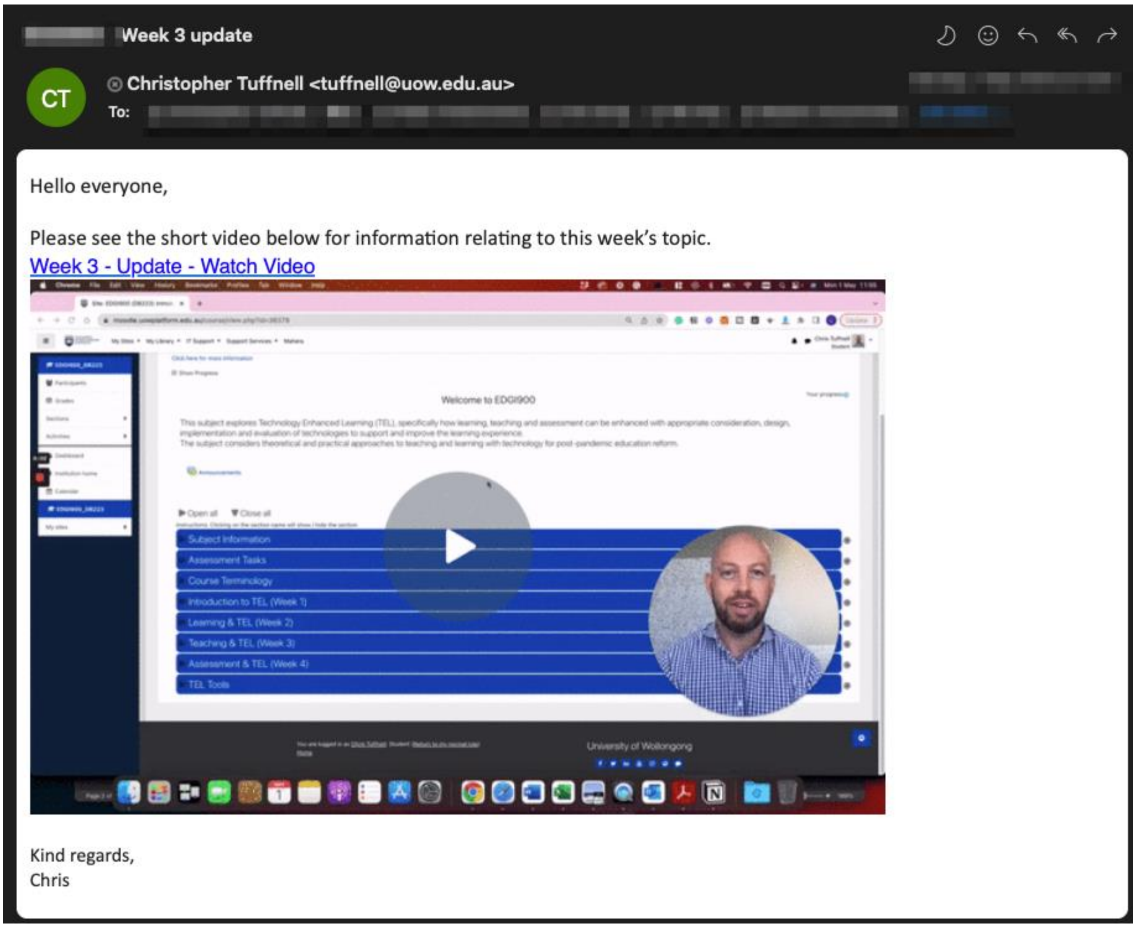
7.3.2 Facilitation and Support

As cycle-C's redesigned intervention course now had a large in-person component, I envisaged that more guidance and facilitation would occur during the synchronous sessions.

Following the same approach as in the previous cycle, an email was sent to the participants' 1-week before the scheduled first session. The email contained instructions on how to access the course in the LMS. Once in the LMS, the only section visible was 'section 0 - Introduction', containing asynchronous content that gave an overview of the course, terminology, and theoretical underpinning for the course. The first activity was also visible with instructional videos to guide participants through the task. The rationale for this links back to my pragmatic use of constructivist principles, I wanted to control the participants' access to content as to not overwhelm and provide only the information they needed for that week, also helping to manage their workload.

The following week and every week thereafter, participants were sent an email at the beginning of the week with text or a short video providing an overview for the coming week, including requirements of the pre-session content that needed to be completed before attending the in-person session (Figure 7.6).

Figure 7.6: *Weekly email reminder*



Once in the synchronous in-person sessions, facilitation and support were provided to both the group and individuals as required, following either a scaffolding model of trying to give just enough for learners to be able to do or understand themselves or rely on the CBL approach to draw upon the support and guidance of peers.

7.3.3 Monitoring Participant Engagement

As discussed in section 4.5, the recruitment process led to 16 educators agreeing to participate in cycle-C of the design intervention course. Each participant was assigned a code consisting of a P-C plus a sequential number to anonymises the data presentation.

Participants' engagement in the course was tracked by the completion of their portfolios. As shown in Table 7.3, the majority of participants (n=14/16) completed the entire course within the designated timeframe. The remaining (n=2/16) did not complete the course. Participants P-C12 and P-C14 were contacted multiple times throughout the course delivery and once following the course delivery without response.

Table 7.3: *Participant course completion - Cycle-C*

Activity	Participant															
	P-C1	P-C2	P-C3	P-C4	P-C5	P-C6	P-C7	P-C8	P-C9	P-C10	P-C11	P-C12	P-C13	P-C14	P-C15	P-C16
Educator Video	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
Discussion Forums	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Empathy mapping	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Define course aims and learning outcomes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
3-2-1 Evaluation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓

Ideate - COI	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
UDL Tech tools peer-support	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Create an e-portfolio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Prototype – visual learning designs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Prototype – instructional video	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓
Peer-presentation and feedback (VLD)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓

7.3.4 Participants' Portfolio development

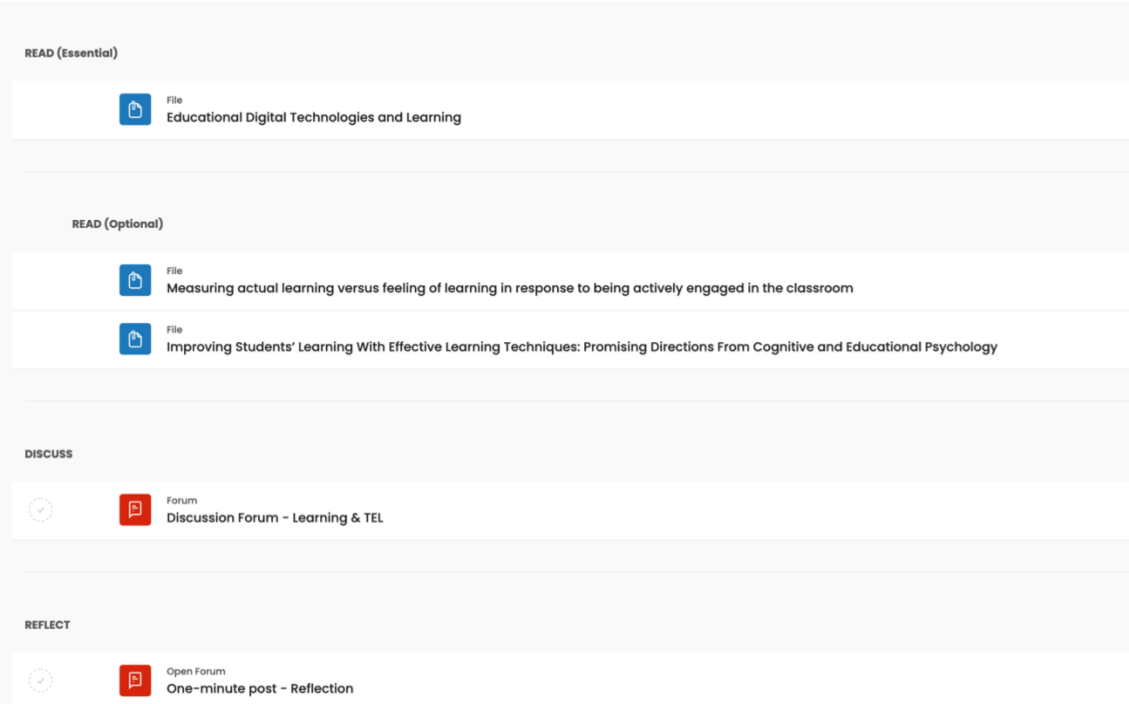
As with the previous cycle, design artefacts created during the course form a design portfolio, which provides evidence of participants' understanding of design decisions and achievement of learning outcomes.

The following provides a description of some course activities that have been redesigned for cycle-C, highlighting the relationship between TPACK and design conjectures, as shown in Figure 7.2.

7.3.4.1 Activity 2: Discussion Forums

Activity 2 took the form of six forum posts over a 3-week period with the aim of developing participants' PCK, as shown in Figure 7.7. At the beginning of each week (before the synchronous session), the participants were asked to read a selected article and contribute to the forum with an original post based on the reading, and guiding questions were offered. In addition, participants were asked to respond to at least one peer post to further their conversation (DC-B4). Following the synchronous session, the participants were asked to submit a reflection post based on the week's topic and experience (DC-A3).

Figure 7.7: *C-C Activity 2: Discussion Forum structure*



7.3.4.2 Activity 3: Empathy Map

The concept of empathy mapping remained from cycle-B and was linked directly to the DT approach to develop PK. The variance in the delivery of this activity for cycle-C was that the concept was explored in the group setting. Participants supported each other with an activity in the synchronous session before being asked to apply what they learned to their own context (DC-B4, DC-B5, and DC-C7).

Figure 7.8: *C-C Activity 3: Empathy map*

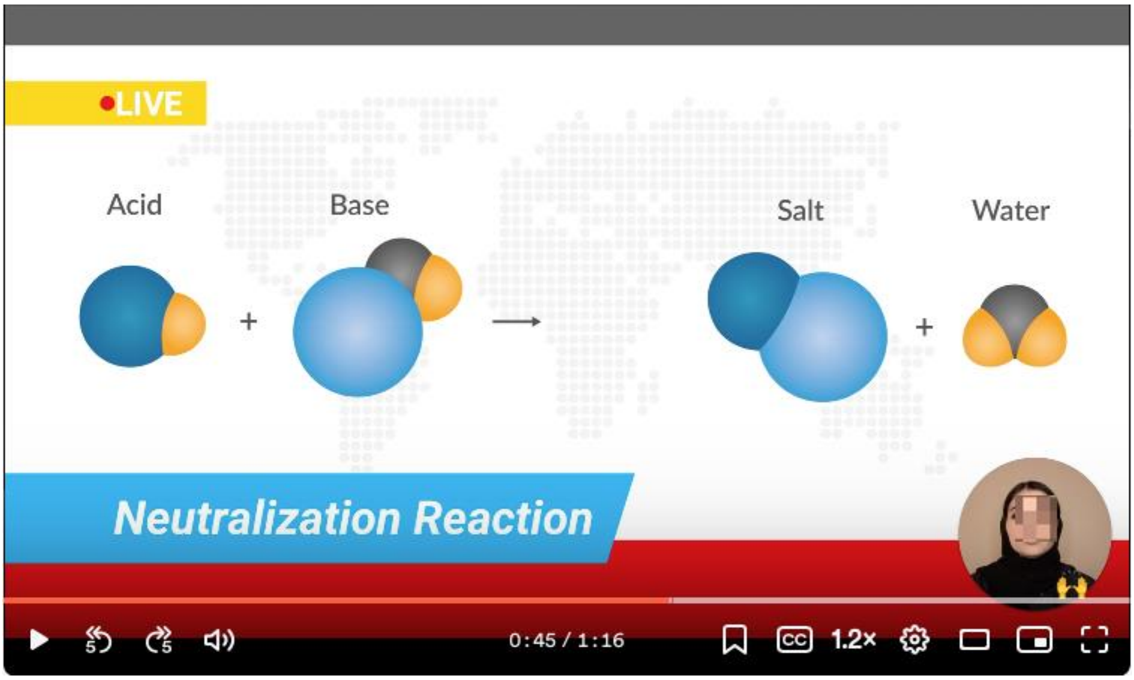
7.3.4.3 Activities 7, 8 and 9: Ideating Cognitive, Social and Teaching Presence

The purpose of these activities remained the same as that discussed in section 6.3.4.5, however, for cycle-C, they were first tackled in small groups during the synchronous sessions before the concept was applied to an individual's design portfolio.

7.3.4.4 Activity 13: Instructional Video Creation

The purpose of Activity 13 was the same as that discussed in section 6.3.4.7, as shown in Figure 7.9. However, for cycle-C, a wider variety of technology tools were available for participants to experiment with, supported by peers in the synchronous session time (DC-C7).

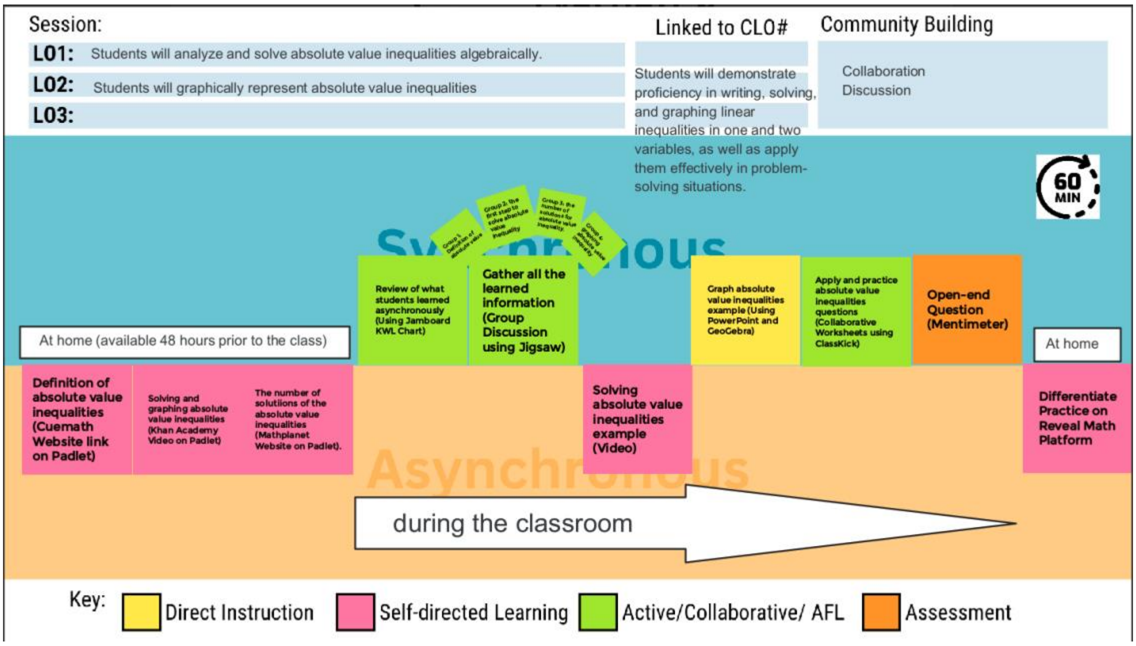
Figure 7.9: *C-C Activity 13: Instructional video*



7.3.4.5 Activity 14: Peer review presentations

Activity 14 was adapted into a pitch and presentation format that required participants to present their design portfolios and talk to the audience through design decisions such as their VLDs (see Figure 7.10). Peers were then able to ask questions and offer advice to develop their designs further. The activity had the dual aim of providing feedback to the peer being reviewed and prompting internal reflection for the reviewer on elements they could improve in their own portfolios (TPACK).

Figure 7.10: *C-C Activity 14: VLD slide from peer review presentations*



7.3.5 Summary of Implementation phase for Cycle-C

The implementation of the design intervention for cycle-C is outlined. The course was structured for flipped learning delivery and a cohort-based approach. Engagement was judged by portfolio completion, as learning artefacts created demonstrated participants' understanding of the content. The following evaluation section quantifies the success of cycle-C.

7.4 Cycle-C: Evaluation

Following the same format as sections 5.4 and 6.4, this evaluation phase of cycle-C was critical for understanding the efficacy of the design intervention, eliciting insights that inform future iterations, and extracting broader findings for the study's conclusive synthesis. This phase marks the culmination of cycle-C by discussing each of the DCs in turn, presenting a reflective analysis, based data collected following the design intervention course completion to identify substantiating aspects of the DC and identifying further considerations for future iterations. Based on reflective analysis, each DC will ultimately be fully validated, partially validated, or not validated.

7.4.1 DC-C1: A flipped learning course design will increase participant engagement

DC-C1 proposed that a flipped learning approach to a PD learning experience would increase participants' engagement. When evaluating this DC, I aimed to understand whether the model that integrates 'flexible' asynchronous (online) and 'collaborative' synchronous (in-person) learning environments led to the engagement of adult learners, particularly in a PD context.

The data that was most relevant for the evaluation of DC-C1 were data relating to the completion of portfolio artefacts and interview questions relating to their engagement in the course activities, and overall reflections on their experience in the course.

7.4.1.1 Substantiating the Design Conjecture

The course completion rate for cycle-C was 87.5% (n=14/16), as shown in section 7.3.3. This was a significant improvement, showing an increase of 45.5% in completion compared to cycle-B's fully asynchronous course. Attempts were made to contact the two incomplete participants to gain insight into their constraints, however, this was unsuccessful.

Of those who completed the course and agreed to be interviewed (n=14/14), feedback was largely supportive of the flipped learning structure of the course. Subjectively, participants shared their appreciation of the flexibility offered by the flipped approach:

> P-C5: "*Having control over when I accessed the pre-session content helped me to prepare for the workshops*"

This sentiment was echoed by an additional participant.

> P-C7: "*I liked watching the videos...I really enjoyed going back and having the opportunity to go through the contents again as well*"

These comments indicate the advantages of flexible asynchronous learning content in the course.

In addition to the advantages related to the structure of the course, the participants commented that the design of the asynchronous pre-session environment also helped foster a community.

> P-C5: "*I felt the [flipped] approach helped build a good community, even in the online discussion forums we got to know each other before attending the sessions on-campus*"

When exploring the synchronous workshop aspect of the flipped model, participants' showed support for the practical experience, one participant stated:

> P-C1: "*I liked the practical aspects of the workshops and appreciate we could do it as the pre-session content covered much of the theory*"

An additional participant added,

> P-C3 "*I found myself more involved during the campus workshops as I felt well prepared by the online pre-session material*"

This feedback highlights the advantage of the flipped approach in allowing participants to have a more engaging in-person experience once the fundamentals were covered in the pre-session content.

The evaluation of DC-C1 was validated. This is largely due to increased levels of completion and participants acknowledging the enhanced engagement afforded by the flipped learning model. The ability to engage flexibly in pre-session content during interactive sessions has been highlighted as a significant benefit.

7.4.1.2 Further considerations for the Design Conjecture

Despite widespread support for the flipped learning approach, some participants faced challenges that suggested areas for improvement. Pre-session preparation was the key challenge for some participants, as P-C2 pointed out:

> P-C2: "While I appreciate the flexibility, I sometimes felt overwhelmed with the pre-class workload."

Indicating time management or workload concerns. There also remains a technical challenge for some when engaging in the asynchronous online environment, participant P-C13 revealed:

> P-C13: "There was a technical learning curve to accessing the material which slightly hindered my initial engagement"

This was an interesting comment, as the course was delivered on the institutional LMS (Moodle) that participant P-C13 was required to use for his own teaching. Future iterations of this design intervention could focus on these enhancements to further strengthen participants' engagement in the flipped learning environment.

7.4.2 DC-C7: Providing coaching, and fostering a risk-taking attitude will increase technological confidence and competence

DC-C7 proposed that developing technological confidence will, in turn, increase educators' competence in utilising technology in their BL experiences.

The data that was most relevant for the evaluation of DC-C1 was participant' data relating to their portfolio artefacts and interview questions relating to their engagement in the course activities, and overall reflections on their experience in the course.

7.4.2.1 Substantiating the Design Conjecture

As shown in section Table 7.3, 87.5% of participants (n=14/16) completed TK- and TPK-related activities, as shown in Figure 7.2. Course activities included the introduction of various technology tools during synchronous workshops to allow participants to experiment in groups and support each other with their utilisation. This approach was acknowledged as useful by several participants, including P-C9, who stated that:

> P-C9: "*I think that learning the different tools is an interesting aspect of the course. I learned things I never knew existed but now I'll be using them with my students*"

In relation to this peer experimentation approach, an additional participant commented,

> P-C11: "*My fear of technology reduced as we helped each other figure it out. I'm more confident to try on my own now*"

In relation to confidence-building, P-C2 stated:

> P-C2: *As I grew more confident in using the new software, I found myself exploring more of its features with ease*"

The comments indicated that the collaborative approach to learning new technologies led to participants being more likely to continue with and further utilise technology in their teaching.

When exploring the digital learning content creation aspect of technological components, two of the portfolio activities required participants to create videos, the first of which was intended to be a confidence builder, using one tool to create an educator introduction video. The second activity aimed to provide additional approaches and tools to create educational videos. The participants' progression between the two activities was apparent, with one participant sharing her thoughts:

> P-C9: "*Firstly, I'm not someone who likes to speak to the camera, so it was very hard for me to make a video. But after practicing in the workshop and experimenting with different techniques I'm now happy that I can do it and will continue creating them for my students*"

Commenting on the practical applications of the workshops, one participant stated:

> P-C10: "*The hands-on practice sessions were crucial in building my technical skills*"

Therefore, the evaluation of DC-C7 was validated. The majority completion of technology-related activities, the subjective quality of digital artefacts, and positive feedback from participants indicate that confidence building is instrumental in enhancing educators' technological competence.

7.4.2.2 Further considerations for the Design Conjecture

Despite support for DC-C7, some challenges were noted, such as participant P-C13, who stated:

> P-C13: "*I find it challenging to keep up with the rapid pace of technological change*"

Along with participant P-C7 who stated: “There's so much to learn, and it can be overwhelming at times"

These comments indicate a need for sustained support and training to maintain and grow confidence, especially as technological landscapes evolve rapidly.

7.4.3 DC-C8: A Cohort-based Learning approach will increase participant engagement

DC-C8 proposed a CBL approach to PD, which groups learners to progress through a programme simultaneously, fostering increased engagement through shared experiences and peer support. This model is based on the understanding that collaborative learning environments can enhance motivation and commitment to course material.

The data that were most relevant for the evaluation of DC-C8 were participants' responses to interview questions relating to their engagement in the course activities and overall reflections on their experience in the course.

7.4.3.1 Substantiating the Design Conjecture

Attendance was not taken for the synchronous workshop sessions, as it is not an accurate metric for engagement, however, I did observe that each session was consistently attended by at least 12 of the participants. The cohorts' enthusiasm for activities and discussions was evident and led to high-quality design artefacts and portfolios. Subjectively, participants shared their appreciation of the cohort approach in relation to the synchronous workshops P-C2 shared:

"*Coming to the workshops sessions each week was fun and engaging, I looked forward to our group activities*"

In addition, P-C10 stated,

"*I really appreciated the support from my peers when working together in the workshops, specifically when experimenting with the tech tools*.

These participant statements indicated that the peer support provided during the workshop sessions was useful.

In relation to the asynchronous online component, the comments from participants highlighted that the cohort was supporting each other in this space with P-C5 commenting: "*… we got to know each other before attending the sessions on-campus*".

The cohort approach also helped participants experience a deeper understanding of P-C4:

"*I really enjoyed the discussions with colleagues in the forums and the workshops, they deepened my understanding of the concepts we covered*"

The evaluation of DC-C8 was validated. The feedback from the participants suggests that the CBL approach has successfully increased engagement by providing a supportive and collaborative learning environment. The shared journey appears to have fostered a productive space for discussion, reflection, and accountability.

7.4.3.2 Further considerations for the Design Conjecture

Despite positive reception, some participants identified challenges related to the pacing of the course, and one participant expressed:

> P-C8: "I felt the pressure of keeping pace with the cohort and the completion of the activities, which was sometimes stressful."

This highlights a time management challenge that can negatively affect engagement.

7.4.4 Summary of Evaluation phase for Cycle-C

This section provides an evaluation of DCs for cycle-C. It discussed the three DCs based on participants' engagement in a flipped, cohort-based approach, along with building technological confidence and competence in technology. Evaluation validation of the three DCs while recognising areas for improvement for future iterations.

The evaluation is distilled into a summary Table 7.4, to provide a visual overview of the validated conjectures.

Table 7.4: *Summary of Cycle-C: Evaluation of Design Conjectures*

TPACK Domain	Cycle C's DCs	Summary of the Evaluation for Cycle-C (Key: ☑= validated ☒= not/partially validated)
Content Knowledge	DC-C1 A flipped learning course design will increase participant engagement	☑ – *validated* Participants acknowledged the enhanced engagement afforded by the flipped learning model. The ability to engage flexibly in pre-session content during interactive sessions has been highlighted as a significant benefit. However further exploration of alternative modalities of delivery to assess levels of participation would be beneficial.
	DC-C8 A Cohort-based Learning approach will increase participant engagement	☑ – *validated* The feedback from the participants suggests that the cohort-based learning approach has successfully increased engagement by providing a supportive and collaborative learning environment. Although a future comparison between participants that select a cohort-based approach, or an individual self-directed approach would be valuable.
Technological Knowledge	DC-C7 Providing coaching, and fostering a risk-taking attitude will increase technological	☑ – *validated* The majority of participants completed technology related activities, along with the subjective quality of digital artefacts and positive feedback from participants, indicates that confidence-building is instrumental in enhancing educators' technological competence.

	confidence and competence	Further research is needed for continued exploration of confidence in relation to technological adoption and competence.

7.5 Cycle-C: Conclusion

Cycle-C was the final iteration for this DBR project exploring educator PD for BL design underpinned by the TPACK framework. The analysis section of this cycle explored the supporting literature for each of cycle-B's partially validated DCs to identify key considerations that would inform the refinement of the DCs for this cycle. The key considerations identified the use of a flipped learning model and cohort-based approach for increased participant engagement along with developing educators' technological confidence and components as the main considerations to inform the development of new DCs in the design section. The implementation section describes the delivery of a redesigned intervention course outlining participant engagement in a flipped learning and cohort-based environment. The concluding section of this cycle evaluated the new DCs based on data analysis to validate or identify which DCs need further development.

Chapter 8: Discussion

This research aims to contribute to the literature on educator PD for BL design. The contributions of the three cycles of DBR are identified and presented in this section. First, the cumulative knowledge of this study in the form of a learning design framework was presented (section 8.1). Then, the components of the learning design framework are discussed (section 8.2). Finally, the contributions of this study to the literature are identified and presented (section 8.3).

8.1 The Iterative Learning Experience Design Model

As discussed in section 4.1.1, DBR aims to advance our knowledge of the practical creation of transferable solutions to real-world educational settings (Brown,1992; Plomp, 2013). In relation, the Iterative Blended Learning Design (IBLD) model, as shown in Figure 8.1, named as such due to the emphasis on the iterative element of BL design, is a learning design framework to guide the PD of educators focused on BL design. The model is informed and underpinned by the DCs that were refined throughout the three cycles of development, as shown below in Table 8.1, with the final validated conjectures colour-coded green. While many of the validated conjectures are presented in the IBLD model (DC2, DC3, DC4, DC5, DC6, and DC7), DC1 and DC8 are not represented in the model due to them relating to how the PD is delivered rather than a design process to follow.

The complete IBLD model for this study is presented below (Figure 8.1), followed by a breakdown of its components (section 8.2). The sub-sections of the iterative structure (section 8.2.1), empathy (section 8.2.2), definition (section

8.2.3), and prototype (section 8.2.5) follow the same to describe what the component, why the findings led to its inclusion, how it relates to the literature, and what is important about the component. However, ideation (section 8.2.4) deviates from this structure slightly by elaborating further on the lens of the CoI and how it correlates with DCs, as this component requires more time and input for participants. Finally, the test component (section 8.2.6) is discussed.

Figure 8.1: *The IBLD Model*

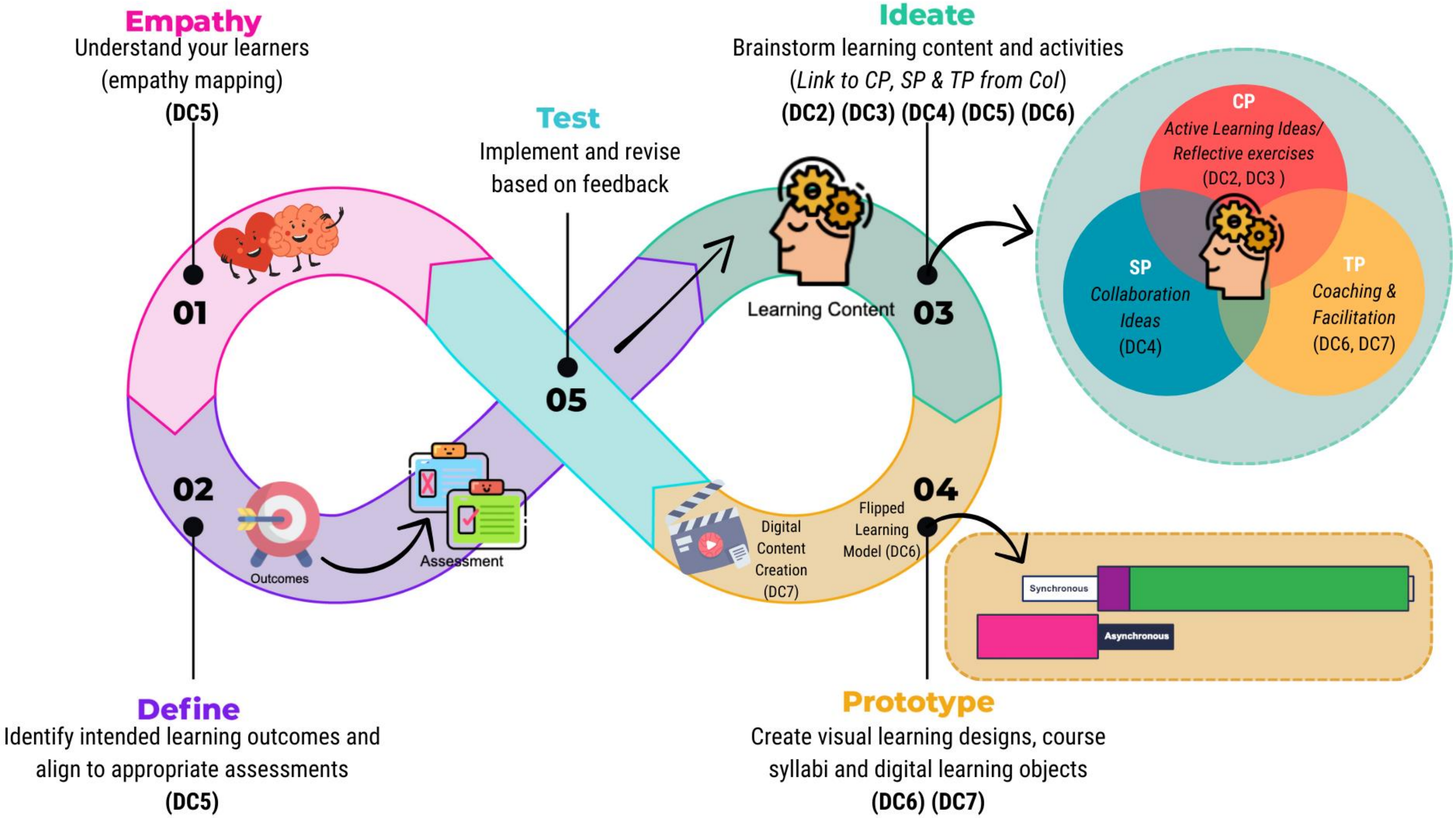


Table 8.1: *The Iterative Development of Design Conjectures*

TPACK Domain	DC	Cycle-A	Cycle-B	Cycle-C	Overview
Content Knowledge	DC1	DC-A1: A flexible, self-directed learning experience will increase participant engagement	DC-B1: An online, asynchronous PD learning experience will increase participant engagement	DC-C1: A flipped learning course design will increase participant engagement	The evolution of DC1 across three cycles reflects a progressive refinement of the course design based on empirical data and theoretical insights, moving from a self-directed approach to a fully flexible online more before settling on a structured flipped learning approach.
	DC2	DC-A2: Integration of content and activities to provide real-world relevance will increase engagement.	DC-B2: Integration of active blended learning strategies will develop participants' PK		The evolution of DC2 across two cycles illustrates an ongoing refinement of approaches to enhance engagement and PK in educators.

	DC3	DC-A3: Incorporation of reflective exercises will deepen participants' learning comprehension.			DC3 was one of the few DCs that was validated from the first cycle and remained a key component for the design intervention for the following two iterations.
	DC4	DC-A4: Providing collaborative opportunities will foster a faculty learning community	DC-B4: Providing intentional collaborative opportunities will foster a faculty learning community		The evolution of DC2 across two cycles emphasised the shift from relying on organically occurring collaboration opportunities to intentionality incorporating collaborative opportunities to foster an FLC.
	DC8			DC-C8: A CBL approach will increase participant engagement	DC8 was the only conjecture to be newly introduced for cycle-C. While elements of cohort existed in previous cycles, explicitly identifying the approach to build into the course design proved beneficial for participant engagement.

Pedagogical Knowledge	DC5	DC-A5: Learning design approaches will help guide intentional BL design for participants’	DC-B5: Learner-centred design approaches will help guide intentional blended learning design for educators’		The evolution of DC5 across two cycles explored various models to guide intentional learning design for participants. Backward Design and COI was introduced in cycle-A with further refinement in the for of the Design Thinking framework being added in cycle-B for a comprehensive learner-centred learning design approach for BL.
	DC6	DC-A6: The flipped learning model will support educators’ learning design decisions.			In addition to the learning design approaches from DC5, this conjecture provided participants with an articulation of the flipped learning model to follow, to guide their blended learning designs. This was validated in cycle-A and continued to be part of the design intervention for the following cycles.

Technological Knowledge	DC7	DC-A7: The considered utilisation of technology will develop participants' technological experience and competence.	DC-B7: Educators technological knowledge can be developed through intentional, evidence-based PD.	DC-C7: Providing coaching, and fostering a risk-taking attitude will increase technological confidence and competence	The evolution of D7 across three cycles evolved from focusing on the utilisation of technology to enhance participants' TK, to the development of educators' TK through intentional, evidence-based professional development, and finally improving educators' technological competence for TK and TPK by building their confidence with technology.

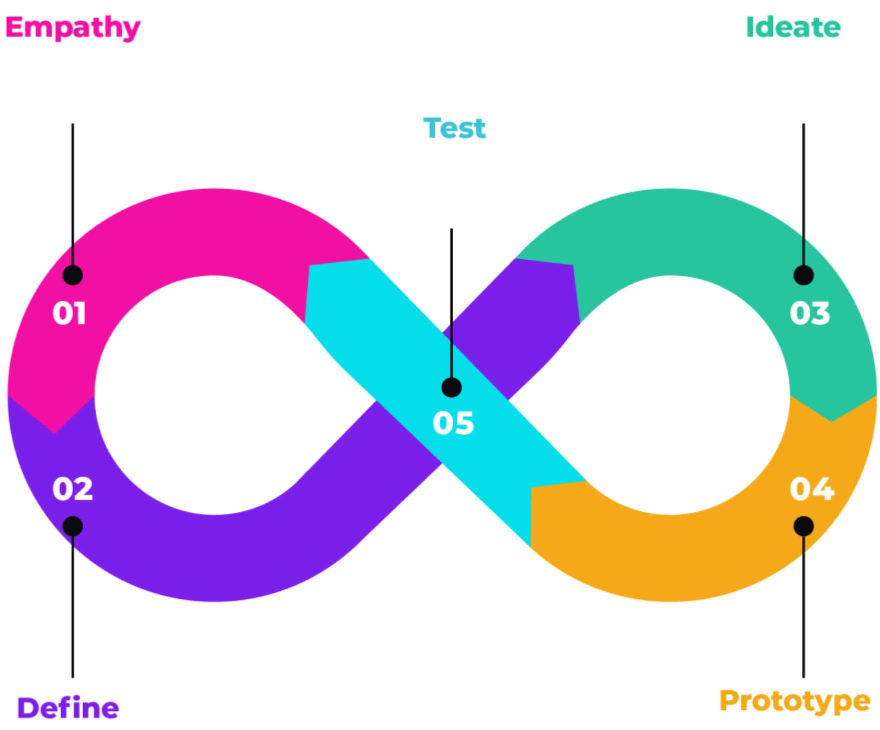
8.2 Components of the IBLD model

The following discussion presents the components of the IBLD model and discusses their value for research in the area of educator PD design for BL design. First, I discuss the overall iterative structure and its importance before describing each key component of *empathising, defining, ideating, prototyping, testing,* and their value.

8.2.1 The iterative structure

The overarching structure of the IBLD model is an iterative infinite loop, as shown in Figure 8.2. An iterative approach to learning design was identified as a key factor in guiding intentional BL design.

Figure 8.2: *The infinity loop component*



Iteration is a crucial component of the model that arose from existing literature advocating for iterative processes to redefine educational experiences (section 6.1.5.2). In addition to literature stating that an iterative approach to learning design coincides with the need for a shift in the educator mindset to embrace designing learning experiences as a part of the educator's role (section 5.1.1.2). The study's use of an iterative approach was validated in findings related to cycle-B's evaluation of DC5 (section 6.4.4.1), from which participants identified that the iterative structure of the course provided them with a "clear pathway" and that not aiming for perfection in the first iteration was "liberating" and led to increased confidence in learning design for BL.

The uniqueness of this study's iterative structure for the IBLD model comes from its combination with the DT stages of *Empathise, Define, Ideate, Prototype,* and *Test*, as discussed in the following sections, providing an evidence-informed approach to guide PD for BL design.

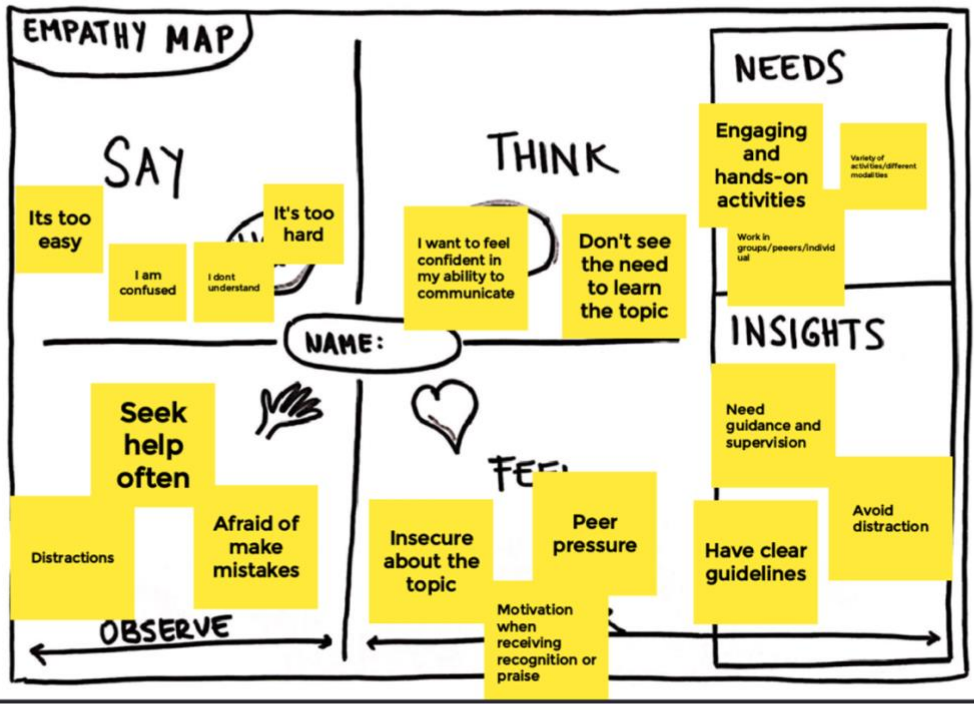
8.2.2 Empathy component

The *empathy* component of the IBLD model involves the utilisation of need-finding activities, such as observation and/or interviewing of learners, to identify learner needs that will impact and inform the BL design. The inclusion of the empathy section in the IBLD model followed cycle-A's evaluation (section 5.4.5.2), from which participants felt that deliberate consideration for learners was missing from the learning design approach.

Therefore, based on the analysis of literature that highlighted the importance of placing the student at the heart of the educational process (section 6.1.5.2), learner consultation was included in the empathy stage for cycle-B of the design intervention. This study employed the empathy mapping approach for learner consultation (see Figure 8.3), requiring participants to observe and interview learners, documenting key insights that could be used to develop personas or inform later components of the IBLD model. Participants acknowledged the advantages of this inclusion in cycle-B’s evaluation of DC5 (section 6.4.4.1), for enabling learners to be “*involved in the design process*" and helping to *“…create a deeper understanding of* [their] *needs and experiences*.”

While the execution of learner consultation in the empathy component of the IBLD may take various forms of observation and/or interviewing techniques to gain insights into learner requirements, its inclusion is unique in ensuring a learner-centred approach to BL design that potentially uncovers unknown needs that are considered throughout the design process.

Figure 8.3: *Empathy map example*

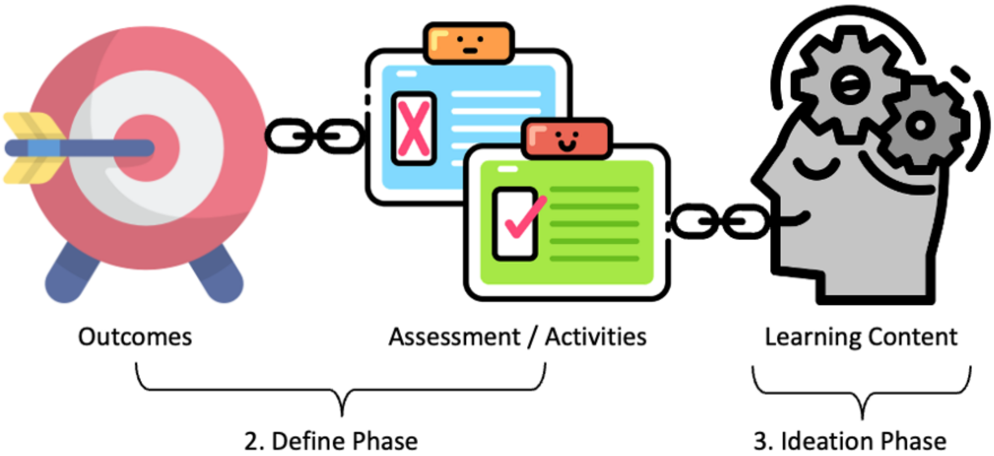


8.2.3 Define component

The *defining component of the IBLD model deliberately defines* the intended learning outcomes and appropriate assessments as part of a constructively aligned, outcomes-focused approach to learning design to increase the quality of BL design and learning experience (see Figure 8.4).

This component of the IBLD model follows two of the three stages of Wiggins and McTighe's (2005) backward design approach, selected based on the literature (section 5.1.2.2), which states that the intentional approach is beneficial for educators less versed in learning design. The third stage of the backward design approach is covered in the ideate component of the model (8.2.4) to ensure a constructively aligned learning experience that is relevant, focused, and privileged learning over teaching.

Figure 8.4: *Define component of backward design model*



Participants in cycle-A highlighted the benefit of following backward design to map out learning outcomes based on a taxonomy and link to appropriate assessments before thinking about content, they identified the approach as instrumental in making design components more tangible and intentional (5.4.5.1).

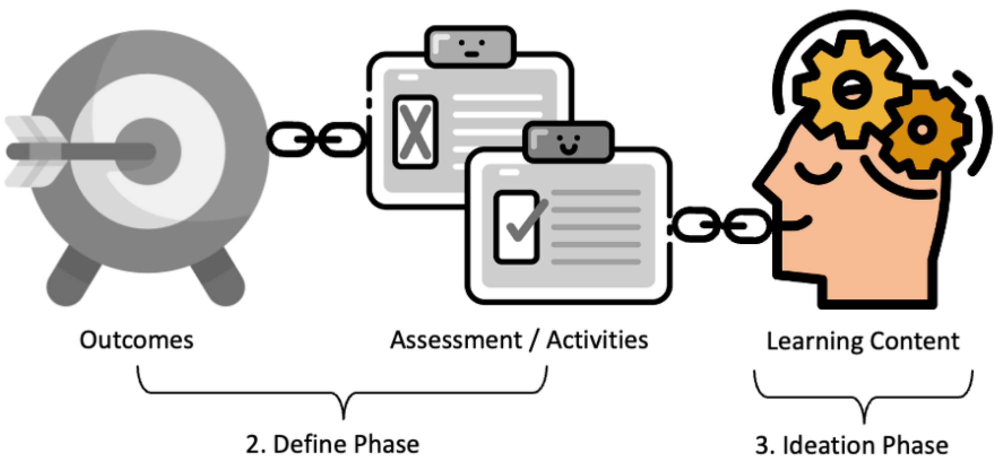
Defining course learning outcomes and appropriate assessments may take several iterations to ensure alignment before moving to the next stage of the *Ideate* to identify appropriate learning content and activities that support the learner to succeed in the assessments and, in turn, achieve the outcomes.

This component is a crucial part of the IBLD model for making design decisions based on course learning outcomes, rather than content, allowing for the consideration of appropriate modalities for achieving said outcomes.

8.2.4 Ideate component

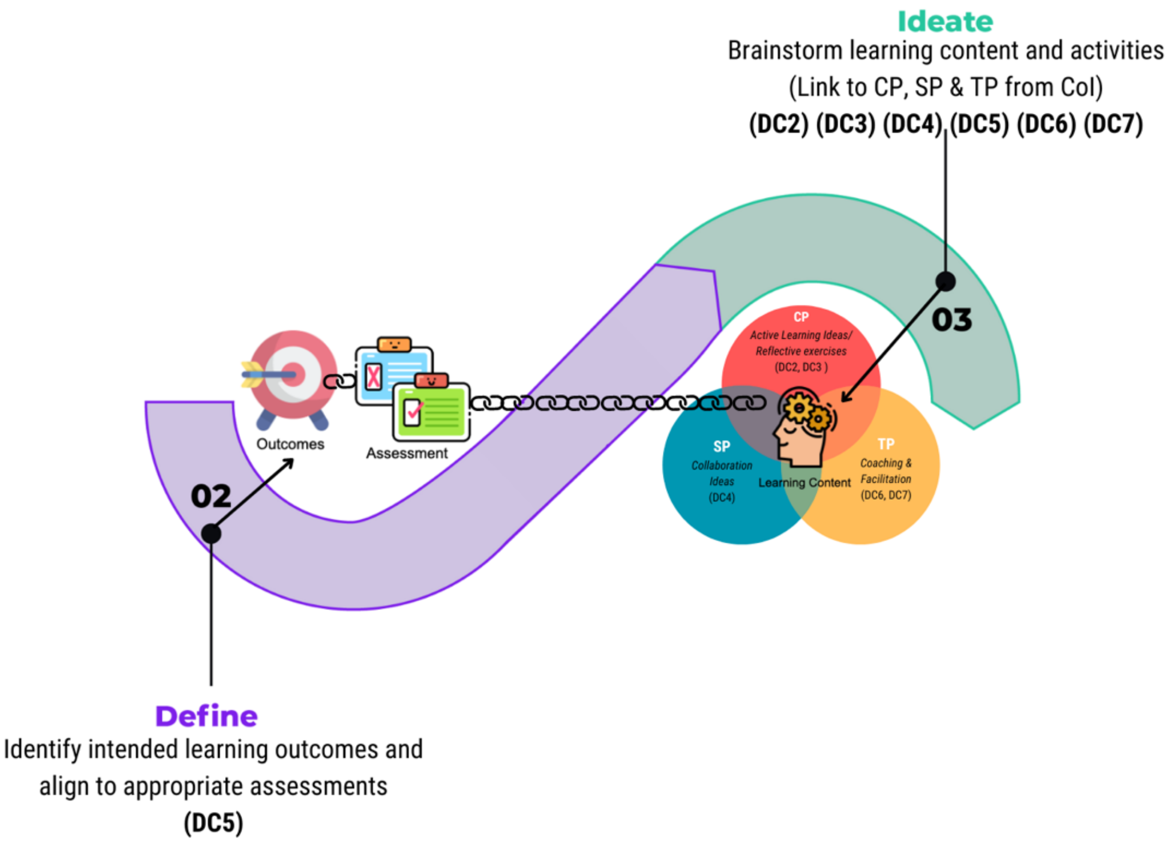
The *ideate* component of the IBLD model focuses on brainstorming ideas in relation to the third element of the backward design approach, learning content, and activities (Figure 8.5) and in relation to the CoI elements of CP, TP, and SP. The literature (section 5.1.2.1) supports the use of CoI as a robust learning design framework for consideration of sustained reflection and discourse, and to establish a supportive community to enhance the achievement of learning outcomes

Figure 8.5: Ideate component of backward design model



Therefore, the CoI framework was introduced in this model to focus on participants' ideation and brainstorming in relation to specific aspects of the learning content. The learning content related to the CP domain of the CoI framework focuses on ideas for active learning activities and reflective exercises for course design. Learning content related to the CoI's SP domain focuses on collaborative ideas for BL course design. Learning content related to the CoI's TP domain focuses on ideas relating to what coaching and facilitation could be needed in the BL course design (Figure 8.6).

Figure 8.6: *Define and Ideation components of IBLD*



In relation to the utilisation of the CoI framework to guide these design decisions, the evaluation of cycle-A's DC-A5 (5.4.5) states that participants identified the benefits of *"Mapping out … different* [CoI] *presences"* to *"make more deliberate and thoughtful design decisions".*

In relation to the CP domain's ideation of active blended learning strategies and reflective exercises, the evaluation of cycle-B's DC-B2 (section 6.4.2) highlighted the importance of balancing the integration active BL strategies. Supporting literature (section 6.1.2.2) has discussed that the inclusion of active learning can reduce failure rates and increase performance in assessments, improve problem-solving and critical thinking skills, and increase engagement and learner satisfaction. The effectiveness of active learning in BL design is contingent upon the thoughtful integration and synthesis of these strategies in synchronous and asynchronous learning environments.

In addition, literature highlighting the significant role of reflection in the mental organisation and integration of new information for the CP domain was identified (section 5.1.1.1), and cycle-A's evaluation of DC-A3 (section 5.4.3) highlighted the importance of reflection in the learning design process to refine the BL design.

In relation to the SP domain's ideation of collaborative activities, literature (section 6.1.4.2) encourages learning from diverse colleagues, reflection, self-efficacy, and the formation of connections with like-minded individuals. Cycle-B's evaluation of DC-B4 (section 6.4.3) highlights the value of collaborative activities for learning with and from each other.

Finally, in relation to the TP domain's ideation of coaching and facilitation, the literature (section 5.1.3.2) discusses the challenge of supporting a balance of content delivery, activities, and learning materials across both learning environments. Cycle-A's evaluation of DC-A6 (section 5.4.6) highlights the need to consider the facilitation of asynchronous and synchronous aspects of flipped learning.

In addition, the literature (section 7.1.3.2) highlights the critical role of building confidence in using digital technology, linking greater confidence with increased proficiency in technological usage. Cycle-C's evaluation of DC-C7 (section 7.4.2) highlights the need for coaching and confidence building, specifically with the use of any technology.

This comprehensive integration of CoI as an ideation lens to brainstorm identified design considerations for the learning content component of the backward design approach, which is a unique interpretation of BL design.

8.2.5 Prototype component

The *prototype* component of the IBLD model promotes the rapid creation of tangible aspects of BL design, such as VLDs (DC6) and creation of digital learning content (DC7).

Literature from section 5.1.2.1, supports a structured (template) approach to learning design to encapsulate the required key design elements. In addition, it was suggested that scaffolding learning content can incite reflection and deeper cognitive processing, thereby facilitating the improved achievement of learning outcomes, a BL design in this case. The evaluation of cycle-A's DC-A6 (section 5.4.6) identified that the use of VLD templates proved to be significant for guiding participants' learning designs and helping to translate the flipped model from theory into practice more concretely.

The evaluation of cycle-C's DC-C7 (section 7.4.2) raised the challenge of creating digital learning content, while highlighting the benefits of instructional support, peer teaching, and hands-on practice to build confidence in using technology for digital learning content creation. This study emphasises the importance of technological training in both synchronous and asynchronous teaching environments. Individual coaching and hands-on learning have been highlighted as significant for enhancing educators' confidence in using educational technology.

While the concept of scaffolding with templates and coaching educators' technological confidence is in line with existing research, as with other components of the IBLD model, the unique aspect is the combination of these evidence-based approaches into one learning design model for BL design.

8.2.6 Test component

The *test* component of the IBLD model provides an opportunity to implement the prototype (VDL and digital learning content) with the target audience in a real-world teaching session and obtain feedback to improve the next iteration.

The Test component of this model has two approaches. First, VDLs are tested by sourcing feedback from learners, peers, or pedagogical experts to gain feedback and allow for revisions before delivery. Second, the test phase culminates in the delivery of the BL sessions, with learner feedback sought at key points in the delivery and not just at the end. This feedback can be used to link back to the empathy component, as learners are proving insight that will inform refinement of the next iteration of the course.

8.3 Contributions to research knowledge

In this section, I discuss the study's contribution to the two areas of literature reviewed in Chapter 2, namely Designing Educator PD (section 2.3) with contributions discussed below in section 8.3.1 and Designing BL (section 2.4) with contributions discussed below in section 8.3.2.

8.3.1 Area 1: Designing Educator Professional Development

This first area contributes to the literature on Designing Educator PD (section 2.3), highlighting the study's findings related to PD modality for educator engagement (section 8.3.1.1) and the centrality of learning design (section 8.3.1.2).

8.3.1.1 PD modality for educator engagement

This study's contribution to the literature on *designing educator professional development* is **to highlight the importance of the PD modality in engaging participants.**

Modality refers to the method by which PD is delivered, determining design decisions related to participant engagement with content, instructors, fellow participants, and learning experience.

The literature on the changing role of the educator, reviewed in Chapter 2, discussed reasons for educators' lack of engagement in PD (section 2.3.1), ranging from previous teacher training, an intuitive rather than evidence-based approach to teaching, concerns related to reduction in the educators' role, time constraints, capabilities with digital tools, and workload issues including additional preparation time, technological understanding, and confidence.

Therefore, cycle-A's analysed literature (section 5.1) explored how to mitigate potential barriers to PD engagement with suggestions identified (section 5.1.1.1) relating to the provision of flexibility in how, when, and where participants' accessed PD, empowering them with better control over their time, and aiding in balancing study with personal and professional commitments. This flexibility, in turn, has been said to enhance learners' interest and motivation, and trigger more active cognitive processing. The resulting conjecture (DC-A1) aimed to combine these elements and led to the design of a flexible, self-directed learning modality. However, low engagement and completion, along with participant feedback that identified time constraints and workload, led to refinement of the modality for cycle-B.

The analysis of the literature in cycle-B (section 6.1) identified the benefits of a fully asynchronous (online) PD modality to accommodate educators' busy schedules (section 6.1.1). Therefore, DC-B1 resulted in an online asynchronous PD learning experience for participant engagement. However, this modality achieved a 27% drop in course completion compared to the previous implementation in cycle-A. While there was some support for the flexibility of the modality, participants highlighted that without in-person facilitation, they felt confused with expectations and had technical issues around navigation and video playback.

Cycle-C further explored modality options through analysing the literature (section 7.1), identifying the benefits of a blended approach, specifically flipped educator PD, to facilitate deeper reflection, collaboration, and interactive learning experiences (section 7.1.1). This results in DC-C1: *A flipped learning* *course design* increases participant engagement. In addition to DC-C1, cycle-C also explored cohort-based learning as an additional consideration to increase participant engagement and enhance educational outcomes (section 7.1.2). Several authors have highlighted the advantage of a cohort approach for participants' engagement by enhancing community spirit and fostering a sense of belonging and mutual support, while offering flexibility and support. Resulting in DC-C8: *A CBL approach* increases participant engagement.

The combination of DC-C1 and DC-C8 resulted in a course completion rate of 87.5%. Participant feedback was largely supportive of flipped learning and the cohort-based modality of the course. Participants highlighted the advantages of covering theory before sessions, in addition to the ability to revisit the asynchronous content, which led to greater involvement during the on-campus sessions. However, the approach was not without challenges as participants continued to indicate that workload was a concern and there also remained technical challenges for some when engaging in the asynchronous online environment

Therefore, this contribution to the literature relating to the lack of engagement in PD and the overarching theme of the changing role of the educator (section 2.3.1) **highlights the importance of the PD modality in engaging participants.** Based on this study's findings, a flipped learning and cohort-based modality has been identified to increase participants' PD engagement for researchers involved in the field of *professional development,* exploring how to effectively engage participants.

8.3.1.2 The centrality of learning design

This study's contribution to the literature on *designing educator PD* is **to emphasise the centrality of learning design in supporting educators' transition to designers of learning experience**.

The literature on Learning design as a priority skill for educator PD (section 2.3.2) identified that due to the increase in innovative educational approaches such as BL, educators need to fundamentally rethink their practice. It is suggested that repositioning away from traditional approaches of knowledge conveyance embraces the role of designing learning experiences. However, several authors have identified a deficit in educators' practical learning design skills along with a lack of consensus on how PD can support educators' repositioning.

In relation to this, the literature from section (section 2.3.3) proposes that learning design frameworks are pivotal in directing participants' design decisions, ensuring consistency and sustainability in design outcomes, and that the structured approach inherent in learning design encapsulates the theoretical foundations required for effective pedagogical progression. However, several frameworks have been discussed with limitations, such as a lack of learner-centredness and lack of theoretical grounding.

Therefore, this study aligns with the discourse that educator PD containing learning design frameworks can play a supportive role in a mindset shift towards learning design. However, an explicit framework was provided to address the lack of clarity in the current literature. The IBLD framework, based on the findings of this study, can inform researchers involved in the design of educator PD, relating to participants developing to be designers of learning experiences. The framework consisted of four validated design conjectures.

1. Iterative design approach (DC-B5)
2. *Integration of active learning strategies* (DC-B2)
3. *Incorporation of reflective exercises* (DC-A3)
4. *Provision of intentional collaborative opportunities* (DC-B4)

The *iterative design approach* is a key component of the IBLD model, as discussed in section 8.2.1. Based on the supporting literature (section 6.1.5.2), calling for incremental steps to iteratively refine, advance, and improve through cycles of learning design, the iterative component highlights the importance of a small, continuous focus on improvement and was validated with DC-B5 in cycle-B. However, the iterative approach alone does not provide robust guidance for developing educators' learning design.

Therefore, the *Integration of active learning strategies* validated in cycle-B and DC-B2 was also included. Related literature (section 6.1.2.2) recognised that active learning strategies are a critical factor in enhancing educational outcomes and should therefore be included in the design of PD to develop educators' learning design approaches. Evaluation of the design intervention highlighted participants' comments on the benefits of active learning activities, showing them what was possible in their own learning designs and allowing them to interact with peers, both in-person and in the asynchronous environment.

The *Incorporation of reflective exercises* validated in cycle-A, DC-A3, identifies that reflection activities provide insight into teaching practice and help participants to consider what works and to adjust and improve learning designs. This key aspect draws on the literature (section 5.1.1.1) that highlighted the benefit of reflection for the organisation and integration of new information and for deeper cognitive processing.

The final component of this framework is the *provision of intentional collaborative opportunities* validated in cycle-B, DC-B4. This concept has been identified as advantageous in the literature (section 6.1.4.2). Influential frameworks in the realm of PD support participants' engagement in scholarship and reflection and improve educational outcomes. The evaluation of the design intervention highlighted participants' appreciation of collaboration in relation to their learning design approach, the benefit of being able to discuss with each other, and in-person and online forums to clarify and refine their understanding. In addition, participants highlighted the advantage of being able to "see what others are doing" and reflect on and improve their own learning designs.

While the existing literature supports the individual components of the IBLD model, the combination of these components into a cohesive learning design framework for PD design provides a unique approach.

Therefore, this contribution to the literature on learning design as a priority skill for educator PD **emphasises the centrality of learning design** by proposing a learning design framework consisting of four validated conjectures to inform future researchers in the field of *designing professional development* for educators' transition to designers of learning experiences.

8.3.2 Area 2: Designing blended learning

This second area contributes to the literature on designing BL (section 2.4), highlighting the study's findings related to clarifying the BL approach (section 8.3.2.1), a learner-centred approach to BL (section 8.3.2.2) and a learning design model for BL design (section 8.3.2.3).

8.3.2.1 Clarifying the BL approach

This study's contribution to the literature on *designing blended learning* emphasises **the importance of a clearly articulated BL approach.**

The literature related to pedagogical considerations for BL design (section 2.4.1) identified that educators should have a pedagogically correct understanding of the concept of BL to engage and perform in the BL design process. Additionally, it is challenging to strike the right balance in content delivery, activities, and learning materials across learning environments.

Therefore, related literature for cycle-A's design intervention (section 5.1.2.2) identified that while there are various BL models, the "flipped learning" model has been particularly useful for its flexibility and structured approach when integrating asynchronous (online) and synchronous (in-person) learning environments and providing a clear framework for educators' understanding of BL.

Cycle-A's design intervention presented a well-articulated flipped learning model to guide the participants' BL design. In addition, a VLD template was provided to allow participants to plot and sequence the elements of their flipped learning designs. In evaluating this approach, participants highlighted how misconceptions of flipped learning were alleviated following the learning content in the course which subsequently improved their ability to apply the model effectively in their designs. With the aid of the VLD template, participants felt supported in transferring theory into practice more concretely.

Therefore, this contribution to the literature on blended learning design **emphasises the importance of a clearly articulated BL approach**. The flipped learning model, along with the inclusion of a template to guide the participants' design process, can inform future researchers on effective BL design strategies.

8.3.2.2 A learner-centred approach to blended learning design

This study's contribution to the literature on *designing blended learning* also **highlights the importance of a *learner-centred approach to BL design.***

The literature on pedagogical considerations for BL design (section 2.4.1) suggests that, due to the complexity of BL design, emphasis should be placed on pedagogical approaches. Several suggestions as to what these approaches could be range from theoretical to tangible, such as integrating learning theories, curriculum design models, knowledge acquisition, active participation, reflection, and course materials and learning platforms. However, during the evaluation of DC-A5 (section 5.4.5), which proposed evidence-based learning design approaches such as backward design and the CoI framework to help guide intentional blended learning design for participants, the deficit of the learner's involvement in the BL design process was highlighted.

Therefore, when refining this conjecture for cycle-B (DC-B5), an analysis of the literature (section 6.1.5) highlighted the importance of learner-centred approaches when developing educational solutions, such as BL, centred on student experiences and needs. In addition, the literature discusses how educators could consider their students' needs, feelings, and challenges in their learning designs by adopting a human-centred pedagogy. However, it was not specifically evident what these approaches would look like in the BL design process.

Further analysis of the literature (section 6.1.5.2) identified a potential use for design thinking methodology, generally applied to innovative problem solving, as a BL design approach that could foster learner-centred consideration. Specifically, the 'empathy' component of the design thinking approach was integrated into cycle-B's design intervention to engage with learners, by employing ethnographic methods like observation and interviewing to identify learner needs and consider them during the BL design.

Evaluation of this approach (section 6.4.4) was positive, and participants acknowledged the advantages of this component in allowing learners to be "*involved in the design process*" and helping to *"…create a deeper understanding of* [their] *needs and experiences*". Therefore, the contribution to the literature on *designing BL* **highlights the importance of a *learner-centred***

approach to BL design by including learner consideration, specifically in the form of an empathy component in the BL design process, which offers unique insight for further exploration for future researchers.

8.3.2.3 A learning design model for BL design

A final contribution to the literature on *designing blended learning* is **to highlight the benefit of an iterative learning design model** to guide research in the BL design field.

The literature on designing BL (section 2.4) highlights the need for an understanding of both pedagogical and technological elements. However, tensions have been identified regarding the prioritisation of each element in the BL design.

The literature supporting pedagogy prioritisation (section 2.4.1) identifies frameworks as options to help novice learning designers navigate the BL course design. However, there remains a lack of clearly articulated pedagogical models to guide BL course design, and scholars have criticised current BL models as impersonal, sequential, and disconnected elements.

Alternatively, literature supporting technological prioritisation (section 2.4.2) identifies the need for the development of educators' digital competence to best serve learners and leverage affordance of flexibility, time conservation, learner control over pace and content, analytics, collaboration, and communication opportunities. In addition, the literature highlights that there is a deficit of research pertaining to BL design, and little is known about the best way to design an effective BL. In line with that assertion, this study also highlighted the lack of learner-centred approaches to BL design (section 6.4.2.2).

To address the vagueness of BL design in the literature, this study identified a learning design model (IBLD) that encapsulates a balanced consideration of pedagogical and technological elements to guide BL design. The model is based on conjectures that have been refined and validated over three cycles of iterative development, culminating in a learning design approach to guide educators in the BL design.

The IBLD model was previously presented in section 8.2 and consists of six components, an *iterative structure* (section 8.2.1), *empathy component* (section 8.2.2), *define component* (section 8.2.3), *ideate component* (section 8.2.4), *prototype component* (section 8.2.5) and *test component* (section 8.2.6). The uniqueness of this *structured learning design model to guide the BL design* contribution lies in the IBLD model's integration of key elements, such as an iterative approach that prioritises learner-centred design and combines evidence-based learning design frameworks refined over three cycles of iterative refinement.

Therefore, this contribution to the literature on *designing BL* sets a future research agenda in relation to **iterative BL design** in various contexts to further validate or improve the model while adding to the literature.

Chapter 9: Conclusion

This concluding chapter begins by outlining the research objective (section 9.1) before summarising the study's contributions to new research knowledge (section 9.2). The study's implications for policy (section 9.3) and practice (section 9.4) are also discussed. The limitations of the study are presented (section 9.5) before personal reflections (9.6) and future research (section 9.7) is discussed.

9.1 Research objective

The primary objective of this study was to contribute to new theoretical and practical knowledge in the field of educator PD for BL design. Given the recent experiences of EOL, the rapid development of digital technologies, and the growing transition towards BL, it was deemed crucial to contribute to the discourse on supporting educators to design effective BL experiences. This study specifically contributes to the literature on designing PD and designing BL, discussing how a comprehensive PD programme can adequately prepare educators for the complexities of BL design, specifically utilising TPACK as the theoretical framework.

Through DBR methodology, this study drew on existing literature to iteratively designed, implemented, and refined a PD course tailored for educators transitioning to BL. This research was conducted in the unique context of the UOWD, which is aimed at becoming the first accredited institution in the UAE to deliver BL programmes. By examining the experiences and outcomes of educators participating in the PD course, this study identified effective strategies, tools, and approaches to enhance educators' competencies in BL design. Additionally, this research proposed a new iterative BL design (IBLD) model based on the findings from the DBR cycles, contributing valuable insights and practical frameworks to the field of PD for BL design.

9.2 Contributions to new research knowledge

The intention of this research was to address the deficit in the literature on PD that addresses supporting educators in designing BL. The literature tends to focus on the integration of technology with pedagogy, the necessity for PD in adapting pedagogical practices for BL, and the importance of designing effective BL environments. However, it is typically weaker in providing detailed actionable frameworks for PD.

The contributions of this research to the identified scholarly areas are discussed in detail in Chapter 8, however, Table 9.1 summarises the contributions in relation to the area of literature identified in Chapter 2.

The contributions outlined in the table highlight the role of delivery modality in effective participant engagement. The prioritisation of learning design as a key skill for educator PD was first identified in the policy content (section 1.2) and actioned in this study. In relation to the BL design, the importance of clearly defining the BL along with a BL model was identified. The importance of learner-centred approaches and the benefits of an iterative learning design model emerged from this study.

Table 9.1: *Summary of contributions to new research*

Research Area	Contribution	Explanation	Significance
Area 1: Designing Educator Professional Development	To highlight the importance of the PD modality to engage participants	The study demonstrates that a flipped learning and cohort-based modality significantly increased participant engagement in PD for BL design.	This contribution addresses the challenge of educator engagement in educator PD, providing a practical model that can be adapted by institutions to improve PD effectiveness.
	To emphasise the centrality of learning design in supporting educators' transition to designers of learning experiences	The research highlights the critical role of learning design skills in enabling educators to effectively create BL experiences. The study provides a structured approach to developing these skills through the IBLD model.	This contribution shifts the focus of PD to a more holistic approach that emphasises educators as designers of learning experiences.
Area 2: Designing Blended Learning	To emphasise the importance of a clearly articulated BL approach	The study highlights the need for a well-defined BL approach (in this case, defining synchronous	This contribution addresses the confusion often surrounding BL implementation,

		and a synchronous and the flipped learning model) to guide educators' design decisions.	providing a clear framework for institutions and educators.
	To highlight the importance of a learner-centred approach to BL design	The research incorporates human-centred principles (design thinking), particularly empathy mapping, to ensure that learner needs are central to the BL design process.	This contribution enhances the effectiveness of BL designs by ensuring they are tailored to learner needs and preferences.
	To highlight the benefit of an iterative learning design model to guide research in the BL design field	The study introduced the IBLD model, which provides a structured yet flexible approach to designing BL experiences.	*This contribution offers a practical tool for both researchers and practitioners in the field of BL design, contribution to a gap in existing literature and practice.

*The IBLD model developed in this study demonstrates potential for scalability across different educational contexts and institutions. The scalability of this model is supported by several factors:

1. Iterative nature: The model is designed to allow for incremental improvement and adaptation in various institutional contexts, disciplines, and levels of educator expertise. The model's components (Empathy, Define, Ideate, Prototype and Test) can be applied at different scales, from individual course redesign to programme-wide transformations.
2. Modular PD structure: The flipped, cohort-based PD approach can be scaled to accommodate larger numbers of educators. The asynchronous components can be delivered to unlimited participants, while the synchronous sessions can be replicated with multiple cohorts or facilitators.
3. Technology-enhanced delivery: The use of online platforms for both asynchronous content delivery and collaborative activities allows for geographical scalability, potentially extending the reach of the PD beyond a single institution.
4. Peer-learning emphasis: The cohort-based approach encourages peer learning and support, which can help maintain the quality of the PD experience even as it scales to larger numbers of participants.

However, it is important to note that scalability may present challenges, such as maintaining the quality of facilitation in synchronous sessions, ensuring adequate technical support, and adapting the content to diverse disciplinary contexts. Future research could explore these challenges and develop strategies for effective large-scale implementation of the IBLD model and associated PD approach. It is for these reasons that I claim that the IBLD model demonstrates potential for scalability. The extent to which this potential can be realised in practice should be the focus of future studies.

9.3 Implications for policy

In section 1.2, the policy discussion focused on considerations relating to *BL terminology*, *reimagining pedagogical practices for BL*, *the role of learning design in BL*, and *the need for specialised educator PD for BL design*.

In relation to policies referring to *BL terminology*, the inference was that due to inconsistency in approaches to BL, along with evolving pedagogical, methodological, and technological changes in HE, a clear and shared BL definition should be defined in policy documents. There is no consensus on the definition provided in the reviewed policy documents. However, if policy clearly defines BL terminology to provide a shared institutional understanding of the concept and a foundation for the next policy component, as highlighted in section 8.3.2.1, then misconceptions of BL can be alleviated leading to more effective implementation.

Building on the well-defined definition of BL with a purposeful and deliberate approach to BL design, policies referring to *reimagining pedagogical practices for BL,* documents have identified that a more considered blend of teaching modalities is required to mitigate instances of poor teaching practices from the EOL period. Policy documents were critical of HE approaches and provided too much autonomy to individual departments in deciding the nature of their BL approaches.

Therefore, this study also highlights the opportunity for policy to reimagine pedagogical approaches to BL with a well-articulated BL model (section 8.3.2.1) to provide a universal pathway to BL design. The flipped learning model was selected for this study, as it aligns with the defined BL intentions and participants highlighted how the approach helped to clarify their approach to BL designs.

In relation to policies referring to *the need for specialised educator PD for BL design,* documents called for the PD of educators involved in BL to ensure quality and the achievement of learning outcomes. However, there is a lack of clarity regarding which PD approaches should be covered in policy. Therefore, in section 8.3.1.2, this study highlights the advantage of prioritising PD in purposeful learning design to support the changing role of the educator and the incorporation of a learning design framework for BL, four validated design conjectures from this study are:

1. Iterative design approach (DC-B5)
2. *Integration of active learning strategies* (DC-B2)
3. *Incorporation of reflective exercises* (DC-A3)
4. *Provision of intentional collaborative opportunities* (DC-B4)

This framework should be used to inform BL policies on PD related to the development of learning design approaches for educators.

9.4 Implications for practice

As discussed in Chapter 1 (section 1.3) UOWD was the practice setting for this study and the research site, Chapter 4 (section 4.3). The university transitioned to BL following the disruption of EOL. The opportunity for this study was identified because the educators involved in the transition to BL, while being experienced in their respective subject areas and in teaching on-campus delivery, self-identified as lacking experience in the process of BL design. In addition, educators' immediate concern was the time it would take to develop digital learning content, not their learning design skills, which the literature has highlighted as lacking in many educators for BL design. This disparity between self-identified PD requirements and probable requirements is a position in which many HEI's and educators can find themselves.

Therefore, this study has practical implications, as it focused on PD to support educators' holistic transition to designers of learning experiences. While existing research has arrived at the same conclusion, there is a lack of explicit approaches for PD that can be transferred into practice. Therefore, this study aimed to contribute a clear pathway for educators who identified learning design skills development as a priority focus area of PD to facilitate the purposeful design of BL experiences.

The impact of the study on UOWD's transition to BL was that several educators volunteered to participate in one of the three cycles of the design intervention. Participation resulted in over 50 modules being redesigned for BL in the Programmes that were identified, thus meeting the accreditation standards. The intention was for educators to continue to iteratively develop their modules beyond their involvement in the study. This element remains to be seen as having a lasting impact on practice.

The university now aims to roll out BL redesign for additional programmes; however, I have recently left the organisation. As part of my handover, I provided access to the IBLD model and resources to continue providing an explicit PD journey for educators based on an iterative learning design approach. It was explained that each component of the model intended to prompt the educator to consider learning design decisions. While the IBLD in this study had specific elements in each component, such as the adoption of the CoI framework to guide the ideation component or a visual learning design template to guide the flipped learning model design in the prototype component, the IBLD model offers adaptability to educators. Perhaps the practice context changes and flipped learning is not the preferred BL model, or an alternative instruction design approach could be experimented with in the definition and ideate components of the model. The strength of the IBLD model lies in prompting the educator to consider elements in an iterative design that might not be suitable in the first iteration but allows for reflection and improvement over time. The university executive team said that they intended to continue using the framework.

9.5 Limitations

This study acknowledges several limitations, previously discussed in section 4.1.2. and in Table 4.1. A summary of limitations is that the research was conducted at a single institution with specific policies and cultural dynamics, potentially limiting its generalisability. The participant pool was relatively small and homogeneous, consisting mainly of educators experienced in traditional face-to-face teaching but with limited blended learning experience. Maintaining consistency was a challenge across DBR cycles and relying primarily on self-reported data. The study's focus on the TPACK framework and specific technological tools may have limited exploration of alternative approaches. Additionally, variations in participant engagement and the subjective nature of reflective practices could have influenced the depth and quality of data collected. These limitations provide important context for interpreting the study's findings and highlight areas for consideration in future research.

Table 9.2: *Limitations*

Category	Limitation	Details
Contextual Constraints	Single Research Site	The research was conducted at the University of Wollongong in Dubai, a unique setting with specific institutional policies and cultural dynamics, therefore findings may not be directly transferable to other HEI internationally with different contexts or cultures.
	Accreditation-Driven Blended Learning	The implementation of BL at UOWD was shaped by UAE's CAA accreditation guidelines, which may limit the generalisability of the findings to other contexts with alternative understandings of BL and accreditation requirements.
Participant Diversity and Sample Size	Limited Participant Pool	The study involved a relatively small number of volunteer participants, which may affect the generalisability of the findings. The self-selection bias could influence outcomes as participants might have been more motivated or predisposed to adopt BL strategies.
	Homogeneity of Participants	Most participants identified as experienced in traditional face-to-face teaching but had limited prior experience with BL, potentially underrepresenting challenges faced by more technologically adept or pedagogically diverse groups of educators.

Design and Methodological Constraints	DBR Limitations	The iterative nature of DBR can pose challenges in maintaining consistency across cycles. Elements of the design that have been selected to stay the same in one cycle might not be perfectly replicated in subsequent ones, affecting the comparability of data.
	Data Collection and Analysis	Primary data sources included participants' design artefacts and post-course interviews, which may not capture the full extent of participants' learning and development. Reliance on self-reported data may introduce biases such as social desirability bias.
	Lack of Longitudinal Data	The study did not include a long-term follow-up to assess the sustainability and long-term impact of the PD interventions, reflecting primarily short-term outcomes and immediate feedback from participants.
Technological and Pedagogical Scope	Focus on TPACK Framework	The selection of the TPACK framework for the theoretical framework might have overlooked other relevant frameworks or models, potentially limiting the exploration of alternative or complementary approaches to PD in BL design.
	Technological Limitations	The PD course emphasised specific technological tools and platforms available at the research site, which would likely differ significantly in contexts with different technological infrastructures or resources.

Reflective Practices and Participant Engagement	Varied Engagement Levels	Participants' engagement with reflective practices and collaborative activities varied, potentially influencing the depth and quality of the data collected. Some participants might have engaged more deeply, providing richer data, while others might have been less engaged.
	Subjectivity in Reflective Practices	Reflective practices introduce subjectivity, affecting the consistency and objectivity of the findings as participants' reflections are inherently personal and can vary widely in depth and honesty.

9.6 Personal Reflections

Reflecting on this research journey, this study has been deeply intertwined with my professional evolution and personal dedication towards enhancing educational practices through BL. This study represents not just a scholarly endeavour but also a personal mission to bridge the gap between theory and practice in educator PD for BL design, and some highlights and disappointments were evident on this journey.

One notable highlight was that this research sought to provide practical, actionable insights into how educators can be better supported in their transition from traditional teaching roles to designers of BL experiences. I believe the study has been successful in this aspect, and the DBR methodology has been instrumental, allowing for the refinement and adaptation of PD interventions based on real-world feedback and evolving educational contexts.

Reflecting on the use of the TPACK framework, its selection was based on providing a robust, well-defined theoretical underpinning for this study. In this sense it did meet the requirements and provided a general structure to key aspects of the study. However, I do feel there was a missing aspect of explicit community or social consideration. Although a social aspect was factored into the design intervention across cycles, I feel the additional theoretical augmentation of the COI framework or CoP would have made social considerations a more explicit part of the study.

The data analysis provided useful insights that led to the contributions discussed. However, I was disappointed to have to discount the data from the focus groups (section 4.9), as I feel it would have added a further layer of depth and validity to the findings. In addition, the study was heavily reliant on qualitative data, therefore a consideration for future research could be to explore quantitative data to add an extra perspective.

Through this study, I aimed to contribute to the growing body of literature on BL and educator PD by addressing the gaps in existing research, particularly in terms of practical frameworks and strategies for effective BL design. The IBLD model provides an approach that fosters a deep understanding of pedagogical principles tailored to BL environments along with the development of technological competence for BL design.

This research journey has reaffirmed my belief in the transformative potential of BL and the pivotal role of well-designed PD in achieving this transformation. As educators navigate the complexities of modern educational landscapes, the insights gained from this study offer a pathway towards more effective, engaging, and flexible learning experiences that are responsive to the needs of both educators and learners.

9.7 Future research

Building on the findings and consideration the limitations identified in this study, several avenues for future research emerge that could further contribute to the research field of PD for BL design.

A significant area for future research that interests me is the related to the continued exploration of the IBLD model. One area I would like to further experiment on is the importance of the modalities of the PD related to this model, I would aim to understand more clearly the link between alternative modalities and participant engagement.

An addition area for future research relates to the theoretical underpinning of the IBLD model. Building on reflections from section 9.6, I would aim to explore if an augmentation of TPACK with a framework such as CoI would provide more explicit consideration for social engagement in the PD model and to what effect it would impact the BL design.

Building on the identified contribution related to the centrality of learning design in supporting educators' transition to designers of learning experiences. In relation to the IBLD model, the importance of a learner-centred approach to BL design deserves further exploration, specifically in relation as this is not overtly evident in existing literature. Finally, I would aim to further explore how iterative approaches to learning design could support educators transitioning role towards designers of learning experiences.

Appendix

Appendix 1: Interview Questions

Technological Knowledge:

1. How would you describe your current technological skills?
2. Have you noticed any changes in your technological skills since the design intervention?
3. Which specific technological tools or resources did you find most helpful during the design intervention?

Pedagogical Knowledge:

4. How would you describe your current teaching practices?
5. In what ways did the design intervention impact your teaching practices?
6. Did you feel like the design intervention provided you with new pedagogical insights or strategies?

Content Knowledge:

7. How would you describe your current understanding of the content area you teach?
8. Did the design intervention impact your understanding of the content area?
9. Were there any specific content-related challenges or opportunities that arose during the design intervention?

Technological Pedagogical Knowledge (TPK):

10. How would you describe your current ability to integrate technology into your teaching practices?
11. Did the design intervention impact your ability to use technology in your teaching?
12. Were there any specific technological challenges or opportunities that arose during the design intervention?

Technological Content Knowledge (TCK):

13. How would you describe your current ability to use technology to support your content area teaching?
14. Did the design intervention impact your ability to use technology in this way?
15. Were there any specific content-related challenges or opportunities that arose during the design intervention?

Technological Pedagogical Content Knowledge (TPACK):

16. How would you describe your current ability to effectively integrate technology, pedagogy, and content knowledge in your teaching?
17. Did the design intervention impact your TPACK development?

Were there any specific challenges or opportunities related to TPACK that arose during the design intervention?

Appendix 2: Participant information sheet

Lancaster University

Participant information sheet

Link to the online version of this form: https://tally.so/r/wArx5W

Title: Exploring university educators' professional development for blended learning design

For further information about how Lancaster University processes personal data for research purposes and your data rights please visit our webpage: www.lancaster.ac.uk/research/data-protection

Hello, I'm Christopher Tuffnell, a PhD student at Lancaster University. I would like to invite you to take part in a research study about Exploring university educators' professional development for blended learning design.

Please take time to read the following information carefully before you decide whether you wish to take part.

What is the study about?

This study aims to explore the topic of educator professional development for blended learning (BL) design. A design-based research (DBR) approach has been chosen to facilitate a design intervention (training course) for university educators (research participants) involved in teaching BL courses at the university level.

The research output will contribute to the literature on BL design for Higher Education (HE) by exploring the impact of an educator development training course for university educators engaged in the design of blended learning in HE.

The course will be designed based on theoretical concepts with the aim to:

1. develop educators' pedagogical and technological knowledge in relation to BL design
2. foster a mindset of educators as designers of learning experiences
3. propose the adoption of a learning design model to guide the design of Courses for BL

Why have I been invited?

You have approached because you have identified yourself as an educator in higher education who is involved with or interested in designing blended learning experiences for your context.

What will I be asked to do if I take part?

If you decided to take part, this would involve the following:

- Completion of pre and post-intervention survey
- Participation in a cohort-based, 4–5-week online training course that aims to support you in the design of blended learning experiences. The course requires contributions to an ePortfolio
- Semi-structured interviews following participation in the course.

What are the possible benefits from taking part?

When taking part in this study you be encouraged to reflect on your teaching practice, and you will be offered guidance, tools, and templates that you could adopt outside of the study should you decide to do so.

Do I have to take part?

No. It's completely up to you to decide whether or not you take part. Your participation is voluntary.

What if I change my mind?

If you change your mind, you are free to withdraw from the study at any point during the delivery of the training course or up to 2 weeks after data collection is complete.

If you want to withdraw, please let me know, and I will attempt to extract any ideas or information (i.e. data) you contributed to the study and destroy them.

It can be difficult and often impossible to take out data from one specific participant when this has already been anonymised or pooled together with other participants' data. Therefore, please understand that if data analysis commences before the end of the study and then you decide to withdraw your anonymised data will remain part of the study.

What are the possible disadvantages and risks of taking part?

Please consider that the training course will require 60-90 minutes of your time per week for up to 5 weeks. Surveys could take up to 30 minutes to complete and interviews at the end of the course could take up to 1-hour to participate in.

Will my data be identifiable?

During the course delivery, you will be part of a cohort, and each cohort member will see the digital artefacts created by other members of the cohort. This is by design in order to allow support, feedback and reflection from other cohort members.

Following the analysis of surveys and interview data, only I, the researcher conducting this study and my Supervisor (Dr Brett Bligh) will have access to the information you have shared.

I will keep all personal information about you (e.g. your name and other information about you that can identify you) confidential, that is I will not share it with others. I will remove any personal information from the written record of your contribution. All reasonable steps will be taken to protect the anonymity of the participants involved in this project.

How will we use the information you have shared with us and what will happen to the results of the research study?

I will use the information you have shared with me in the following ways:

I will use it for research purposes that will include my PhD thesis and other publication opportunities that may arise. I may also present the results of the study at academic conferences or inform policymakers about the findings of the study.

When writing up the findings from this study, I would like to reproduce some of the views and ideas you shared with me. I will only use anonymised quotes (e.g. from my interview with you) so that although I will use your exact words, all reasonable steps will be taken to protect your anonymity in **our publications.**

How my data will be stored Your data will be stored on the online course platform (*Thinkific) and on a password-protected computer. Once analysed data will be uploaded to Lancaster University's MS OneDrive (no one other than me, the researcher will be able to access them). I will keep data that can identify you separately from non-personal information (e.g. your views on a specific topic). In accordance with University guidelines, I will keep the data secure for a minimum of ten years. ***** Thinkific's Data Security

The course platform's physical infrastructure is hosted and managed within Amazon's secure data centres and utilizes the Amazon Web Service (AWS) technology as well as the Google Cloud Platform (GCP) technology. Both Amazon and Google continually manage risk and undergo recurring assessments to ensure compliance with industry standards as seen here and here, respectively. Thinkific hosts customer and learner data in the United States.

Encryption

- Thinkific encrypts data using secure cryptographic algorithms.
- All data in transit is encrypted using TLS 1.2 or greater.
- Thinkific leverages AES-256 encryption for data at rest.
- Key management is in place for all Thinkific encryption keys

For more information on Thinkific's data security please refer to the following:

https://www.thinkific.com/security-overview/

What if I have a question or concern?

If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact myself:

Christopher Tuffnell

Email: c.tuffnell@lancaster.ac.uk

Or my Supervisor

Dr. Brett Bligh

Email: b.bligh@lancaster.ac.uk

Department for Educational Research

Lancaster University

County South, Lancaster University, Bailrigg, Lancaster, United Kingdom, LA1 4YL

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:

Professor Paul Ashwin

Email: **paul.ashwin@lancaster.ac.uk**

Head of Department and Deputy Director of the Centre for Global Higher Education

Department of Educational Research

Lancaster University

LA1 4YD

This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

Thank you for considering your participation in this project.

Appendix 3: Consent Form

CONSENT FORM

Link to the online version of this form: https://tally.so/r/mKpLyk

Project Title: Exploring university educators' professional development for blended learning design

Name of Researcher: Christopher Tuffnell

Email: c.tuffnell@lancaster.ac.uk

Name:

Gender:

Higher Education Institution:

Area of Teaching:

Number of years Teaching:

Please tick each box

I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily	☐

I understand that my participation is voluntary and that I am free to withdraw at any point during the delivery of the training course or up to 2 weeks after data collection is complete, without giving any reason and my data will be removed. I understand that if data analysis commences before the end of the study and then I decide to withdraw my anonymised data will remain part of the study.	☐
If I am participating in the focus group I understand that any information disclosed within the focus group remains confidential to the group, and I will not discuss the focus group with or in front of anyone who was not involved unless I have the relevant person’s express permission	☐
I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher/s, but my personal information will not be included and all reasonable steps will be taken to protect the anonymity of the participants involved in this project.	☐
I understand that my name/my organisation’s name will not appear in any reports, articles or presentation without my consent.	☐
I understand that any interviews or focus groups will be audio-recorded and transcribed and that data will be protected on	☐

secure devices and only accessed by the researcher (Christopher Tuffnell) and his Supervisor (Dr Brett Bligh).	
I understand that data will be kept according to University guidelines for a minimum of 10 years after the end of the study.	☐
I agree to take part in the above study.	☐

___________________________ _________________ ________________

Name of Participant Date Signature

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____________________________ Date ____________ Day/month/year

One copy of this form will be given to the participant and the original kept in the files of the researcher at Lancaster University

References

Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: the challenges and opportunities. *Interactive Learning Environments*, *31*(2), 863–875. https://doi.org/10.1080/10494820.2020.1813180

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, *41*(1), 16-25. https://doi.org/10.3102/0013189X11428813

Angeli, C., Valanides, N., & Christodoulou, A. (2016). Theoretical considerations of technological pedagogical content knowledge. In M. C. Herring, M. J. Koehler, & P. Mishra (Eds.), *Handbook of technological pedagogical content knowledge (TPACK) for educators* (pp. 11-32). Routledge.

Angelone, L., Warner, Z., & Zydney, J. M. (2020). Optimizing the technological design of a blended synchronous learning environment. *Online Learning*, *24*(3). https://doi.org/10.24059/olj.v24i3.2180

Arbaugh, J. B. (2014). What might online delivery teach us about blended management education? prior perspectives and future directions. *Organizational Behavior Teaching Review*, *38*(6), 784–817. https://doi.org/10.1177/1052562914534244

Archambault, L. M., & Barnett, J. H. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPACK framework. *Computers & Education*, *55*(4), 1656–1662. https://doi.org/10.1016/j.compedu.2010.07.009

Armstrong, M., Dopp, C., & Welsh, J. (2022). Design-Based Research: What is DBR, why might one do it, and how does one do it well. *Kimmons, R., Education Research*. https://edtechbooks.org/education_research/design_based_research

Aziz, A., Saddhono, K., & Setyawan, B. W. (2022). A parental guidance patterns in the online learning process during the COVID-19 pandemic: case study in Indonesian school. *Heliyon*, *8*(12), e12158. https://doi.org/10.1016/j.heliyon.2022.e12158

Baepler, P., Walker, J. D., & Driessen, M. (2014). It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. *Computers & Education*, *78*, 227-236. https://doi.org/10.1016/j.compedu.2014.06.006

Bali, S., & Liu, M. C. (2018, November). Students' perceptions toward online learning and face-to-face learning courses. *Journal of Physics: Conference Series*, *1108*(1), 012094. https://doi.org/10.1088/1742-6596/1108/1/012094

Bandura, A., & Walters, R. H. (1977). *Social learning theory* (Vol. 1). Prentice Hall.

Baker, A. C., Jensen, P. J., & Kolb, D. A. (2005). Conversation as experiential learning. *Management Learning*, *36*(4), 411-427. https://doi.org/10.1177/1350507605058130

Bakker, A. (2018). What is design research in education? 1. In *Routledge eBooks* (pp. 3–22). https://doi.org/10.4324/9780203701010-2

Barab, S., & Squire, K. (2016). Creating a framework for research on systemic technology innovations. In *Psychology Press eBooks* (pp. 45–78). https://doi.org/10.4324/9780203764565-2

Baran, E., & Correia, A. P. (2014). A professional development framework for online teaching. *TechTrends*, *58*, 95-101. https://doi.org/10.1007/s11528-014-0791-0

Berger, R. (2013). Now I see it, now I don't: researcher's position and reflexivity in qualitative research. *Qualitative Research*, *15*(2), 219–234. https://doi.org/10.1177/1468794112468475

Bidarra, J., and E. Rusman. 2017. "Key Pedagogical and Technological Factors for Effective Blended Learning Design." In *The Envisioning Report for Empowering Universities*, edited by G. Ubachs and L. Konings, 20–23. Maastricht: EADTU. http://hdl.handle.net/10400.2/6394

Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking. *Qualitative Health Research*, *26*(13), 1802–1811. https://doi.org/10.1177/1049732316654870

Bizami, N. A., Tasir, Z., & Kew, S. N. (2022). Innovative pedagogical principles and technological tools capabilities for immersive blended learning: a systematic literature review. *Education and Information Technologies*, *28*(2), 1373–1425. https://doi.org/10.1007/s10639-022-11243-w

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in*

Open and Distributed Learning, *13*(1), 56-71. https://doi.org/10.19173/irrodl.v13i1.1076

Bligh, B. (2022). Physical learning spaces and teaching in the blended learning landscape. In *Encyclopedia of Teacher Education*(pp. 1285–1292). https://doi.org/10.1007/978-981-16-8679-5_60

Bligh, B., & Crook, C. (2017). Learning spaces. In *Springer eBooks* (pp. 69–87). https://doi.org/10.1007/978-3-319-02600-8_7

Bligh, B., & Flood, M. (2015). The change laboratory in higher education: Research-intervention using activity theory. In J. Huisman & M. Tight (Eds.), *Theory and method in higher education research* (pp. 141-168). Emerald Group Publishing Limited. https://doi.org/10.1108/S2056-375220150000001007

Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, *22*, 1-18. https://doi.org/10.1016/j.edurev.2017.06.001

Booth, S. E. (2012). Cultivating knowledge sharing and trust in online communities for educators. *Journal of Educational Computing Research*, *47*(1), 1-31. https://doi.org/10.2190/EC.47.1.a

Bostancıoğlu, A., & Handley, Z. (2018). Developing and validating a questionnaire for evaluating the EFL 'Total PACKage': Technological Pedagogical Content Knowledge (TPACK) for English as a Foreign Language (EFL). *Computer Assisted Language Learning*, *31*(5–6), 572–598. https://doi.org/10.1080/09588221.2017.1422524

Bourdeau, J. (2017). The DBR Methodology for the Study of Context in Learning. In *Lecture notes in computer science* (pp. 541–553). https://doi.org/10.1007/978-3-319-57837-8_44

Bracken, S., & Novak, K. (2019). Conclusion: Universal Design for Learning: a global framework for realising inclusive practice in higher education. In *Transforming higher education through Universal Design for Learning* (pp. 346-357). Routledge.

Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and TPACK. *Journal of Research on Technology in Education*, *46*(2), 103–128. https://doi.org/10.1080/15391523.2013.10782615

Brinkmann S. (2014). Unstructured and semi-structured interviewing. In Leavy P. (Ed.), *The Oxford handbook of qualitative research* (pp. 277-299). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199811755.013.030

Brown, A. L. (1992). Design Experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, *2*(2), 141–178. https://doi.org/10.1207/s15327809jls0202_2

Calhoun, C., Sahay, S., & Wilson, M. (2021). Instructional Design Evaluation. *Design for Learning*. https://edtechbooks.org/id/instructional_design_evaluation

Callo, E. C., & Yazon, A. D. (2020). Exploring the factors influencing the readiness of faculty and students on online teaching and learning as an alternative delivery mode for the new normal. *Universal Journal of Educational Research*, *8*(8), 3509-3518. https://doi.org/10.13189/ujer.2020.080826

Carrillo, C., & Flores, M. A. (2020). COVID-19 and teacher education: a literature review of online teaching and learning practices. *European Journal of Teacher Education*, *43*(4), 466–487. https://doi.org/10.1080/02619768.2020.1821184

CAST. (2012). Universal Design for Learning Guidelines Version 2.0. CAST.

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2013). A review of technological pedagogical content knowledge. Journal of Educational Technology & Society, 16(2), 31-51.

Chammas, G. (2020). The insider-researcher status: A challenge for social work practice research. *The Qualitative Report*, *25*(2), 537-552. https://doi.org/10.46743/2160-3715/2020.3928

Charmaz, K., & Thornberg, R. (2020). The pursuit of quality in grounded theory. *Qualitative Research in Psychology*, *18*(3), 305–327. https://doi.org/10.1080/14780887.2020.1780357

Cheung, W. S., & Hew, K. F. (2015). Applying "First Principles of Instruction" in a blended learning course. In *Communications in computer and information science* (pp. 127–135). https://doi.org/10.1007/978-3-662-46158-7_13

Chitanana, L. (2022). Enhancing Student Engagement and Active Learning in Online Learning Environments. *Handbook of Research on Active Learning and Student Engagement in Higher Education*, 128.

Chrysti, K. S., Rokhmaniyah, N., & Chamdani, M. (2020). Enhancement of artifact based activities learning in Natural Science through Scientific Reading Based Project (SRBP) model for preservice teacher using Design Based Research

(DBR). *Proceedings of the 4th International Conference on Learning Innovation and Quality Education*, 1–5. https://doi.org/10.1145/3452144.3452210

Clark, C. E. J., & Post, G. (2021). Preparation and synchronous participation improve student performance in a blended learning experience. *Australasian Journal of Educational Technology*, 187–199. https://doi.org/10.14742/ajet.6811

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, *32*(1), 9–13. https://doi.org/10.3102/0013189x032001009

Cohen, L., Manion, L., & Morrison, K. (2017). Mixed methods research. In *Routledge eBooks* (pp. 31–50). https://doi.org/10.4324/9781315456539-2

Collins, A., Joseph, D., & Bielaczyc, K. (2016). Ontological innovation and the role of theory in design experiments. In *Psychology Press eBooks* (pp. 79–106). https://doi.org/10.4324/9780203764565-3

Comas-Quinn, A. (2016). Blended teaching and the changing role of the language teacher: The Need for a review of teacher professional development. In Michael McCarthy (Ed.), In book: *The Cambridge guide to blended learning for language teaching* (pp. 68–82). Cambridge University Press. **http://www.cambridge.org/ke/cambridgeenglish/profe...**

Commission for Academic Accreditation. (2022). Procedural guidelines for blended learning. UAE Ministry of Education.

Cooper, T., & Scriven, R. (2016). Communities of inquiry in curriculum approach to online learning: Strengths and limitations in context. *Australasian Journal of Educational Technology*. https://doi.org/10.14742/ajet.3026

Cooper, T. (2019). Rethinking teaching excellence in Australian higher education. *International Journal of Comparative Education and Development*, *21*(2), 83–98. https://doi.org/10.1108/ijced-10-2018-0038

Cox, S., & Graham, C. R. (2009). Diagramming TPACK in practice: Using an elaborated model of the TPACK framework to analyze and depict teacher knowledge. *TechTrends: Linking Research & Practice to Improve Learning*, *53*(5). https://doi.org/10.1007/s11528-009-0327-1

Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). Sage publications.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

D'Mello, S., Lehman, B., Pekrun, R., & Graesser, A. (2012). Confusion can be beneficial for learning. *Learning and Instruction*, *29*, 153–170. https://doi.org/10.1016/j.learninstruc.2012.05.003

D'Souza, I., Luu, J., & Cui, T. (2022). Educational Designer social influence: changing teaching and learning practice. *ASCILITE Publications*, e22056. https://doi.org/10.14742/apubs.2022.56.

Dancy, M., Lau, A. C., Rundquist, A., & Henderson, C. (2019). Faculty online learning communities: A model for sustained teaching transformation. *Physical Review Physics Education Research*, *15*(2). https://doi.org/10.1103/physrevphyseducres.15.020147.

Design-Based Research: an Emerging paradigm for educational inquiry. (2003). *Educational Researcher*, *32*(1), 5-8. https://doi.org/10.3102/0013189x032001005

Dewey, J. (2018). Logic-The theory of inquiry. Read Books Ltd.

Dwyer, S. C., & Buckle, J. L. (2009). The space between: on being an Insider-Outsider in qualitative research. *International Journal of Qualitative Methods*, *8*(1), 54–63. https://doi.org/10.1177/160940690900800105

Eom, S. B., & Ashill, N. J. (2018). A System's View of E-Learning Success Model. *Decision Sciences Journal of Innovative Education*, *16*(1), 42–76. https://doi.org/10.1111/dsji.12144

Eralita, N., & Azzizzah, F. A. (2023). Blended Learning's Effect Toward Learning Achievement Post COVID 19 Pandemic. *IJCER (International Journal of Chemistry Education Research)*, 1–5. https://doi.org/10.20885/ijcer.vol7.iss1.art1

Evans, L. (2018). Implicit and informal professional development: what it 'looks like', how it occurs, and why we need to research it. *Professional Development in Education*, *45*(1), 3–16. https://doi.org/10.1080/19415257.2018.1441172

Evans R., Kurantowicz E., Lucio-Villegas E. (2022). Communities and adult learning in the making. In Kurantowicz E., Lucio-Villegas E. (Eds.), *Remaking communities and adult learning: Social and community-based learning, new forms of knowledge action for change* (pp. 242–250). Brill.

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Floyd, A., & Arthur, L. (2012). Researching from within: external and internal ethical engagement. *International Journal of Research & Method in Education*, *35*(2), 171–180. https://doi.org/10.1080/1743727x.2012.670481

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, *111*(23), 8410–8415. https://doi.org/10.1073/pnas.1319030111

Garrison, D. R., Anderson, T., & Archer, W. (2003). A theory of critical inquiry in online distance education. In M. G. Moore & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 113-127). Lawrence Erlbaum Associates.

Garrison, D., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. John Wiley & Sons.

Garreta-Domingo, M., Sloep, P.B., Hernández-Leo, D. *et al.* Learning design for teacher professional development. *Int J Educ Technol High Educ* **14**, 36 (2017). https://doi.org/10.1186/s41239-017-0074-x

Gedik, N., Kiraz, E., & Ozden, M. Y. (2013). Design of a blended learning environment: Considerations and implementation issues. *Australasian Journal of Educational Technology*, *29*(1). https://doi.org/10.14742/ajet.6

Gentles, S. J., Charles, C., Ploeg, J., & McKibbon, K. (2015). Sampling in Qualitative Research: Insights from an Overview of the Methods Literature. *The Qualitative Report*, *20*(11), 1772-1789.https://doi.org/10.46743/2160-3715/2015.2373

Glass, D., Meyer, A., & Rose, D. (2013). Universal design for learning and the arts. *Harvard Educational Review*, *83*(1), 98–119. https://doi.org/10.17763/haer.83.1.33102p26478p54pw

Graham, C. R. (2006). Blended learning systems. In C.J. Bonk & C.R. Graham (Ed.), *The handbook of blended learning: Global perspectives, local designs*, *1*, 3-21

Graham, C. R. (2013). Emerging practice and research in blended learning. In M.G. Moore (Ed.), *Handbook of distance education* (3rd ed.) (pp. 351-368). Routledge. https://doi.org/10.4324/9780203803738

Graham, C. R., Henrie, C. R., & Gibbons, A. S. (2013). Developing models and theory for blended learning research. In A.G. Picciano, C.D. Dziuban, C.R. Graham (Ed.) *Blended learning, Research Perspectives, Volume 2* (pp. 13-33). Routledge. https://doi.org/10.4324/9781315880310

Greene, M. J. (2014). *On the Inside Looking In: Methodological Insights and Challenges in Conducting Qualitative Insider Research*. NSUWorks. http://nsuworks.nova.edu/tqr/vol19/iss29/3

Grgurovic, M. (2011). Blended learning in an ESL class: A case study. *CALICO Journal*, *29*(1), 100–117. https://doi.org/10.11139/cj.29.1.100-117

Gunawardena, C. N., Frechette, C., & Layne, L. (2018). Culturally inclusive instructional design. In *RoutledgeeBooks*. https://doi.org/10.4324/9781315439204

Hasani, L. M., Santoso, H. B., & Junus, K. (2022). Designing asynchronous online discussion forum interface and interaction based on the community of inquiry framework. *The International Review of Research in Open and Distributed Learning*, *23*(2), 191–213. https://doi.org/10.19173/irrodl.v23i2.6016

Hawks, S. R., & Judd, H. A. (2019). Excellence in the design and Delivery of an Online Global Health Survey Course: A Roadmap for educators. *Pedagogy in Health Promotion*, *6*(1), 70–76. https://doi.org/10.1177/2373379919872781

Hay, L., Duffy, A. H. B., Grealy, M., Tahsiri, M., McTeague, C., & Vuletic, T. (2019). A novel systematic approach for analysing exploratory design ideation. *Journal of Engineering Design*, *31*(3), 127–149. https://doi.org/10.1080/09544828.2019.1662381

Heinze, A., & Heinze, B. (2009). Blended e-learning skeleton of conversation: Improving formative assessment in undergraduate dissertation supervision. *British Journal of Educational Technology*, *40*(2), 294–305. https://doi.org/10.1111/j.1467-8535.2008.00923.x

Hindaryatiningsih, N. (2023). Online learning in University: Pros and Cons of study. *Journal of Innovation in Educational and Cultural Research*, *4*(1), 74–80. https://doi.org/10.46843/jiecr.v4i1.455

Huang, R., & Zhou, Y. (2006). Designing blended learning focused on knowledge category and learning activities: Case studies from Beijing Normal University. In C. J. Bonk & C. R. Graham (Eds.), *Handbook of blended learning: Global perspectives, local designs* (pp. 296–310). Pfeiffer Publishing.

Huber, S. G., & Helm, C. (2020). COVID-19 and schooling: evaluation, assessment and accountability in times of crises—reacting quickly to explore key issues for policy, practice and research with the school barometer. *Educational Assessment Evaluation and Accountability*, *32*(2), 237–270. https://doi.org/10.1007/s11092-020-09322-y

Ismaya, E. A. (2022). Development of E-Module-Based parenting modules for early childhood. *www.ejicccm.com*. https://doi.org/10.53797/icccmjssh.v1i6.2.2022

Jayashanka, R., Hewagamage, K. P., & Hettiarachchi, E. (2018, July). Improving blended learning in higher education through the synergy between learning design and learning analytics. In 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT) (pp. 227-228). IEEE.

Jeffrey, L. M., Milne, J., Suddaby, G., & Higgins, A. (2014). Blended learning: How teachers balance the blend of online and classroom components. *Journal of*

Information Technology Education: Research, *13*. Retrieved from http://www.jite.org/documents/Vol13/JITEv13ResearchP121-140Jeffrey0460.pdf

JISC. (2020). Reimagining blended learning in higher education. Retrieved from https://www.jisc.ac.uk/guides/reimagining-blended-learning-in-higher-education

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational researcher*, *33*(7), 14-26.

Joubert, J., Callaghan, R., & Engelbrecht, J. (2020). Lesson study in a blended approach to support isolated teachers in teaching with technology. *ZDM*, *52*(5), 907–925. https://doi.org/10.1007/s11858-020-01161-x

Kaufman, D. (2019). The shifting paradigm: Blended learning a transformative approach in teacher education. *The TESOL Encyclopedia of English Language Teaching*, 1–8. https://doi.org/10.1002/9781118784235.eelt0970

Kaymakamoglu, S. E. (n.d.). *Teachers' beliefs, perceived practice and actual classroom practice in relation to traditional (Teacher-Centered) and constructivist (Learner-Centered) teaching (Note 1).* https://eric.ed.gov/?id=EJ1153685

Kern, B. B. (2002). Enhancing accounting students' problem-solving skills: the use of a hands-on conceptual model in an active learning environment. *Accounting Education*, *11*(3), 235–256. https://doi.org/10.1080/09639280210141680

Kiger, M. E., & Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131. *Medical Teacher*, *42*(8), 846–854. https://doi.org/10.1080/0142159x.2020.1755030

Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education*, *14*(1). https://doi.org/10.1186/s41239-017-0043-4

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, *32*(2), 131–152. https://doi.org/10.2190/0ew7-01wb-bkhl-qdyv

Koehler, M. & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge (TPACK)?. *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70. Waynesville, NC USA: Society for Information Technology & Teacher Education. Retrieved from https://www.learntechlib.org/primary/p/29544/

Koehler, M. J., & Mishra, P. (2014). Introducing TPCK. In Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators (pp. 13-40). In *Routledge eBooks*. https://doi.org/10.4324/9781315759630

Koh, J. H. L., Chai, C. S., & Tsai, C. (2012). Examining practicing teachers' perceptions of technological pedagogical content knowledge (TPACK) pathways: a structural equation modeling approach. *Instructional Science*, *41*(4), 793–809. https://doi.org/10.1007/s11251-012-9249-y

Koh, J. H. L., & Divaharan, S. (2013). Towards a TPACK-fostering ICT instructional process for teachers: Lessons from the implementation of interactive whiteboard instruction. *Australasian Journal of Educational Technology*, *29*(2). https://doi.org/10.14742/ajet.97

Krajcik, J., & Shin, N. (2023). Student conceptions, conceptual change, and learning progressions. In *Handbook of research on science education* (pp. 121-157). In *Routledge eBooks*. https://doi.org/10.4324/9780367855758

Krzyszkowska, K., & Mavrommati, M. (2021). Applying the Community of Inquiry e-Learning Model to Improve the Learning Design of an Online Course for In-service Teachers in Norway. *The Electronic Journal of e-Learning*, *18*(6). https://doi.org/10.34190/jel.18.6.001

Kyngäs, H. (2019). Inductive Content analysis. In *Springer eBooks* (pp. 13–21). https://doi.org/10.1007/978-3-030-30199-6_2

Lakshmi, D. V., & Lakshmi, M. S. (2020, December). Integrated technological tools for effective blended learning. In 2020 IEEE Bombay Section Signature Conference (IBSSC) (pp. 163-168). IEEE. https://doi.org/10.1109/IBSSC51096.2020.9332223

Laurillard, D. (2002). Rethinking University Teaching: A Framework for the Use of Technology in Higher Education.

Laurillard, D. (2018). Teaching as a design science: Teachers building, testing, and sharing pedagogic ideas. *Second handbook of information technology in primary and secondary education*, 557-566.

Lee, J., & Choi, H. (2018). Rethinking the flipped learning pre-class: Its influence on the success of flipped learning and related factors. British Journal of Educational Technology, 50(2), 934–945. https://doi.org/10.1111/bjet.12618

Lee, J., Lim, C., & Kim, H. (2016). Development of an instructional design model for flipped learning in higher education. *Educational Technology Research and Development*, *65*(2), 427–453. https://doi.org/10.1007/s11423-016-9502-1

Lee, K., Fanguy, M., Bligh, B., & Lu, X. S. (2021). Adoption of online teaching during the COVID-19 Pandemic: a systematic analysis of changes in university teaching activity. *Educational Review*, *74*(3), 460–483. https://doi.org/10.1080/00131911.2021.1978401

Leo, D. H., Pérez, J. I. A., & Dimitriadis, Y. A. (2004). IMS learning design support for the formalization of collaborative learning patterns. In IEEE International Conference on Advanced Learning Technologies, 2004. Proceedings (pp. 350-354). IEEE. doi: 10.1109/ICALT.2004.1357434

Levitt, H. M., Motulsky, S. L., Wertz, F. J., Morrow, S. L., & Ponterotto, J. G. (2016). Recommendations for designing and reviewing qualitative research in psychology: Promoting methodological integrity. *Qualitative Psychology*, *4*(1), 2–22. https://doi.org/10.1037/qup0000082

Li, R., Lund, A., & Nordsteien, A. (2021). The link between flipped and active learning: a scoping review. *Teaching in Higher Education*, *28*(8), 1993–2027. https://doi.org/10.1080/13562517.2021.1943655

Liu, Y., & Szabo, Z. (2009). Teachers' attitudes toward technology integration in schools: a four-year study. *Teachers and Teaching*, *15*(1), 5–23. https://doi.org/10.1080/13540600802661295

Li, M., Han, X., & Cheng, J. (2023). *Handbook of Educational Reform through Blended Learning*. https://doi.org/10.1007/978-981-99-6269-3

Lumpkin, A., Achen, R. M., & Dodd, R. K. (2015). Student perceptions of active learning. *College Student Journal*, *49*(1), 121-133.

MacNeill, S., & Beetham, H. (2023). Beyond blended post-pandemic curriculum and learning design: Lessons from the higher education (HE) sector (p. 40). JISC. https://repository.jisc.ac.uk/9227/1/beyond-blended-post-pandemic-curriculum-and-learning-design-report.pdf

Maeng, J. L., Mulvey, B. K., Smetana, L. K., & Bell, R. L. (2013). Preservice Teachers' TPACK: Using Technology to support inquiry instruction. *Journal of Science Education and Technology*, *22*(6), 838–857. https://doi.org/10.1007/s10956-013-9434-z

Makri, K., Papanikolaou, K., & Al, A. T. E. (2014, May 1). *Blending the Community of Inquiry Framework with Learning by Design: Towards a Synthesis for Blended Learning in Teacher Training*. https://academic-publishing.org/index.php/ejel/article/view/1690

Mangiatordi, A. (2018). Applying Universal Design for Learning guidelines to a blended learning course for prospective teachers. In *Proceedings of the 11th International Conference on Networked Learning* (pp. 33-40).

Marlor, L., Finelli, C. J., Husman, J., Borrego, M., Graham, M. C., Smith, M., & Prince, M. (2022). Reducing student resistance to active learning through faculty development: Project update. In *2022 ASEE Annual Conference & Exposition*. American Society of Engineering Education.

Marshall, S. (2020). Blended learning: A long-term shift in pedagogy. Higher Education Policy Institute. Retrieved from https://www.hepi.ac.uk/2020/11/04/blended-learning-a-long-term-shift-in-pedagogy/

Martinez-Alvarez, P., & Bannan, B. (2013). Blending practices: DBR and CALL to enrich emergent bilingual learners' concept and language development. *Computer Assisted Language Instruction Consortium (CALICO) Journal*, *11*, 127-156.

Maxwell, R., & Khatri, R. (2021). Exploring active blended learning through the lens of Team-Based Learning. In *Advances in educational technologies and instructional design book series* (pp. 172–192). https://doi.org/10.4018/978-1-7998-7856-8.ch009

Mayer, R. E. (2014). Research-based principles for designing multimedia instruction. In V. A. Benassi, C. E. Overson, & C. M. Hakala (Eds.), *Applying science of learning in education: Infusing psychological science into the curriculum* (pp. 59–70). Society for the Teaching of Psychology

McDowell, M. R., & Tasker, T. J. (2023). Motivate to educate. In *Advances in educational technologies and instructional design book series* (pp. 51–68). https://doi.org/10.4018/978-1-6684-7712-0.ch004

McGee, P. (2014). Blended course design. *International Journal of Mobile and Blended Learning*, *6*(1), 33–55. https://doi.org/10.4018/ijmbl.2014010103

McKenney, S., & Reeves, T. C. (2020). Educational design research: Portraying, conducting, and enhancing productive scholarship. *Medical Education*, *55*(1), 82–92. https://doi.org/10.1111/medu.14280

Meyer, A., Rose, D. H., & Gordon, D. (2014) *Universal design for learning: Theory and practice*. Wakefield, MA: CAST.

Mercer, J. (2006). The challenges of insider research in educational institutions: wielding a double-edged sword and resolving delicate dilemmas. *Oxford Review of Education*, *33*(1), 1–17. https://doi.org/10.1080/03054980601094651

Milad, M. (2018). The pedagogical development of blended learning. In *Springer eBooks* (pp. 609–635). https://doi.org/10.1007/978-3-319-98533-6_27

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: a framework for teacher knowledge. *Teachers College Record the Voice of Scholarship in Education*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Moon, M. D. (2019). Triangulation: a method to increase validity, reliability, and legitimation in clinical research. *Journal of Emergency Nursing*, *45*(1), 103–105. https://doi.org/10.1016/j.jen.2018.11.004

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative Inquiry*, *20*(8), 1045–1053. https://doi.org/10.1177/1077800413513733

Mozelius, P., & Rydell, C. (2017). Blended learning, Virtual learning environment, Technology-enhanced learning. *Higher education, E-learning. ICTEJoumal*, *6*(1), 4-13.

Müller, F. A., & Wulf, T. (2023). Differences in learning Effectiveness across Management Learning Environments: A Cognitive Load Theory perspective. *Organizational Behavior Teaching Review*, *48*(4), 802–828. https://doi.org/10.1177/10525629231200206

Núñez-Canal, M., De Las Mercedes De Obesso, M., & Pérez-Rivero, C. A. (2021). New challenges in higher education: A study of the digital competence of educators in Covid times. *Technological Forecasting and Social Change*, *174*, 121270. https://doi.org/10.1016/j.techfore.2021.121270

Nolan-Grant, C. R. (2019). The Community of Inquiry framework as learning design model: a case study in postgraduate online education. *Research in Learning Technology*, *27*(0). https://doi.org/10.25304/rlt.v27.2240

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis. *International Journal of Qualitative Methods*, *16*(1), 160940691773384. https://doi.org/10.1177/1609406917733847

Office for Students. (2022). Blended learning review panel. Retrieved from https://www.officeforstudents.org.uk/media/dc1c3c84-269a-4c40-8f87-15bfae0fcced/blended-learning-review-panel-report.pdf

Palmer, S., & Holt, D. (2014). Development of student and academic staff perceptions of the elements of an online learning environment over time. *Australasian Journal of Educational Technology*, *30*(4). https://doi.org/10.14742/ajet.581

Papanikolaou, K., Makri, K., & Roussos, P. (2017). Learning design as a vehicle for developing TPACK in blended teacher training on technology enhanced learning. *International Journal of Educational Technology in Higher Education*, *14*(1). https://doi.org/10.1186/s41239-017-0072-z

Pareto, L., & Willermark, S. (2018). TPACK in Situ: a Design-Based approach supporting professional development in practice. *Journal of Educational Computing Research*, *57*(5), 1186–1226. https://doi.org/10.1177/0735633118783180

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.

Picciano, A. G. (2015). Research in online and blended learning: New challenges, new opportunities. In *Conducting research in online and blended learning environments* (pp. 1-11). Routledge.

Piskurich, G. M. (2015). *Rapid instructional design: Learning ID fast and right*. John Wiley & Sons.

Plomp, T. (2013). Educational design research: An introduction. *Educational design research*, 11-50.

Prasetya, D. D., Wibawa, A. P., Hirashima, T., & Hayashi, Y. (2020). Designing Rich Interactive Content for Blended Learning: A Case Study from Indonesia. *The Electronic Journal of e-Learning*, *18*(4). https://doi.org/10.34190/ejel.20.18.4.001

Precel, K., Eshet-Alkalai, Y., & Alberton, Y. (2009). Pedagogical and design aspects of a blended learning course. *The International Review of Research in Open and Distributed Learning*, *10*(2). https://doi.org/10.19173/irrodl.v10i2.618

Qian, Y., & Lehman, J. (2018). Using Technology to Support Teaching Computer Science: A Study with Middle School Students. *Eurasia Journal of Mathematics Science and Technology Education*, *14*(12). https://doi.org/10.29333/ejmste/94227

Reeves, T. C. (2005). Design-Based Research in Educational Technology: Progress Made, Challenges Remain. *Educational Technology*, *45*(1), 48–52. http://www.jstor.org/stable/44429189

Reidsema, C., Hadgraft, R., & Kavanagh, L. (2017). Introduction to the flipped classroom. In *Springer eBooks* (pp. 3–14). https://doi.org/10.1007/978-981-10-3413-8_1

Reinking, D. (2021). *Design-based research in education: Theory and applications*. Guilford Publications..

Riddle, M. (2022). Responding to the challenges of the OfS's blended learning review. Higher Education Policy Institute. Retrieved from https://www.hepi.ac.uk/2022/12/19/responding-to-the-challenges-of-the-ofs-blended-learning-review/

Rieber, L. P. (2012). A pragmatic view of instructional technology. In *The practice of constructivism in science education* (pp. 193-212). Routledge.

Robinson, K. (2010). Sir Ken Robinson: Bring on the learning revolution!.

Rienties, B., Divjak, B., Eichhorn, M., Iniesto, F., Saunders-Smits, G., Svetec, B., Tillmann, A., & Zizak, M. (2023). Online professional development across institutions and borders. *International Journal of Educational Technology in Higher Education*, *20*(1). https://doi.org/10.1186/s41239-023-00399-1

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2017). Universal Design for Learning: Guidelines for Accessible Online instruction. *Adult Learning*, *29*(1), 20–31. https://doi.org/10.1177/1045159517735530

Rosenberg, J. M., & Koehler, M. J. (2015). Context and Technological Pedagogical Content Knowledge (TPACK): a Systematic review. *Journal of Research on Technology in Education*, *47*(3), 186–210. https://doi.org/10.1080/15391523.2015.1052663

Rourke, L., & Kanuka, H. (2009). Learning in Communities of Inquiry: A Review of the Literature (Winner 2009 Best Research Article Award). *International Journal of E-Learning & Distance Education Revue Internationale Du E-Learning Et La*

Formation à Distance, *23*(1), 19–48. Retrieved from https://www.ijede.ca/index.php/jde/article/view/474

Rose, D. (2000). Universal design for learning. *Journal of Special Education Technology*, *15*(4), 47–51. https://doi.org/10.1177/016264340001500407

Sandoval, W. (2013). Conjecture Mapping: An approach to Systematic Educational design research. *Journal of the Learning Sciences*, *23*(1), 18–36. https://doi.org/10.1080/10508406.2013.778204

Sannino, A., & Engeström, Y. (2018). Cultural-historical activity theory: founding insights and new challenges. *Cultural-Historical Psychology*, *14*(3), 43–56. https://doi.org/10.17759/chp.2018140304

Scheiter, K., & Gerjets, P. (2007). Learner control in hypermedia environments. *Educational Psychology Review*, *19*(3), 285–307. https://doi.org/10.1007/s10648-007-9046-3

Selwyn, N. (2013). Education and 'the digital.' *British Journal of Sociology of Education*, *35*(1), 155–164. https://doi.org/10.1080/01425692.2013.856668

Shand, K., Glassett Farrelly, S. & Costa, V. (2016). Principles of Course Redesign: A Model for Blended Learning. In G. Chamblee & L. Langub (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 378-389). Savannah, GA, United States: Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.learntechlib.org/primary/p/172311/.

Sharp, R., Green, A., & Lewis, J. (2017). Education and social control. In *Routledge eBooks*. https://doi.org/10.4324/9781315210179

Shea, P., Richardson, J., & Swan, K. (2022). Building bridges to advance the Community of Inquiry framework for online learning. *Educational Psychologist*, *57*(3), 148–161. https://doi.org/10.1080/00461520.2022.2089989

Sibanda, T., & Josua, L. (2022). Covid-19 triggered technology integration strategies for enhanced student engagement in blended learning. *African Journal of Education and Practice*, *8*(5), 1-18.

Sierra, Á. a. J., Iglesias, J. M. O., Cabero-Almenara, J., & Palacios-Rodríguez, A. (2023). Development of the teacher's technological pedagogical content knowledge (TPACK) from the Lesson Study: A systematic review. *Frontiers in Education*, *8*. https://doi.org/10.3389/feduc.2023.1078913

Singh, H. (2021). Building effective blended learning programs. In *Advances in educational technologies and instructional design book series* (pp. 15–23). https://doi.org/10.4018/978-1-7998-7607-6.ch002

Song, G. (2021). Blended learning and student satisfaction. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3869741

Starr-Glass, D. (2021). Moving from passive to active blended learning. In *Advances in educational technologies and instructional design book series* (pp. 23–42). https://doi.org/10.4018/978-1-7998-7856-8.ch002

Stewart, M. K. (2017). Communities of Inquiry: a heuristic for designing and assessing interactive learning activities in Technology-Mediated FYC. *Computers & Composition/Computers and Composition*, *45*, 67–84. https://doi.org/10.1016/j.compcom.2017.06.004

Stockwell, B. R., Stockwell, M. S., Cennamo, M., & Jiang, E. (2015). Blended learning improves science education. *Cell*, *162*(5), 933–936. https://doi.org/10.1016/j.cell.2015.08.009

Su, F. (2019). Blended learning pedagogy in higher education. *The Encyclopedia of educational innovation*.

Suartama, I. K., Setyosari, P., Sulthoni, S., & Ulfa, S. (2019). Development of an instructional design model for mobile blended learning in higher education. *International Journal of Emerging Technologies in Learning (iJET)*, *14*(16), 4. https://doi.org/10.3991/ijet.v14i16.10633

Swan, K. (2021). The Community of Inquiry framework, online and blended learning, and the I2Flex classroom model. In *Advances in mobile and distance learning book series* (pp. 1–17). https://doi.org/10.4018/978-1-7998-7760-8.ch001

Szeto, E., & Cheng, A. Y. N. (2014). Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students' social presence experience? *Interactive Learning Environments*, *24*(3), 487–503. https://doi.org/10.1080/10494820.2014.881391

Tayag, J. R. (2020). Pedagogical support for blended learning classrooms: Interfacing teacher and student perspectives. *Universal Journal of Educational Research*, *8*(6), 2536–2541. https://doi.org/10.13189/ujer.2020.080637

Tertiary Education Quality and Standards Agency. (2020). Foundations for good practice: The student experience of online learning in Australian higher education during the COVID-19 pandemic. Retrieved from https://www.teqsa.gov.au/guides-resources/resources/sector-updates-and-alerts/foundations-good-practice-student-experience-online-learning-australian-higher-education-during-covid-19-pandemic

Terry, G., Hayfield, N., Clarke, V., & Braun, V. (2017). Thematic analysis. *The SAGE handbook of qualitative research in psychology*, *2*(17-37), 25.

Thamri, T., Hasan, D. C., Rina, N., Gani, M. H., Gani, M. H., & Miranda, A. M. (2022). Advantages and Disadvantages of online learning during the COVID-19 Pandemic: The perceptions of students at Bung Hatta University. *KnE Social Sciences*. https://doi.org/10.18502/kss.v7i6.10636

Thorne, S. L. (2000). Beyond bounded activity systems: Heterogeneous cultures in instructional uses of persistent conversation. In *Proceedings of the 33rd annual Hawaii international conference on system sciences* (pp. 11-pp). IEEE. https://doi.org/10.1109/HICSS.2000.926719

Tokmak, H. S., Yelken, T. Y., & Konokman, G. Y. (2013). Pre-service Teachers' Perceptions on Development of Their IMD Competencies through TPACK-based Activities. *Journal of Educational Technology & Society*, *16*(2), 243–256. http://www.jstor.org/stable/jeductechsoci.16.2.243

Tuffnell, C. (2021). Faculty learning communities: Supporting the development of online educators. Studies in Technology Enhanced Learning, 1(2). https://doi.org/10.21428/8c225f6e.2191c396

Tuffnell, C. (2023). Digital transformation of post-pandemic learning and teaching: Utilising TPACK to support educator development in a flipped learning pilot. Studies in Technology Enhanced Learning, 3(2). https://doi.org/10.21428/8c225f6e.6f043b79

Vaezi, H., Moonaghi, H. K., & Golbaf, R. (2019). Design-Based Research: definition, characteristics, application and challenges. *Journal of Education in Black Sea Region*, *5*(1), 26–35. https://doi.org/10.31578/jebs.v5i1.185

Valtonen, T., Sointu, E. T., Mäkitalo-Siegl, K., & Kukkonen, J. (2015). Developing a TPACK measurement instrument for 21st century pre-service teachers. *Seminar Net*, *11*(2). https://doi.org/10.7577/seminar.2353

Vaughan, N., & Garrison, D. R. (2006). How blended learning can support a faculty development community of inquiry. *Journal of Asynchronous Learning Networks*, *10*(4), 139-152.Vaughan, N. D., Cleveland-Innes, M., & Garrison, D. R. (2013). Teaching in blended learning environments: Creating and sustaining communities of inquiry. Athabasca University Press.

Vaughan, N. D., Cleveland-Innes, M., & Garrison, D. R. (2013). *Teaching in Blended Learning Environments: Creating and Sustaining Communities of Inquiry*. https://doi.org/10.15215/aupress/9781927356470.01

Vaughan, N. D., Reali, A., Stenbom, S., Van Vuuren, M. J., & MacDonald, D. (2017). Blended Learning From Design to Evaluation: International Case Studies of Evidence-Based Practice. *Online Learning*, *21*(3). https://doi.org/10.24059/olj.v21i3.1252

Volery, T., & Lord, D. (2000). Critical success factors in online education. *International Journal of Educational Management*, *14*(5), 216–223. https://doi.org/10.1108/09513540010344731

Voogt, J., Fisser, P., Roblin, N. P., Tondeur, J., & Van Braak, J. (2012). Technological pedagogical content knowledge – a review of the literature. *Journal of Computer Assisted Learning*, *29*(2), 109–121. https://doi.org/10.1111/j.1365-2729.2012.00487.x

Vygotsky, L. S. (2012). Thought and language. MIT Press.

Wang, Q., & Huang, C. (2017). Pedagogical, social and technical designs of a blended synchronous learning environment. *British Journal of Educational Technology*, *49*(3), 451–462. https://doi.org/10.1111/bjet.12558

Weinstein, Y., Sumeracki, M., & Caviglioli, O. (2018). Understanding how we learn. In *Routledge eBooks*. https://doi.org/10.4324/9780203710463

Wenger-Trayner, E., & Wenger-Trayner, B. (2015). Introduction to communities of practice: A brief overview of the concept and its uses.

Wicks, D. A., Craft, B. B., Mason, G. N., Gritter, K., & Bolding, K. (2014). An investigation into the community of inquiry of blended classrooms by a Faculty Learning Community. *The Internet and Higher Education*, *25*, 53–62. https://doi.org/10.1016/j.iheduc.2014.12.001

Willermark, S. (2017). Technological Pedagogical and Content Knowledge: A review of empirical studies published from 2011 to 2016. *Journal of Educational Computing Research*, *56*(3), 315–343. https://doi.org/10.1177/0735633117713114

Wong, K., Hwang, G., Goh, P. S. C., & Arrif, S. K. M. (2018). Effects of blended learning pedagogical practices on students' motivation and autonomy for the teaching of short stories in upper secondary English. *Interactive Learning Environments*, *28*(4), 512–525. https://doi.org/10.1080/10494820.2018.1542318

Wu, Y. T. (2013). Research trends in technological pedagogical content knowledge (TPACK) research: A review of empirical studies published in selected journals from 2002 to 2011. *British Journal of Educational Technology*, *44*(3). https://doi.org/10.1111/j.1467-8535.2012.01349.x

Wu, Xiuwen. (2010). Universal Design for Learning: A Collaborative Framework for Designing Inclusive Curriculum. *i.e.: inquiry in education: Vol. 1: Iss. 2, Article 6.* Retrieved from: https://digitalcommons.nl.edu/ie/vol1/iss2/6

Wynants, S., & Dennis, J. (2018). Professional Development in an Online Context: Opportunities and Challenges from the Voices of College Faculty. *The Journal of Educators Online*, *15*(1). https://doi.org/10.9743/jeo2018.15.1.2

Xu, S., Luo, H., & Tan, Y. (2018). Re-examining the community of inquiry framework from the perspective of learning analytics. In *2018 13th International Conference on Computer Science & Education (ICCSE)* (pp. 1-5). IEEE. https://doi.org/10.1109/ICCSE.2018.8468800

Yin, R. K. (2018). Case study research and applications.

Yuan, H., Rippetoe, J., Ding, L., Kang, Z., Shehab, R. L., & West, S. G. (2017, August). Universal design for learning in the framework of neuroscience-based education and Neuroimaging-based assessment. In *2017 2nd International Conference on Bio-engineering for Smart Technologies (BioSMART)* (pp. 1-4). IEEE. https://doi.org/10.1109/BIOSMART.2017.8095338

Zalavra, E., & Papanikolaou, K. (2019). Exploring the potential of the learning designer as a teacher support tool. *The Electronic Journal of e-Learning*, *17*(2). https://doi.org/10.34190/jel.17.2.04

Zawilinski, L., Shattuck, J., & Hansen, D. (2020). Professional Development to promote Active learning in the Flipped Classroom: A Faculty perspective. *College Teaching*, *68*(2), 87–102. https://doi.org/10.1080/87567555.2020.1753643

Zhao, S., & Song, J. (2022). Unpacking the emotional experiences of learners in a blended learning context. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.879696

Zhao, Y., Huen, J. M., & Prosser, M. (2017). Comparing perceived learning experiences of two concurrent cohorts under curriculum reform in Hong Kong. *Quality Assurance in Education*, *25*(3), 270–286. https://doi.org/10.1108/qae-11-2016-0070

Zinger, D., Naranjo, A., Amador, I., Gilbertson, N. & Warschauer, M. (2017). A Design-Based Research Approach to Improving Professional Development and Teacher Knowledge: The Case of the Smithsonian Learning Lab. *Contemporary Issues in Technology and Teacher Education, 17*(3), 388-410. Waynesville, NC USA: Society for Information Technology & Teacher Education. Retrieved from https://www.learntechlib.org/primary/p/178235/.