

**Teacher educators' infused approach to advance digital
competencies at a Faculty of Education**

by

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Declaration

I declare that the thesis, which I hereby submit for the degree MEd Computer Integrated Education at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.



.....

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March 2023

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Ethics statement

The author, whose name appears on the title page of this dissertation, has obtained, for the research described in this work, the applicable research ethics approval. The author declares that she has observed the ethical standards required in terms of the University of Pretoria's *Code of ethics for research* and *Policy and procedures for responsible research*.

Dedication

I dedicate this work to my parents. To my father, for always believing in my capabilities, for having taught me the value of perseverance ("maak klaar waarmee jy begin"), and for consistently showing interest in my Masters journey. To my mother, for always encouraging my creativity, for teaching me the joy of pursuing knowledge, and for always placing happiness at the core of life goals.

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Abstract

This research explored the experiences of five teacher educators at a Faculty of Education in South Africa in an initiative to advance digital competencies through an infused approach. The initiative focused on the digital competencies of pre-service teacher students; however, this study also viewed teacher educators' engagement as an informal professional development event. It investigated teacher educators' motivations, experiences, professional development, and second-order role in advancing digital competencies. A lack of research about teacher educators' teaching of digital competencies supported the rationale for the study. In an exploratory case study design, qualitative data was collected through semi-structured virtual interviews, document analysis, and field notes. The conceptual framework was based on Activity theory and augmented with Existence, Relatedness, and Growth (ERG) theory. The data was analysed using the six-phase reflective thematic analysis process of Braun and Clark. Teacher educators' motivations to engage in the initiative were found to be complex and dynamic, although the need for Growth and Relatedness from ERG theory played a key role. The research overlaid their actions during the initiative with the digital competencies of South Africa's Professional Development Framework for Digital Learning to illustrate their authentic engagement. From Activity theory, two tools were identified as crucial to the teacher educators' engagement: 'a structured way of work' and meetings. The identified challenges related to the measurement and accreditation of pre-service teachers' participation and the longevity of the initiative. The teacher educators showed notable development of their professional digital competence (PDC). Seven attributes of the initiative were identified to align it with a successful professional development event. Teacher educators were found to enact their second-order role in how they modelled digital competencies. The study concludes with a summative finding and visualisation on how teacher educators engaged in the initiative, which served as a theoretical contribution. It also included a methodological contribution and practical contributions on attaining higher engagement in such initiatives, teacher educators' digital competencies and PDC development, and the role of educational technology departments.

Key Terms:

Activity theory; Digital competencies; Digital competency development; ERG theory; Informal professional development; Infused approaches; Second-order teachers; Teacher education; Teacher educators

Language editor

Kim N Smit Editorial Services



Declaration of Professional Editing

30 March 2023

This letter serves to confirm that Ilse de Vries submitted an article to me for editing. The article is entitled, 'TEACHER EDUCATORS' INFUSED APPROACH TO ADVANCE DIGITAL COMPETENCIES AT A FACULTY OF EDUCATION'.

The following aspects were edited:

- Spelling
- Grammar
- Consistency of layout
- Sentence structure
- Logical sequencing
- References (Reference checking involves proofreading and perhaps some editing with regards to the simple formatting of the references into the referencing style required i.e. changing the order of the elements - author, date, title, series, place, publisher, journal, volume, issue, pagination etc.)

My involvement was restricted to language use and spelling, completeness and consistency, referencing style, and formatting of headings, captions and tables of contents. I did no structural re-writing of the content and did not influence the academic content in any way.

Should you have any further queries, please do not hesitate to contact me.

Kind regards,



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List of abbreviations

Abbreviation	Description
AI	Artificial Intelligence
CAQDAS	Computer-Assisted Qualitative Data Analysis Software
Activity	Existence, Relatedness, and Growth theory
ICT	Information and Communications Technology
LMS	Learning Management System
PDC	Professional Digital Competence
POPI Act	Protection of Personal Information Act
SAMR framework	Substitution, Augmentation, Modification, and Redefinition framework
SRQ	Secondary Research Question
TETCs	Teacher Educator Technology Competencies
TPACK framework	Technological, Pedagogical, and Content Knowledge framework

Concept clarification

Term	Definition
Badge activity	The badge activity is the activity (e.g. a task or project) that pre-service teachers had to complete to a set standard to be awarded a badge. The badge refers to digital badges on the university LMS. The badge activities are a result of the initiative explored in this study. Participating teacher educators either redesigned an existing curriculum component to incorporate digital competency development or assigned a badge to an activity that already incorporated technology.
Digital competencies	This concept encompasses a broad, constantly unfolding range of skills that evolved from the original notion of <i>digital literacy</i> . Multiple frameworks exist that outline and define the specific skills that most effectively serve the organisation or country's goals, and these will be referenced in the study where relevant.
Engaging in	To take part in something (Merriam-Webster.com, 2022)
Infused approach	A curriculum and teaching philosophy of “technology-infusion” (Foulger et al., 2019, p. 80) as opposed to stand-alone learning units to incorporate technological skills into teacher education courses.
Initiative	All the actions related to the Faculty of Education's effort to have teacher educators infuse digital competency development into their teaching.
Living lab	Open innovation networks that develop new solutions with the collaboration of diverse stakeholders (Pop, 2022).
Professional digital competence (PDC)	Digital capabilities of teachers; an early proposal for the main dimensions thereof for teacher educators specifically came from Ottestad et al. (2014): Generic digital competence, didactic digital competence, and professional-oriented digital competence.
SA framework	South Africa's Professional Development Framework for Digital Learning (Department of Basic Education, 2017).
Teacher educator	The term <i>teacher educator</i> is predominantly used in the literature and describes professionals dedicated to training both pre-service teachers and practising teachers (Even, 2012). This study will focus on the first group, i.e. teacher educators working in higher education.
To advance	With the aim of developing or improving, without assuming progress as a guaranteed result.

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1 CHAPTER 1: INTRODUCTION

1.1 Introduction

Just as humans developed skills to manage emotions and cognition to survive, they now require the competencies to thrive in the Fourth Industrial Revolution. Digital competency development, as much as technological access, has emerged as a discussion cornerstone (Ragnedda & Ruiui, 2021; Sesan, 2020; West et al., 2019). The need for improved digital competencies has far-reaching educational repercussions from how children are taught to workplace upskilling. This makes the teacher educator one of the most compelling actors in the advancement of digital competencies. They are second-order teachers that teach about teaching (Murray & Male, 2005). The researcher's visualisation in Figure 1-1 shows that their own professional digital competence (PDC) impacts, not only on the digital competencies of the pre-service teachers they train (Instefjord & Muntheb, 2017), but also indirectly on those of future pupils (Ghurbhurun, 2020; Ping et al., 2018).

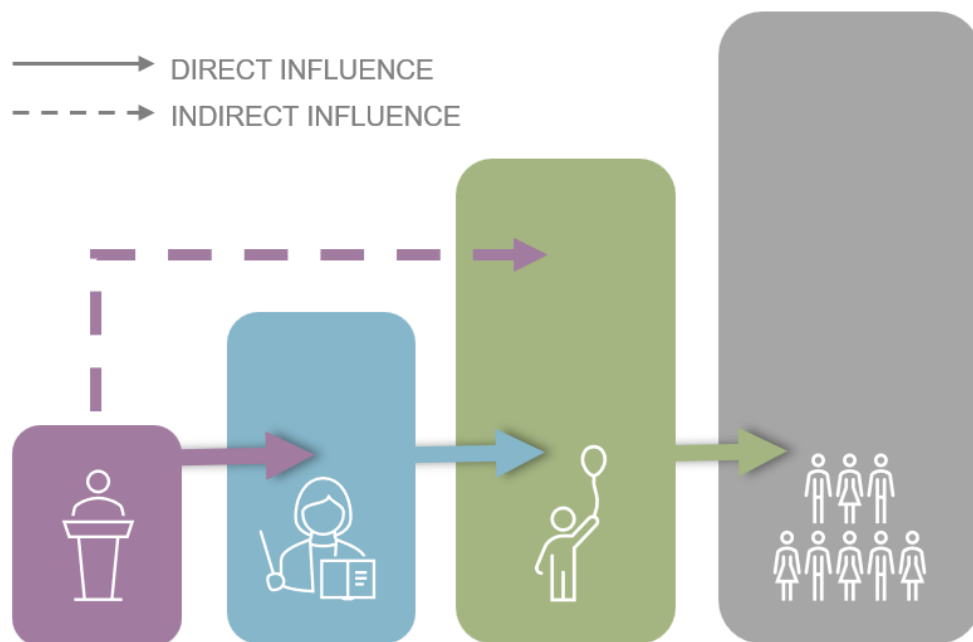


Figure 1-1 Teacher educators as second-order teachers and their impact on society

Source: Researcher

1.2 Background

As gatekeepers of pre-service teachers' technology-integration training (Tondeur et al., 2019), teacher educators need to deliver and model "equitable, high-quality technology experiences" (Foulger et al., 2017, p. 417). Infused approaches, instead of stand-alone technology modules, are increasingly being championed (Foulger et al., 2019). The practical consequence of a technology infusion approach could be that digital elements are no longer contained in isolated modules and assigned to university teachers with suitable technological competencies. Instead, the strategy appeals to all teacher educators to find ways of infusing the teaching of digital competencies into their teaching practices, content delivery, and assessment. This implies that these teacher educators should themselves have, or develop, these digital competencies and be able to teach them.

Such an infused approach is being implemented at a South African Faculty of Education, referred to throughout the study as "the initiative". The initiative guides teacher educators to take an existing third- and fourth-year curriculum component, such as an activity or a project, and change it so that it incorporates the learning of competencies from South Africa's Professional Development Framework for Digital Learning (Department of Basic Education, 2017). The adjusted curriculum component is then loaded onto the university learning management system (LMS) and pre-service teachers are awarded a digital badge for completing it to the required standards. The initiative is voluntary and its goal is to advance the digital competencies of pre-service teachers through technology infusion (Foulger et al., 2019). Although the initiative is not officially positioned as professional development for the teacher educators, it can be seen as an example of informal professional learning.

1.3 Problem statement

Studies show that the digital competencies of university lecturers in general are lacking (Fernández-Batanero et al., 2021; Guillén-Gámez et al., 2020). Research further indicates a pronounced gap in targeted and sufficient training to equip university lecturers with the required digital competencies (Cabero-Almenara et al., 2021; Fernández-Batanero et al., 2021; Guillén-Gámez et al., 2020). The question can then be asked how teacher educators, a specific group of university lecturers, fare in terms of their own digital competencies and their ability to teach them.

There is, however, a considerable lack of research in this area. How teacher educators infuse the teaching of digital competencies into their curriculum is a fairly new academic focus (Ottestad et al., 2014). It can be seen as a specialised topic within the broader field of teacher educators and their relationship with technology integration.

We require a deeper understanding of teacher educators' ability to act as models for pre-service teachers' digital competency development (Admiraal et al., 2017; Instefjord & Muntheb, 2017). There is also a critical lack of knowledge on teacher educators' role as second-order teachers in incorporating digital components into education (Lindfors et al., 2021; Uerz et al., 2018).

This connects to the need for research about teacher educators' own professional digital competence (PDC) (Baran et al., 2019; Lindfors et al., 2021). These studies should apply a healthy scepticism to technology to better implement it in higher education (Castañeda & Selwyn, 2018). This can be done by framing teacher educators' PDC in 'problematic' instead of 'celebratory' terms, as is often the case (Castañeda & Selwyn, 2018). Such research also needs to be reflective to avoid reinforcing policymakers' intent and inadvertently assigning blame to teacher education (Lindfors et al., 2021). Specific research is also lacking with regards to the link between teacher educators' technology competencies and their professional roles, and how to balance their formal and informal PDC development (Gondwe, 2021).

1.4 Rationale

The researcher agrees with Ragnedda and Ruiu (2021) who state that the ability to use Information and Communications Technologies (ICTs) well is a "civic right". For this reason, teacher educators' role in advancing digital competencies through teachers to the younger generation is a worthwhile research focus. The researcher also specialises in professional development and is intrigued by how digital competency development evolves in the workplace. This makes the study compelling because it will enable the researcher to gain a deeper knowledge of how digital competencies are internalised and transferred by teacher educators. There have also been abundant calls for further exploration of how teacher educators integrate the teaching of digital competencies into their curriculum (Admiraal et al., 2017; Baran et al., 2019; Instefjord & Muntheb, 2017; Lindfors et al., 2021; Uerz et al., 2018). The study envisioned helping (1) teacher educators to become more reflective in

developing their PDC, and (2) heads of faculty in supporting these teacher educators through professional development.

1.5 Purpose of the study

The purpose of this study was to explore teacher educators' engagement in an initiative to advance teachers' digital competencies – those of pre-service teachers and, through informal learning, their own – at a Faculty of Education in South Africa. The faculty's initiative was a good vehicle to explore teacher educators' motivations, experiences, and perceived effects on their professional development, including their PDC. The study also looked at how teacher lectures perceive their role as second-order teachers in advancing the digital competencies of future pupils. The completed study produces a summative finding and visualisation on how these teacher educators engaged in the initiative.

1.6 Research questions

1.6.1 Primary research question

How do teacher educators engage in an infused approach to advance digital competencies at a Faculty of Education?

1.6.2 Secondary research questions (SRQs)

1. What motivates teacher educators to engage in the Faculty of Education's infused approach to advance digital competencies?
2. How do teacher educators experience engagement in the initiative in terms of the process, tools, support, and challenges?
3. How does the engagement in the faculty's initiative impact on teacher educators' views of their own professional development?
4. How do teacher educators perceive their role and responsibility as second-order teachers in advancing digital competencies?

1.7 Delineations and assumptions

The study focused on teacher educators at a Faculty of Education in Gauteng, South Africa that took part in a specific infused approach to advance digital competencies. The faculty has been running the initiative since 2019 and participation is voluntary. Teacher educators engaging in the initiative specialise in a variety of subjects from the third- and fourth-year curriculum. The assumption was made that exploring teacher

educators' experiences with this initiative was the best way to investigate teacher educator practises to advance digital competencies in an infused approach.

1.8 Overview of the literature review

Relevant literature is discussed in Chapter 2 in three sections, with multiple authors' work contributing to the researchers' understanding of the topic (included in brackets below).

(1) Digital competency development in teacher education, which looks at the evolving concept of digital competencies in teacher education and the approaches and educational frameworks addressing it (Ala-Mutka, 2011; Department of Basic Education, 2017; Foulger et al., 2019; Herro et al., 2021; Ilomaki et al., 2016; McGarr & McDonagh, 2019; Mishra & Koehler, 2006; Redecker & Punie, 2017; Spante et al.).

(2) The digital competencies of teacher educators, which focuses on relevant frameworks, teacher educator digital competencies, expectations placed on them, and their experiences with digital competency development (Admiraal et al., 2017; Amhag et al., 2019; Avidov-Ungar & Forkosh-Baruch, 2018; Boyd et al., 2021; Department of Basic Education, 2017; Foulger et al., 2017; Foulger et al., 2019; Fulgence, 2020; Gondwe, 2021; Heinonen et al., 2019; Herro et al., 2021; Instefjord & Muntheb, 2017; Lindfors et al., 2021; Murray et al., 2020; Murray & Male, 2005; Skantz-Åberg et al., 2022; Uerz et al., 2018; Viberg et al., 2019).

(3) Professional development of teacher educators, which includes the nature of their professional development, the need for it, recommendations and recommendations relating to it, and institutions' approaches (Amhag et al., 2019; Boyd et al., 2021; Cochran et al., 2020; Czerniawski et al., 2017; Fulgence, 2020; Gondwe, 2021; Herro et al., 2021; Kelchtermans et al., 2018; Lindfors et al., 2021; MacPhail et al., 2019; Murray et al., 2020; Parrish & Sadera, 2019; Ping et al., 2018; Uerz et al., 2018; Vanderlinde et al., 2017; Viberg et al., 2019; White et al., 2021).

These sections are followed by the conceptual framework and gaps in the literature.

1.9 Conceptual framework

The conceptual framework is based on second-generation Activity theory (Engeström, 1987; Leont'ev, 1978), chosen for its ability to explore human activities as mediated by their tools and communities. The **Object** element is augmented with the three

elements of Existence, Relatedness, and Growth (ERG) theory (Alderfer, 1969), **Existence**, **Relatedness**, and **Growth**, to more effectively explore the motivation of the teacher educators.

1.10 Research design

This qualitative research is an explorative case study with a single case and cross-sectional design. It mainly followed an inductive approach with elements of deduction. Five research participants were chosen through purposeful sampling, and data was collected using three instruments: semi-structured virtual interviews, field notes, and document analysis. The data from the interview transcripts, document analysis, and field notes was processed using thematic analysis.

1.11 Outline of the research

Chapter 1 introduces the research and provides the background, problem statement, rationale, purpose of the study and the primary and four secondary research questions. This is followed by the study's delineations and assumptions, an overview of the literature study, the conceptual framework, the research design, and an outline of the research.

Chapter 2 discusses the literature in three components, i.e. digital competency development in teacher education, the digital competencies of teacher educators, and teacher educators' professional development. This chapter then presents the study's conceptual framework, illuminates the gaps in the literature, and concludes with a visualisation using the artificial intelligence (AI) visualisation tool DALL·E 2.

Chapter 3 describes the methodology followed in the study, from its philosophical underpinnings, approach, and research strategy to its sampling and collection and data analysis process. It also includes the research alignment and quality assurance.

Chapter 4 introduces the results and findings in 14 themes. It is laid out according to the elements in the research's conceptual framework.

Chapter 5 presents the study's conclusions, contributions, limitations, recommendations, and researcher reflections. A summative finding and visualisation address the research questions.

1.12 Conclusion

This chapter introduces the study by providing the background, the problem statement, the rationale, and the purpose statement. Thereafter it presents the primary research question with its four secondary research questions. It further summarises the delineations and assumptions of the study and provides an overview of the literature study, the conceptual framework, and the research design. It concludes with an outline of the research chapters.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Outline of the literature review

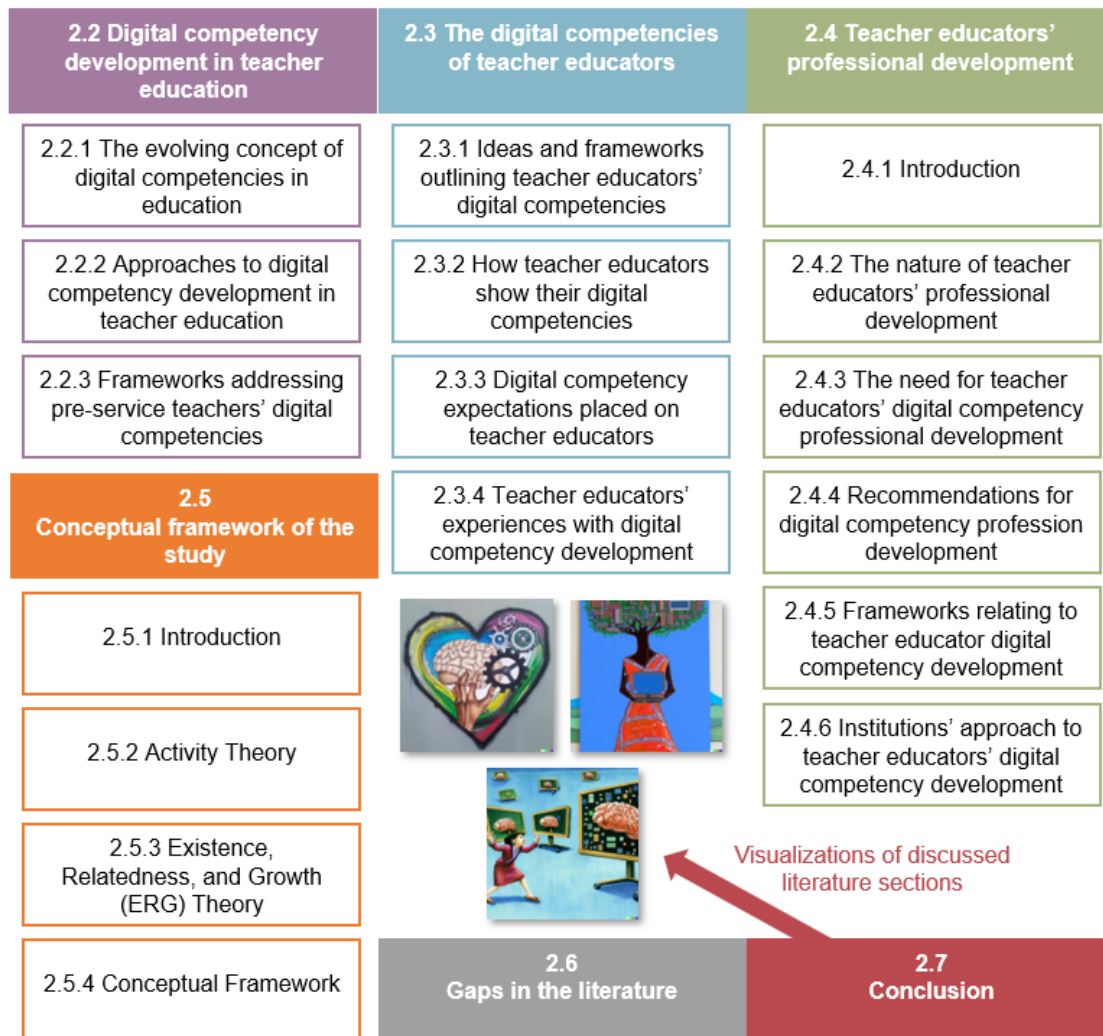


Figure 2-1 Visualisation of Chapter 2 components

Source: Researcher

2.1.1 Introduction

Figure 2-1 shows the outline of this chapter, starting off with three sections discussing the literature. This is followed by the study's conceptual framework (2.5) and the gaps in the literature (2.6). The chapter concludes with a visualisation using DALL·E 2, an AI visualisation tool (2.7).

The very nature of technology makes digital competency in education a rapidly changing and growing arena. It is, therefore, crucial to focus on the most recent studies. Since teacher educators' digital competencies is a fairly new research area (Uerz et al., 2018), slightly older studies that proved pre-eminent were included. It was

found that the bulk of the research done on digital competency development in teacher education at higher education institutions examines pre-service teachers' experiences. Researchers focusing on teacher educators repeatedly emphasized the need for more academic exploration of this distinct professional population (Admiraal et al., 2017; Baran et al., 2019; Czerniawski et al., 2017; Instefjord & Muntheb, 2017; Lindfors et al., 2021; Ottestad et al., 2014; Uerz et al., 2018). The components of Chapter are visualised in Figure 2-1.

2.1.2 Three sections discussing the literature

The literature review first explores relevant research, which is done in three sections. First, the scene is set by looking at **digital competency development in teacher education** (2.2). This is done by tracking the evolution of the concept of digital competencies through a general framework by Ala-Mutka (2011) and the work of Ilomaki et al. (2016), Spante et al. (2018), and McGarr and McDonagh (2019). Research by Foulger et al. (2017) and Herro et al. (2021) informs current approaches to digital competency development in teacher education and three relevant educational frameworks are explored: the TPACK model (Mishra & Koehler, 2006), the DigCompEdu framework (Redecker & Punie, 2017), and the Professional Development Framework for Digital Learning (Department of Basic Education, 2017). The last two frameworks are also compared with the Ala-Mutka (2011) model.

The review then shines the spotlight on the **digital competencies of teacher educators** (2.3). It first explores the ideas and frameworks of teacher educators' digital competencies by (1) showing a correlation between the four teacher educator competency domains of Uerz et al. (2018) and the work of Gondwe (2021) and Skantz-Åberg et al. (2022), and (2) introducing the Teacher Educator Technology Competencies (TETCs) (Foulger et al., 2017) and comparing it with the Professional Development Framework for Digital Learning (Department of Basic Education, 2017). The work of the following authors is then used to investigate teacher educators' showcasing, expectations, and experiences related to their digital competencies, as well as institutions' approaches: Admiraal et al. (2017), Amhag et al. (2019), Avidov-Ungar and Forkosh-Baruch (2018), Boyd et al. (2021), Department of Basic Education (2017), Foulger et al. (2017), Foulger et al. (2019), Fulgence (2020), Heinonen et al. (2019), Herro et al. (2021), Instefjord and Muntheb (2017), Lindfors et al. (2021),

Murray et al. (2020), Murray and Male (2005), Uerz et al. (2018), and Viberg et al. (2019).

Next, the literature review takes a deep dive into **the professional development of teacher educators** (2.4). Their general professional development is illuminated through the work of Boyd et al. (2021), Cochran et al. (2020), Czerniawski et al. (2017), MacPhail et al. (2019), Murray et al. (2020), Ping et al. (2018), and White et al. (2021); while their development of digital competencies are explored through the research by Amhag et al. (2019), Fulgence (2020), Herro et al. (2021), Lindfors et al. (2021), Parrish and Sadera (2019), Uerz et al. (2018), and Viberg et al. (2019). Three frameworks related to teacher educators' digital competency development are looked at: the InFo-TED model of teacher educator professional development (Kelchtermans et al., 2018), nine design principles shaping teacher educators' learning (Vanderlinde et al., 2017), and the teacher educator technology professionalism framework (Gondwe, 2021).

2.1.3 Frameworks included in the literature review

Eight frameworks related to digital competencies are discussed in the literature review. One framework looks at societal digital competencies, three address digital competencies of teachers, and another four relate to the digital competencies of teacher educators specifically (Table 2-1). The various frameworks position teacher educators' professional practise within digital competency development.

Framework	Focus	Section
Model by Ala-Mutka (2011)	Society's digital competencies	2.2.1
TPACK model (Mishra & Koehler, 2006)	Teacher digital competencies (i.e. pre-service teachers)	2.2.3.1
European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker & Punie, 2017)	Teacher digital competencies (i.e. pre-service teachers)	2.2.3.2
Professional Development Framework for Digital Learning (Department of Basic Education, 2017)	Teacher digital competencies (i.e. pre-service teachers)	2.2.3.3
Teacher Educator Technology Competencies (TETCs) (Foulger et al., 2017)	Teacher educator digital competencies	2.3.1.2
InFo-TED model of teacher educator professional development (Kelchtermans et al., 2018)	Teacher educator digital competency development	2.4.5.1
Nine design principles that can shape teacher educators' personalised and workplace learning (Vanderlinde et al., 2017).	Teacher educator digital competency development	2.4.5.2
Teacher educator technology professionalism framework (Gondwe, 2021)	Teacher educator digital competency development	2.4.5.3

Table 2-1 List of digital competency frameworks in the literature review

2.2 Digital competency development in teacher education

This section discusses the literature related to the evolving concept of digital competencies in education; approaches to digital competency development in teacher education; and frameworks addressing pre-service teachers' digital competencies.

2.2.1 The evolving concept of digital competencies in education

From the earliest research about technology in educational contexts, there have been attempts to describe and name the skillset required to navigate the new realities made possible by technology (Ilomaki et al., 2016; McGarr & McDonagh, 2019; Spante et al., 2018). Originally, the word 'literacy' was used to create terms such as information literacy, computer literacy, and digital literacy (Bawden, 2001). As interest in the topic grew and the literature expanded, articulation of this idea diversified and evolved to include the terms digital fluency, digital capabilities, digital competence, and digital competencies (Fulgence, 2020; McGarr & McDonagh, 2019).

Many reasons have been posited for the range of terms, e.g. to account for fast changing technology, to shift the focus from devices and content to skills, to move away from just skills to include broader dimensions, to achieve a higher level of status and recognition, and to identify it as a social practise as well as a skill (McGarr & McDonagh, 2019). The terms are generally related and used interchangeably (Fulgence, 2020), sometimes even in the same article (Ilomaki et al., 2016). The changing terms, however, often only reflect surface level changes rather than representing fundamental new ways of thinking (McGarr & McDonagh, 2019). This echoes a comment by Herro et al. (2021) that it is more the idea rather than the practice of technology-enabled learning that is gaining momentum. This implies a disconnect between technology use inside the classroom and in the real world.

The progression to 'competence' or 'competencies' reflects a widening of what needs to be included in the concept, e.g. attitudinal aspects and critical thinking skills (McGarr & McDonagh, 2019). In Figure 2-2, the researcher visualised the rise of the term 'digital competence' in comparison with 'digital literacy' over a period of two years, with dark orange indicating the most prevalent terms. A study by Ilomaki from 2016 ranked the prevalence of related terms as follows: digital literacy, new literacies, media literacy, multiliteracies, and digital competence. The latter was then described as an emerging term in the literature (indicated with a dotted line). In 2018, a literature review (Spante

et al.) found that, while the term ‘digital literacy’ skill dominated global studies, ‘digital competence’ was steadily gaining ground (light orange). It was also by far the most common term used in European research (bright orange). Grey indicates how the term ‘digital literacy’ had fallen out of favour in European studies.

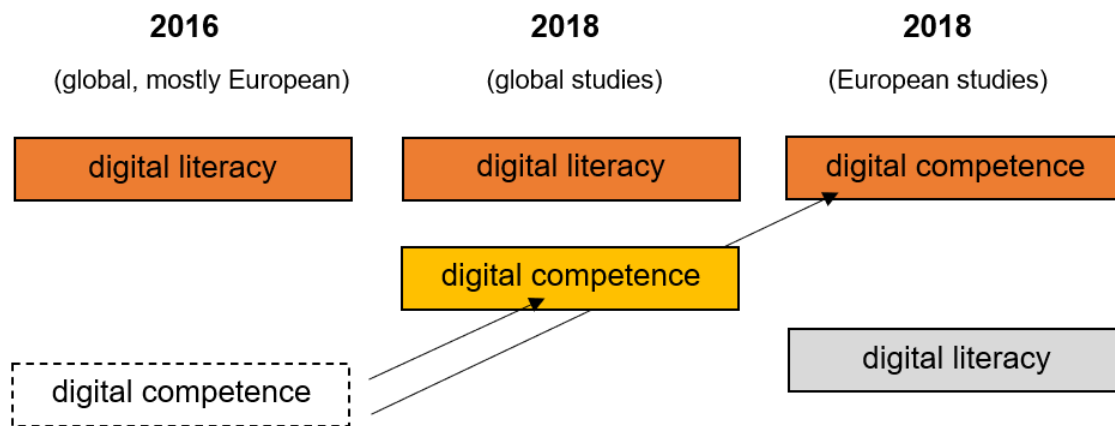


Figure 2-2 Comparing the prevalence of ‘digital literacy’ and ‘digital competence’

Source: Researcher, adapted from Ilomaki et al. (2016) and Spante et al. (2018)

There have been abundant attempts to capture the components of digital competence, which ranged from complex descriptions of its dimensions to frameworks that consider organisational knowledge and skills requirements (McGarr & McDonagh, 2019). Few of these, however, adequately incorporate the media component or take into account the broader implications of digitised life, such as echo chambers. It is telling that McGarr and McDonagh (2019) fairly recent publication goes on to cite a decade-old model (Ala-Mutka, 2011) from a European Union publication as the then most comprehensive representation of the intersection between information, digital, and media literacies. Ala-Mutka (2011) acknowledges that even this high-level framework is only a first step and suggests that it might be impossible to reach an “all-encompassing widely applicable and agreed single definition” (p. 53) of digital competence. In section 2.2.3.4, the researcher compares this model with the DigCompEdu model (Redecker & Punie, 2017) and South Africa’s Professional Development Framework for Digital Learning (Department of Basic Education, 2017) to see how closely this model aligns with current educational frameworks. This model by Ala-Mutka (2011) is shown in Figure 2-3.

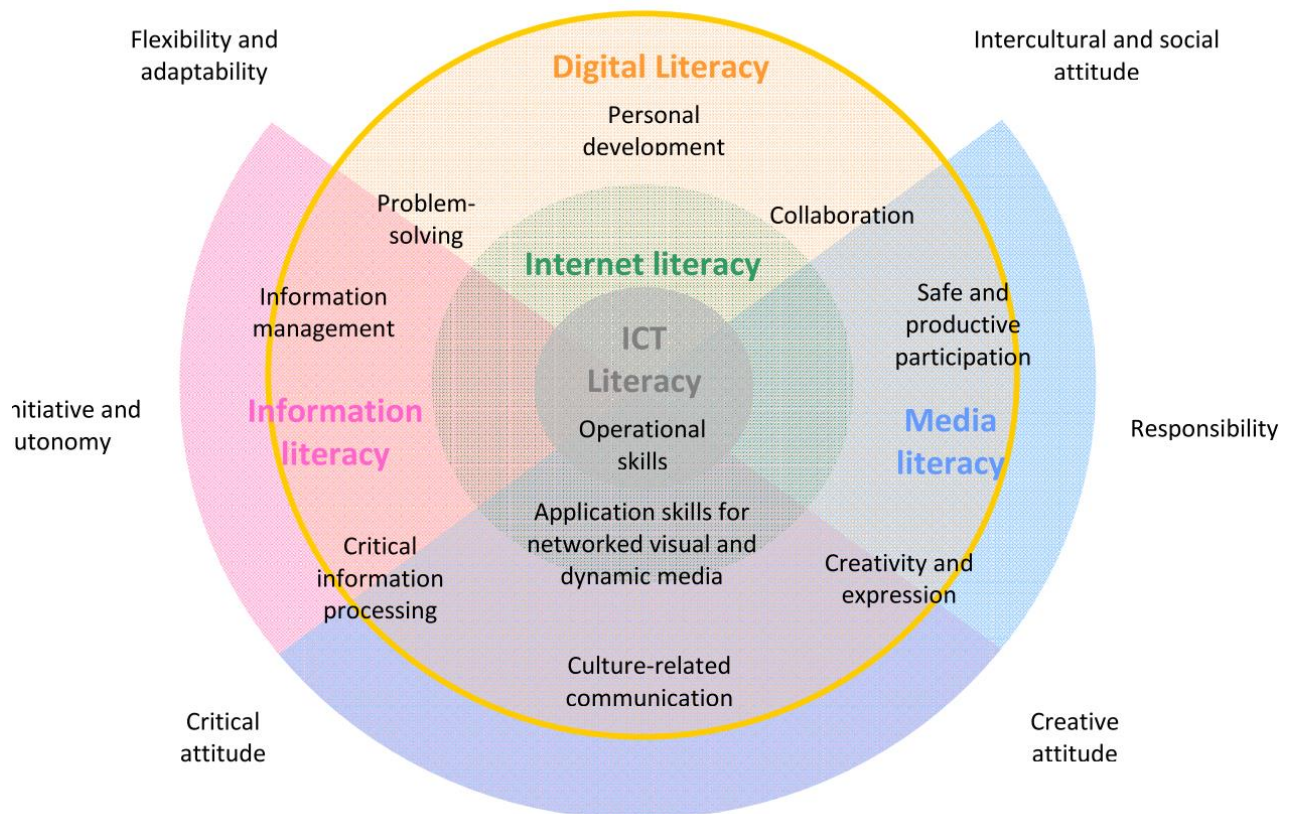


Figure 2-3 Digital competence landscape for the 21st century

Source: Ala-Mutka (2011)

2.2.2 Approaches to digital competency development in teacher education

In 2014, Røkenes and Krumsvik identified eight ways pre-service teachers' digital competencies were being developed in higher education: collaboration, metacognition, blending, modelling, authentic learning, student-active learning, assessment, and bridging theory/practice gap. Since then, there has been a move towards specific digital competency frameworks (see section 2.2.3) and approaches to pre-service teachers' digital competency development. Herro et al. (2021) call for programmes to be redesigned because even innovative teacher education departments fail to offer pre-service teachers appropriate and consistent technology experiences. This will require allocated time to re-evaluate the curriculum and course materials and enable the successful integration of digital competency components (Fulgence, 2020).

2.2.3 Frameworks addressing pre-service teachers' digital competencies

Digital competency development is now a prominent part of teacher education because of the critical role of teachers in encouraging technology use (Instefjord & Muntheb, 2017). Despite the strong focus on teachers, however, Skantz-Åberg et al. (2022) found that the concept of teachers' digital competencies is elusive, ambiguous, and rarely described in detail in research. McGarr and McDonagh (2019) suggest three reasons for this, namely (1) the quick pace of technological innovation, (2) the historical reliance of educational technology courses on the available skills and resources, and, most compellingly, (3) the need for greater consensus about the balance between technical, professional, and pedagogical facets.

Various models have been proposed to help teachers navigate the expectations around their digital competencies. Three frameworks have been selected and discussed as an overview of what such models can offer teachers and the faculties supporting them. The first is one of the early models that helped teachers incorporate the emerging digital world into their teaching, and arguably the most ubiquitous: the TPACK model by Mishra and Koehler (2006). This is followed by a look at an influential regional framework, the European DigCompEdu (Redecker & Punie, 2017). Lastly, South Africa's Professional Development Framework for Digital Learning (Department of Basic Education, 2017) provides insight into local digital competency requirements for teachers.

2.2.3.1 TPACK model

The TPACK model was not created to address digital competencies directly. It did, however, provided an accessible, and much needed, starting point for teachers to consider the skills that they needed to bring to the traditional teaching mix (pedagogical and content knowledge). It has been instinctually understood by teachers due to its simple, though not simplistic, nature (Henderson, 2020).

The model consists of three overlapping circles, with one representing a teacher's Technology Knowledge, i.e. skills required to operate particular technologies (Mishra & Koehler, 2006). Where this circle overlaps with the other two circles, representing Content Knowledge and Pedagogical Knowledge respectively, it creates two additional knowledge domains: Technology Content Knowledge, which makes more varied representations of the subject matter possible; and Technology Pedagogical

Knowledge, which is the understanding of educational technology (Mishra & Koehler, 2006). Finally, an inner domain is created by the overlap of all three circles, namely the Technology Pedagogical Content Knowledge. It is true that this framework originated from the need to bring technology into education (Mishra & Koehler, 2006), rather than with the intent to advance the technology skills of the learners of these TPACK-empowered teachers. This inner facet, however, can be seen as an attempt to express a more holistic approach to how digital components are incorporated into education (Mishra & Koehler, 2006). This makes it comparable to more current digital competency models. The model appears in Figure 2-4.

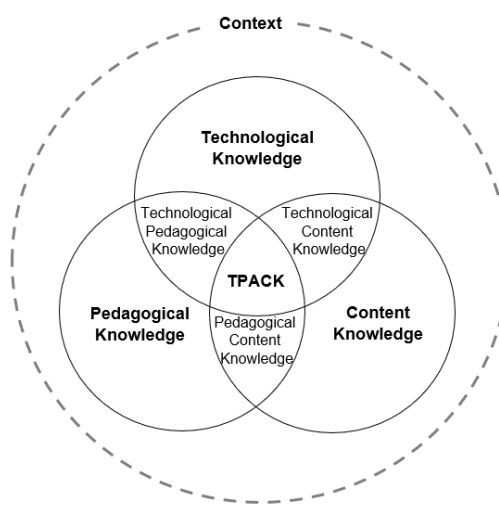


Figure 2-4 TPACK model

Source: Recreated from the original by Mishra and Koehler (2006)

TPACK has brought about wide scale change for teacher professional learning because schools have enthusiastically been adapting the framework to their unique needs (Harris, 2020). It has been used both as a connector – to combine various types of training, and a balancer – to avoid technocentric training (Harris, 2020). This corresponds to the way existing digital competency models advocate an infused approach (Foulger et al., 2019).

While Mishra (2020) cautions that the model should not be over assigned aspects that it was not built for, such as ensuring equity and access, the model continues to be used in current research. In March 2023, a search was done for the title words “TPACK” and “digital” on Harzings’ Publish or Perish, a tool that analyses citations of

academic studies (Harzing, 2022). It yielded almost 90 results for studies published between 2018 and 2023 when searched under Google Scholar alone.

2.2.3.2 DigCompEdu framework

The European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker & Punie, 2017) is the main driver of teacher-specific digital competence in European educational contexts. It consists of six main elements within three overarching categories: educators' professional competencies, educators' pedagogical competences, and learners' competencies, as shown in Figure 2-5.

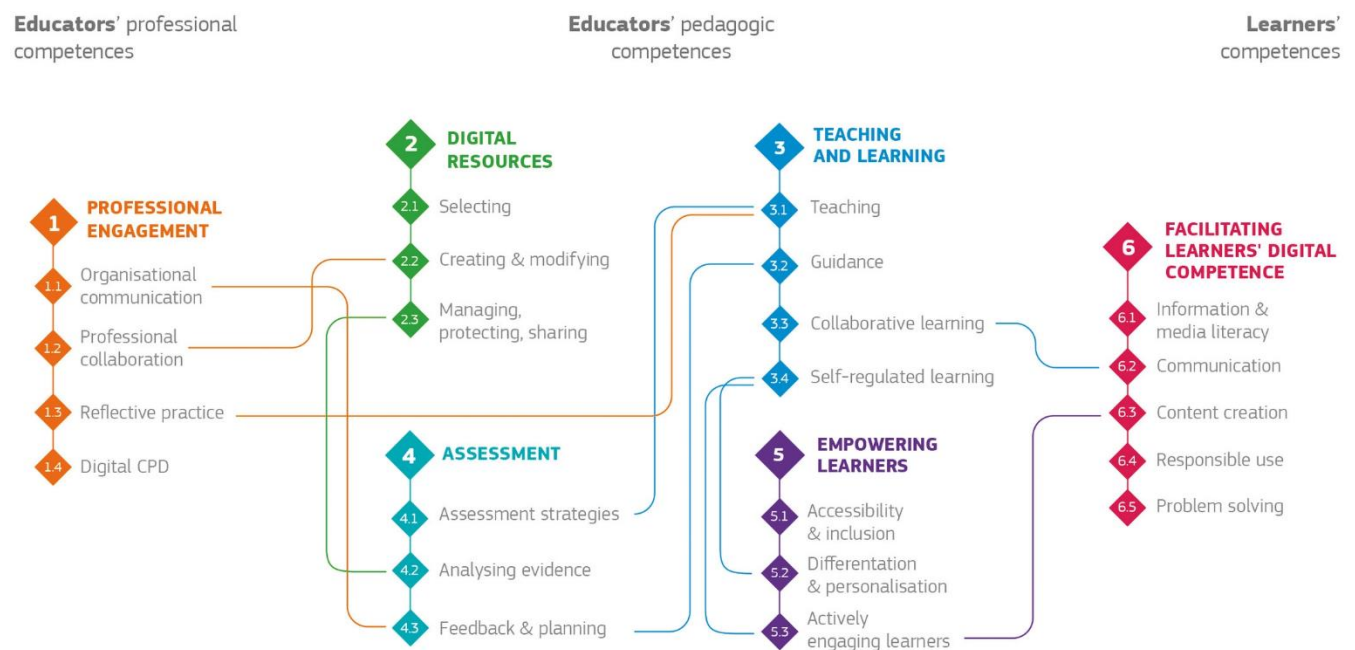


Figure 2-5 The DigCompEdu framework

Source: Redecker and Punie (2017)

When comparing it with TPACK on a surface level, one can see that Sections 2 (digital resources), 3 (teaching and learning), and 4 (assessment) have similar outcomes to what can be achieved through using TPACK. DigCompEdu's main differentiation, however, is how it incorporates teacher's professional engagement and facilitates learner's digital competence. Another notable contrast is that TPACK is value neutral and instead demands these deeper values from the community in which the teaching is situated (Mishra, 2020). DigCompEdu, on the other hand, enshrines the values of access and inclusivity in section 5's 'Empowering learners' component (Redecker & Punie, 2017). Henderson (2020) note that TPACK's later inclusion of the contextual dotted line serves as a reminder to stakeholders to consider aspects beyond the three

‘knowledge’ circles, such as values. DigCompEdu is compared in-depth with two other frameworks later in this section.

2.2.3.3 Professional Development Framework for Digital Learning

In South Africa, the Professional Development Framework for Digital Learning exists to “define professional development for digital learning in an education system that seeks to improve access, quality, equity, redress and efficiency” (Department of Basic Education, 2017, p. 9). This excerpt ties in well with the previous discussion of values in frameworks aimed at digital competency advancement and shows that local values were intrinsic in the design of this framework. While acknowledging the challenges of their very specific socio-economic context, the representatives of this framework hold that these can be mitigated by empowering teachers to use digital tools and resources in their teaching.

Table 2-2 shows this framework, which outlines 13 competencies in three key areas: personal growth and knowledge, curriculum focused, and leadership. As an important framework in the context of this research study, it will be compared with various other frameworks in this and following sections, including the Teacher Educator Technology Competencies (TETCs). For the purposes of easy comparison, this framework will be referred to as the ‘SA framework’.

PROFESSIONAL GROWTH AND KNOWLEDGE	
1	Adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources.
2	Be reflective about challenging current digital learning and teaching practice.
3	Understand the role of the teacher, the learner and the digital resources during digital learning.
4	Participate in local and global professional learning communities.
5	Select appropriate digital tools and resources when fulfilling the roles of the educator.
CURRICULUM FOCUS	
6	Integrate digital tools and resources to enhance learning objectives in various learning environments.
7	Develop learners’ global awareness and understanding using digital communication and collaboration tools.
8	Transform learning through the innovative use of digital tools and resources.
9	Enhance class management, assessment and feedback processes through the use of digital resources.
10	Integrate learners’ skills development in terms of digital literacies with curriculum-based learning.
LEADERSHIP	
11	Demonstrate commitment to the vision for digital learning in the province, district and school.
12	Accept responsibility for planning and implementing digital learning at the school.
13	Initiate peer support and collaborative, work-place learning.

Table 2-2 Professional Development Framework for Digital Learning

Source: Department of Basic Education (2017)

2.2.3.4 Comparisons between frameworks

The researcher compared the DigCompEdu and the SA framework to the earlier model of Ala-Mutka (2011) by replacing the word ‘literacy’ in the latter with ‘competency’. Although the Ala-Mutka model was crafted for broader application, such as societal change, instead of specifically for formal educational contexts, it was possible to interpret it meaningfully in the context of teachers’ professional practices. The purpose was to identify (1) how the digital competency vision of the Ala-Mutka model compares to newer, more specialised versions, and (2) how the two educational frameworks compare with each other. Seven categories for comparison were identified, as outlined in Table 2-3.

Comparison category	Model of Ala-Mutka (2011)	DigCompEdu (2017)	SA Framework (2017)
Application	Broader societal change	Teacher-specific competence in European educational contexts	Digital professional learning for South African teachers
Professional development	Personal development (part of Digital Literacy)	Digital continued professional development	First five competencies as part of “Professional Growth and Knowledge”
Collaboration	Collaboration (part of Digital and Media Literacy)	Professional collaboration	Participate in local and global professional learning communities (#4)
Reflection	Critical attitude; Flexibility and adaptability; Intercultural and social attitude	Reflective practise	Be reflective about challenging current digital learning and teaching practice (#2); Transform learning through the innovative use of digital tools and resources (#8)
Digital resources	Operational skills (part of ICT literacy); Application skills for networked visual and dynamic media (part of internet literacy)	Selecting; creating and modifying; managing, protecting, sharing of digital resources	Select appropriate digital tools and resources when fulfilling the roles of the educator (#5); Integrate digital tools and resources to enhance learning objectives in various learning environments (#6), Transform learning through the innovative use of digital tools and resources (#8)
Values and attitudes	Six values appearing at the outer edge of circular design to be applied to all aspects of the model	Built into the elements of ‘Accessibility and inclusion’, ‘Responsible use’, and ‘Reflective practice’	Incorporated in the intentions of each competency as articulated through its specific indicators, e.g. 10.4 (safe, legal and ethical use)
Unique elements	Explicit mention of cultural considerations	Accentuates assessment in own category	Includes digital leadership in competencies 11, 12, and 13

Table 2-3 Comparing the Ala-Mutka, DigCompEdu, and SA frameworks

Sources: Ala-Mutka (2011; Department of Basic Education (2017); Redecker and Punie (2017)

Table 2-3 shows the five core similarities identified in the three frameworks (professional development, collaboration, reflection, digital resources, and values and attitudes) and how each similarity is uniquely expressed in each framework. The top and bottom row differentiate the frameworks through their application and unique elements.

2.3 The digital competencies of teacher educators

Research about teacher educators as a discrete population has only been available from the turn of the 21st century (Lunenberg et al., 2014). Research into their experiences relating to digital competency development can, therefore, be seen as an emerging field. This section explores digital competency ideas and frameworks specifically aimed at teacher educators (as opposed to those aimed at all teachers); how teacher educators show their digital competencies; digital competency expectations placed on teacher educators; and teacher educators' experiences with digital competency development. The last part is divided into teacher educators' professional identity, including their position as second-order teachers; their role modelling function; and their attitudes and beliefs.

2.3.1 Ideas and frameworks outlining teacher educators' digital competencies

The frameworks addressing teachers' digital competencies, outlined in section 2.2.3 and compared in Table 2-3, can also be used to guide teacher educators' digital competencies. It is, however, important to keep in mind that teacher educators play a unique role in the educational ecosystem (Uerz et al., 2018) and are often explicitly or implicitly held responsible for the quality of teachers (Cochran et al., 2020). For this reason, specific digital competencies have been conceptualised for them.

2.3.1.1 Four domains of teacher educator digital competencies

An influential contribution came from Uerz et al. (2018) who outlined four teacher educator competency domains for teaching with technology: (1) technology competences, (2) knowing how to use technology for pedagogy and education, (3) teaching and learning beliefs, and (4) innovation and professional learning. These domains gain further currency through their similarities to two other academic works (outlined in Table 2-4). The first is a literature review by Skantz-Åberg et al. (2022) that identifies seven aspects used to describe teachers' professional digital competence. Although it focuses on school teachers, its value lies in it being a very

recent work and that it explicitly refers to PDC. The researcher therefore considered it usefulness to compare its findings to the teacher function of teacher educators. The second is a study on teacher educators specifically by Gondwe (2021), which outlines four layers of their professionalism: teacher educators' professionalism, teacher educators' professional development, technology professionalism, and technology professional development. (This framework's application to the professional development of teacher educators is discussed in section 2.4.5.3).

Four domains of Uerz et al. (2018)	How the domain is treated by Skantz-Åberg et al. (2022)	How the domain is treated by Gondwe (2021)
Technology competences	'Technological competence' was identified as the most recurring aspect	'What teacher educators do with technology' is included in 'technology professionalism'
Knowing how to use technology for pedagogy and education	'Pedagogical competence' was identified as the second most recurring aspect	'How teacher educators perform their roles with technology' is included in 'technology professionalism'
Teaching and learning beliefs	'Attitudes to technology use' was identified as the third most recurring aspect	'Attitudes about technology' and 'codes of behaviour' is included in 'technology professionalism'
Innovation and professional learning	'Professional engagement' was identified as the seventh most recurring aspect and includes professional development	'Quality of service and 'how knowledge of technology is acquired' is included in 'technology professional development'; 'incorporating learning activities, content, and evaluation' is included in 'technology professionalism'

Table 2-4 Teacher educator competency domains compared with recent studies

Sources: Gondwe (2021); Skantz-Åberg et al. (2022); Uerz et al. (2018)

Table 2-4 shows the impact and longevity of the domains suggested by Uerz et al. (2018). Their study, however, specifically called for a broadened competence framework to cater for the unique professional nature of teacher educators. This will also enable faculty to unite around a clear goal (Borthwick & Hansen, 2017).

2.3.1.2 Teacher Educator Technology Competencies (TETCs)

The Teacher Educator Technology Competencies (TETCs) can be seen as a framework that aims to contribute to this broadening. It was developed to create meaningful discussions about teacher educators' roles and responsibilities and to affect changes to policy and procedures (Foulger et al., 2017). Rather than putting itself forward as the solution, however, the TETCs is offered as an initial step towards technology integration reform with the goal to "positively impact" (Foulger et al., 2017, p. 436) pre-service teachers and their teacher educators. The 12 TETCs together with their related criteria appear in Table 2-5. Note that the term 'teacher candidate' is used

to reflect the original wording accurately; however, in this research ‘pre-service teachers’ is used.

Teacher Educator Technology Competencies	Related criteria
1. Teacher educators will design instruction that utilises content-specific technologies to enhance teaching and learning.	a) Evaluate content-specific technology for teaching and learning. b) Align content with pedagogical approaches and appropriate technology. c) Model approaches for aligning the content being taught with appropriate pedagogy and technology.
2. Teacher educators will incorporate pedagogical approaches that prepare teacher candidates to effectively use technology.	a) Model using technology for accessing, analysing, creating, and evaluating information. b) Assist teacher candidates with evaluating the affordances of content-specific technologies to support student learning. c) Assist teacher candidates with the selection and use of content-specific technologies to support student learning. d) Facilitate opportunities for teacher candidates to practice teaching with technology.
3. Teacher educators will support the development of the knowledge, skills, and attitudes of teacher candidates as related to teaching with technology in their content area.	a) Support teacher candidates’ alignment of content with pedagogy and appropriate technology. b) Provide opportunities for teacher candidates to reflect on their attitudes about using technology for teaching and for their own learning. c) Provide opportunities to develop teacher candidates’ efficacy about using technology in teaching.
4. Teacher educators will use online tools to enhance teaching and learning.	a) Communicate using online tools. b) Collaborate using online tools. c) Design instruction using online tools. d) Assess teacher candidates using online tools.
5. Teacher educators will use technology to differentiate instruction to meet diverse learning needs.	a) Design instruction using technology to meet the needs of diverse learners. b) Demonstrate using assistive technologies to maximise learning for individual student needs. c) Model using technology to differentiate learning in teaching and learning. d) Provide opportunities for teacher candidates to create learning activities using technology to differentiate instruction.
6. Teacher educators will use appropriate technology tools for assessment.	a) Use technology to assess teacher candidates’ competence and knowledge. b) Model a variety of assessment practices that use technology. c) Provide opportunities for teacher candidates to use appropriate technology for assessment.
7. Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environments.	a) Model online and blended learning methods and strategies. b) Provide opportunities for teacher candidates to practice teaching online and/or in blended/hybrid learning environments.
8. Teacher educators will use technology to connect globally with a variety of regions and cultures.	a) Model global engagement using technologies to connect teacher candidates with other cultures and locations. b) Design instruction in which teacher candidates use technology to collaborate with learners from a variety of backgrounds and cultures. c) Address strategies needed for cultures and regions having different levels of technological connectivity.
9. Teacher educators will address the legal, ethical, and socially-responsible use of technology in education.	a) Model the legal, ethical, and socially-responsible use of technology for teaching and learning. b) Guide teacher candidates’ use of technology in legal, ethical, and socially-responsible ways.

Teacher Educator Technology Competencies	Related criteria
	c) Provide opportunities for teacher candidates to design curriculum following legal, ethical, and socially-responsible uses of technology.
10. Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching.	a) Define goals for personal growth in using technology.
	b) Engage in continuous professional development and networking activities promoting technology knowledge and skills.
	c) Support teacher candidates' continuous participation in networking activities to increase their knowledge of technology.
11. Teacher educators will engage in leadership and advocacy for using technology.	a) Share a vision for teaching and learning with technology.
	b) Engage with professional organisations that advocate technology use in education.
	c) Seek to influence the opinions and decisions of others regarding technology integration.
	d) Assist teacher candidates in becoming advocates for using technology to enhance teaching and learning.
	e) Support teacher candidates in understanding local, state, and national technology policies in education.
12. Teacher educators will apply basic troubleshooting skills to resolve technology issues.	a) Configure digital devices for teaching.
	b) Operate digital devices during teaching.
	c) Model basic troubleshooting skills during teaching.
	d) Find solutions to problems related to technology using a variety of resources.

Table 2-5 The Teacher Educator Technology Competencies (TETCs)

Source: Foulger et al. (2017)

2.3.1.3 Comparing the TETCs to the SA framework

The researcher considered it meaningful to compare the TETCs to South Africa's Professional Development Framework for Digital Learning (Department of Basic Education, 2017), referred to as the SA framework in the comparison. Both are the result of an in-depth, thoughtful, collaborative process with the ambitious goal of bringing about change for their targeted professionals (Department of Basic Education, 2017; Foulger et al., 2017). It is also noteworthy that they were both published in the same year.

In an attempt to meaningfully compare the SA framework to the TETCs, the researcher rewrote its 13 competencies to reflect the unique viewpoint of a teacher educator. Two examples follow (the adjusted versions appear in Table 2-6):

Original wording of the SA framework's Competency 1: Adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources.

Adjusted wording: *Teacher educators will* adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources (*within teacher education*).

Original wording of the SA framework's Competency 7: Develop learners' global awareness and understanding using digital communication and collaboration tools.

Adjusted wording: *Teacher educators will develop pre-service teachers' global awareness and understanding using digital communication and collaboration tools.*

The researcher, however, found that an authentic comparison was somewhat hindered because the TETCs are specifically crafted around the 'modelling' role of the teacher educator. Keeping this issue in mind, Table 2-6 illustrates how the potential alignment between the two frameworks could stack up. Each of the 12 TETCs is depicted first in the table, followed by 13 blocks representing the 13 SA framework competencies. The highlighted blocks illustrate where an overlap was found between one of the SA framework competencies and one of the TETCs.

1. Teacher educators will design instruction that utilises content-specific technologies to enhance teaching and learning.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
2. Teacher educators will incorporate pedagogical approaches that prepare teacher candidates to effectively use technology. <i>(n/a – specifically phrased for teacher educators' modelling role)</i>													
1	2	3	4	5	6	7	8	9	10	11	12	13	
3. Teacher educators will support the development of the knowledge, skills, and attitudes of teacher candidates as related to teaching with technology in their content area. <i>(n/a – specifically phrased for teacher educators' modelling role)</i>													
1	2	3	4	5	6	7	8	9	10	11	12	13	
4. Teacher educators will use online tools to enhance teaching and learning.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
5. Teacher educators will use technology to differentiate instruction to meet diverse learning needs.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
6. Teacher educators will use appropriate technology tools for assessment.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
7. Teacher educators will use <i>effective strategies</i> for teaching online and/or blended/hybrid learning environments. <i>(n/a – specifically referencing teacher educators' modelling role)</i>													
1	2	3	4	5	6	7	8	9	10	11	12	13	
8. Teacher educators will use technology to connect globally with a variety of regions and cultures.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
9. Teacher educators will address the legal, ethical, and socially-responsible use of technology in education.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
10. Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
11. Teacher educators will engage in leadership and advocacy for using technology.													
1	2	3	4	5	6	7	8	9	10	11	12	13	
12. Teacher educators will apply basic troubleshooting skills to resolve technology issues.													
1	2	3	4	5	6	7	8	9	10	11	12	13	

Table 2-6 Comparing TETCs (above) to SA framework competencies (below)

Sources: Foulger et al. (2017); Department of Basic Education (2017)

After an in-depth analysis, core differences become noticeable. To the researcher, its first two competencies specifically suggest that the SA framework aims to (1) transform the teacher as an individual and a professional, i.e. to develop them as a digital citizen and a teacher teaching with technology; and (2) nurture the foundational

attitudes that will enhance their professional capacity and contribution to society. The TETCs, on the other hand, appear to be more specific in their outputs and include very practical tasks, e.g. number 12.

The two frameworks are understandably written with two different ‘teachers’ in mind – for the TETCs, a teacher educator; and for the SA framework, a (mostly developing) teacher in their local context. The TETCs also have no true equivalent of the SA framework’s eighth competency, i.e. *to transform learning through the innovative use of digital tools and resources*. It is noteworthy given the pioneering spirit called for in teacher educators when it comes to digital competency development (Foulger et al., 2017; Tondeur et al., 2019; Uerz et al., 2018). The absence, however, of a counterpart does not necessarily reflect a deficit in the TETCs.

These differences need not be an obstacle in envisioning a meaningful interaction between the two frameworks. Although the TETCs are aimed at teacher educators at a teacher education institution, it was found that teacher education has not yet incorporated pedagogical digital competence effectively (Amhag et al., 2019). This means that any teacher educator can also benefit from the SA framework by considering, or applying, its 13 competencies in their adjusted wording. Apart from supporting pre-service teachers in achieving the competencies, teacher educators could use the SA framework to reflect on how they themselves are achieving the competencies in their own role as a teacher and to determine to what extent they are modelling (Boyd et al., 2021) the competencies.

2.3.2 How teacher educators show their digital competencies

Amhag et al. (2019) found that teacher educators mostly used ICT for communication, administration, and research. ICT was only applied to their teaching to access digital classrooms. This is mirrored by the findings of Lindfors et al. (2021) in which teacher educators employed only basic technology in teaching and administration, and did not feel confident about their ability to improve pre-service teachers’ digital competencies through their teaching. The latter study also found that teacher educators struggled to maintain an informed, reflective class discussion on school digitalisation. This caused the teacher educators to acknowledge the value of PDC, continued professional development and a much-needed broadening of their collective knowledge. Viberg et al. (2019) also found that teacher educators feel alone and inadequate when they do

not perceive themselves as digitally competent. This then prompts an inner desire to become more capable.

Most studies that explore the level of teacher educators' digital competencies rely on self-reported methods, and relatively low scores are generally achieved (Amhag et al., 2019; Foulger et al., 2019; Lindfors et al., 2021). Uerz et al. (2018) acknowledge that such self-assessments can distort reality because teacher educators can over- or underestimate their digital competencies. Admiraal et al. (2017) posit that teacher educators need not have advanced technological competence. This is because the use of more accessible digital tools could make pre-service teachers more comfortable with using technology in teaching.

Various digital competency self-assessment tools are available to teacher educators. One is Foulger et al. (2017) list of the TETCs. Herro et al. (2021) suggest that the self-assessment of these competencies needs to be modelled to teacher educators in order to improve their technology infusion practices. Another tool is the diagnostic self-assessment for teachers by the Department of Basic Education (2017) that could also be useful for teacher educators. For each competency, one of the following responses on a Likert scale is required: Strongly disagree, Disagree, Agree, and Strongly agree. A column for notes on professional development is then provided. This tool supports one of the premises of the Department of Basic Education's transformative practises towards digital learning, i.e. that teachers' professional development needs and learning pathways should be guided by the individual evaluation of their digital learning competencies (Department of Basic Education, 2017).

2.3.3 Digital competency expectations placed on teacher educators

The literature consistently reiterates the need for teacher educators to improve their PDC specifically (Instefjord & Muntheb, 2017; Lindfors et al., 2021; Ottestad et al., 2014). It is the teacher educator's responsibility to use and integrate digital technology into diverse higher education disciplines (Amhag et al., 2019; Instefjord & Muntheb, 2017). Teacher educators help shape pedagogy and curriculum content through their agency and advanced scholarship (Boyd et al., 2021). They therefore contribute to pre-service teachers' development as global citizens and their future role in society (Boyd et al., 2021).

Viberg et al. (2019) found that teacher educators felt both explicit and implicit expectations because of the digitalisation of society and future skills requirements. Teacher educators experienced these expectations on an individual, group, and organisational level. As an individual, they were expected to be knowledge carriers and therefore needed to constantly be learning. They felt the obligation to master everyday technology and to prepare pre-service teachers for digitally enabled teaching. On the group level, teacher educators embraced the expectation to become part of a 'semi-digital' culture where they could learn and critically reflect on technology and teaching together. They saw organisational expectations as trend-sensitive and found guidelines, strategies, and administration relating to digital changes to be few and vague. This is strengthened by a study across multiple countries that showed teacher educators in higher education experienced general professional learning expectations as vague and ambiguous, regardless of their professional background (MacPhail et al., 2019).

2.3.4 Teacher educators' experiences with digital competency development

2.3.4.1 Teacher educators' professional identity

Teacher educators are involved in different roles, i.e. teachers of teachers, coach, researcher, gatekeeper, curriculum developer, and broker (Lunenberg et al., 2014). Their 'role', however, needs to be distinguished from their 'identity' (Boyd et al., 2021). Role is a formalised, negotiated list of practical tasks and responsibilities (Boyd et al., 2021). Identity, on the other hand, is a meaningful, continually constructed story about oneself, and multiple identities can be held at a time (Boyd et al., 2021).

Murray et al. (2020) found that 'identity forging' had a major and long-lasting impact on how teacher educators perceived their professional development. They were able to refine and deepen their understanding of their identity through (1) reflection and dialogue, and by (1) considering the widely different contexts of teacher education organisations, practises, and belief systems. Teacher educators were found to relate more to how digitalisation impacts the professional self than their professional practice (Avidov-Ungar & Forkosh-Baruch, 2018; Viberg et al., 2019).

Teacher educators are required to adapt their identity to align with the needs of the 21st century. One way is to use digital platforms to bolster their identity as a "public

intellectual in a media-rich environment” (White et al., 2021, p. 577). They are also encouraged to become pedagogical innovators as part of their professional identity (Avidov-Ungar & Forkosh-Baruch, 2018; Uerz et al., 2018).

Another important aspect that comes into play in teacher educators’ identity is their position as second-order teachers, i.e. they are teachers of teachers (Murray & Male, 2005) (as shown in Figure 1-1). This requires self-conscious practice and an overt knowledge of why and how one teaches. It was found that a new professional identity can be achieved once they become confident in their role as second-order practitioners (Murray & Male, 2005). Teacher educators’ second-order role also makes the teaching of digital competencies complex because it requires them to teach a skill that they often still have to learn (Viberg et al., 2019). It therefore affects both their professional and personal self.

Murray and Male (2005) also make a compelling point with regards to teacher educators who were first school teachers and who naturally draw from those experiences to enhance their credibility (Murray & Male, 2005). They caution against the overuse of this “first-order experiential knowledge” (p. 137) because it can limit (1) how they help pre-service teachers long-term learning about teaching, (2) the view of teaching they portray (i.e. too technical-rational), and (3) the development of the teacher educator identity. They therefore need to look at pedagogy through the lens of their second-order practice, instead of transferring school teaching skills.

2.3.4.2 Teacher educators as role models

The layered nature of teacher education means that teacher educators not only teach pre-service teachers as students but also model the profession of teaching to them (Boyd et al., 2021). Although there is a lack of research into teacher educators acting as role models (Instefjord & Muntheb, 2017), it was identified as a common strategy to use Information and Communications Technology (ICT) in education (Admiraal et al., 2017; Baran et al., 2019). The outcome ‘to model’ features in eight out of the 12 teacher educator technology competencies (Foulger et al., 2017). Pre-service teachers requested more role models rather than just being shown examples of digital applications (Admiraal et al., 2017). Modelling can be implicit or explicit (Boyd et al., 2021), and Table 2-7 offers examples of both the modelling of teaching and the

modelling of digital competencies in teaching. The examples of digital competency modelling were compiled by the researcher, based on the work of Boyd et al. (2021).

Example type	Implicit modelling	Explicit modelling
Example of modelling in teaching	Teaching consistently	Prompting pre-service teachers to reflect on how they exhibit certain values and skills as a teacher
Example of modelling digital competencies in teaching	Showcasing own digital competencies in their teaching	Using interactive dialogue and letting pre-service teachers evaluate the impact of their own digital competencies

Table 2-7 Examples of implicit and explicit modelling by teacher educators

Source: Adapted from Boyd et al. (2021)

2.3.4.3 Teacher educators' attitudes and beliefs

Perceived apathy of education faculty and the overall lack of technology in education courses is seen as a challenge to pre-service teachers' technology integration (Herro et al., 2021). Fulgence (2020) found that teacher educators were reluctant to embrace new technologies (Fulgence, 2020). Two reasons given were an unwillingness to commit quality time to the opportunities available and the challenge of changing one's attitude. Heinonen et al. (2019) explored the attitudes of cross-disciplinary lecturers developing technology-enhanced learning and identified four divergent belief groups: active developers, adaptive developers, cautious developers, and reluctant developers. Although the participating lecturers were not specifically teacher educators, the study points to the varying views that higher education teachers hold about their role in promoting technological change. This study also suggests that these different roles would require different support and training.

2.4 Professional development of teacher educators

2.4.1 Introduction

Teacher educators have particular expertise, responsibilities, and commitments; therefore, the development of these aspects should be important to educational research, teaching programmes, and policymakers (Kelchtermans et al., 2018). Sufficient attention, however, has not historically been paid to the upskilling of teacher educators or to policies to support their growth (Cochran et al., 2020). An increased global focus on teacher education policy and teacher educator professional learning has only been observed since 2017 (White et al., 2021). Furthermore, higher education institutes were found to show limited interest in the professional development of teacher educators (MacPhail et al., 2019). This points to a missed

opportunity, because teacher educators are also professional learners (Czerniawski et al., 2017).

Murray et al. (2020) emphasise that the professional teacher educator should be seen both as an employee/worker and a scholar/learner; therefore, research into their workplace learning needs to be brought in line with the depth of knowledge that has been achieved in other professions (Murray et al., 2020). Their professional learning should also be considered from a humanist angle, rather than as a narrow, instrumental quest for better university rankings (Czerniawski et al., 2017).

This section looks at research about the nature of teacher educators' professional development; the need for teacher educators' digital competency professional development; recommendations for digital competency professional development; and frameworks relating to teacher educators' digital competency development.

2.4.2 The nature of teacher educators' professional development

The section shows that teacher educators' professional development is generally informal, self-initiated, and collaborative. It also looks at the motivations of teacher educators to pursue professional development.

Teacher educators' professional learning should be seen as essential, occurring on a day-to-day basis, integrated, collaborative, and long-term (Boyd et al., 2021). This contrasts with (1) formal learning outside of the organisation that focuses on short-term achievement and outcomes that are easy to measure, and (2) teacher educator learning that are only rolled out during crises or through imposed initiatives. The professional learning characteristics mentioned above therefore overlap to a greater extent with **informal** learning, i.e. training that is "not explicitly labelled or signposted" (Evans, 2019, p. 6) as such and that can happen without the learner, i.e. the teacher educator, being conscious of their learning. Boyd et al. (2021), however, argues that any distinction between formal and non-formal professional learning activities is unsustainable because of the complexity of teacher educators' workplace setting.

MacPhail et al. (2019) found that teacher educators from multiple countries relied predominantly on **self-initiated** professional development. Despite the lack of professional development opportunities, these teacher educators proactively participated in learning opportunities both inside and outside of their university. Time is, however, a serious concern for teacher educators, with requests to have their

teaching and administrative workload reduced to allow time for professional learning and research (Czerniawski et al., 2017).

Teacher educators find it valuable to develop themselves professionally by **collaborating** with peers and colleagues (Czerniawski et al., 2017; MacPhail et al., 2019; Ping et al., 2018). They show a sincere enthusiasm to create learning communities with professionals with similar interests (Czerniawski et al., 2017). Other ways include academic engagement and, much less frequently, attending professional development programmes (Ping et al., 2018).

Ping et al. (2018) identified three **motivations** for professional learning in teacher educators: personal ambition, external requirements, and professional role transition. Of these, personal ambition as a motivation was found most frequently in literature and can be divided into personal interests and personal responsibility.

2.4.3 The need for teacher educators' digital competency professional development

Professional development is crucial to ensure that teacher educators teach and learn innovatively with technology (Uerz et al., 2018). Herro et al. (2021) found that teacher educators with advanced technological skills score higher on beliefs and practices than their counterparts with lower skills. This means that teacher educators may better incorporate technology practise in pre-service teachers' curriculum when they are given more professional learning opportunities to develop their own digital competencies.

Teacher educators themselves indicate a clear appetite for advancing their digital competencies through personal development. One study found that 87% of participant teacher educators identified a need for medium to extensive technology training to be able to support pre-service teachers adequately (Amhag et al., 2019). Czerniawski et al. (2017) identified using ICT/online learning/social media as one of the five most important professional learning needs indicated by teacher educators (the others being research skills, publish research/academic writing, consideration of pedagogical principles/delivery, and time availability). This is because teacher educators wanted to meet the demands of the 21st century by improving their ICT skills. Studies such as these are especially valuable because teacher educators' own views have mostly

been excluded from discourses and changes regarding their professional development (White et al., 2021).

2.4.4 Recommendations for digital competency profession development

The researcher found that the literature highlights five key aspects that should be present in digital competency professional development, as visualised in Figure 2-6: metacognitive competencies and beliefs (depicted through a brain with gears), structured in-service training (depicted through a person lecturing to people), actual teaching contexts (depicted through a university building), a learning community (depicted through four people holding hands), and individual learning (depicted through one person moving forwards).

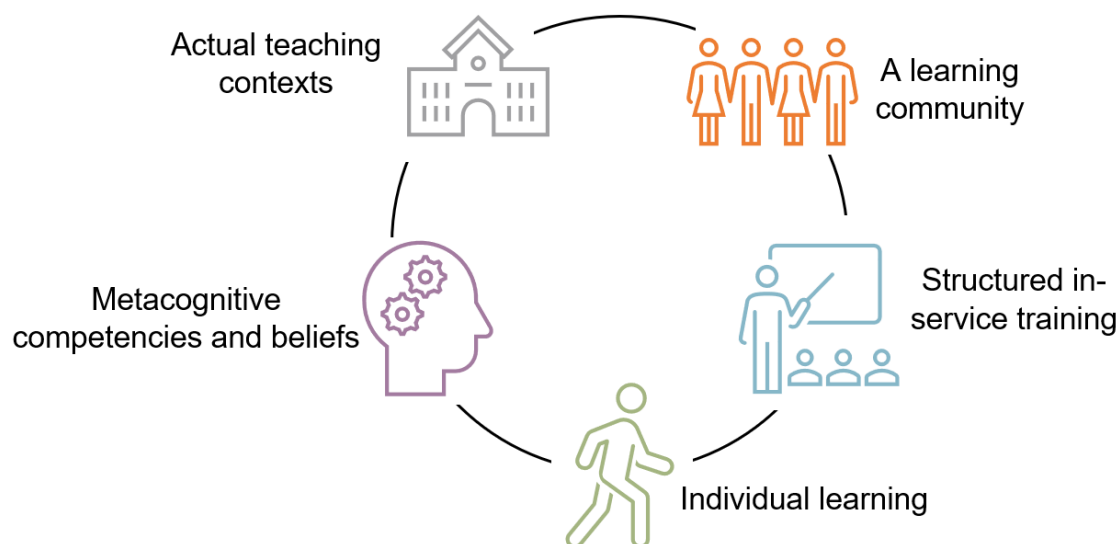


Figure 2-6 Key aspects of teacher educators' digital competency professional development

Source: Researcher

Training should prioritise **metacognitive competencies and beliefs** instead of only technologies to counter the fast-paced evolution of technology (Uerz et al., 2018). This is also in line with higher education's ongoing process of settling the tension between the workplace need for high-level cognitive skills and academia's interest to remain competitive through specialised knowledge development (Laurillard, 2012). Generally, this tension points to how students are trained in higher education, however, it also has relevance for teacher educators' professional development.

Amhag et al. (2019) recommend **structured in-service training** presented by experienced professionals who are ideally skilled in higher education teaching and

learning. In-serve training holds various advantages. First it can increase teacher educator's motivation to use technology, especially if they identify the personal benefits of using digital components in a specific situation. Secondly, it can help teacher educators build networks with people with similar interests and participate in local and international research. Thirdly, it can address the issue of time limitations as a hindrance to digital competency development (Lindfors et al., 2021). This is because mandatory training ensures paid compensation time (Amhag et al., 2019). Fulgence (2020) concurs that dedicated time is required to develop teacher educators' digital capacity.

Uerz et al. (2018) identified four characteristics of teacher educators' digital competency professional development, namely, it (1) connects to their unique teaching environment, (2) involves inter- or multidisciplinary collaboration, (3) is customised to the interests and needs of teacher educators, and (4) fosters reflective learning. The first three represent recurring themes in the literature about teacher educator's digital competency development, described in the following three paragraphs.

A key need that emerges in training teacher educators to teach and learn with technology is to empower them to use technology in their **actual teaching contexts** (Amhag et al., 2019; Herro et al., 2021; Lindfors et al., 2021; Parrish & Sadera, 2019; Uerz et al., 2018). This is because teacher educators often struggle to apply new "thought structures" (Lindfors et al., 2021, p. 401) into their specific courses despite partaking in PDC development. The training of teacher educators needs to include solid, successful, real-world subject-matter examples (Amhag et al., 2019). Teacher educators' own general technology skills also benefit from being developed within teaching and learning contexts (Parrish & Sadera, 2019).

Teacher educators find it valuable to learn more about technology with their colleagues as part of a **learning community** (Uerz et al., 2018; Viberg et al., 2019). Viberg et al. (2019) refer to this as a 'semi-digital culture' that gives them considerable professional autonomy, the obligation to be both a teacher and a researcher, and an assortment of ways to approach digitalisation.

Teacher educators' **individual learning** needs should be targeted (Fulgence, 2020; Parrish & Sadera, 2019). Some teacher educators might need more intense training

than others, and these might even be highly experienced teacher educators (Parrish & Sadera, 2019). Therefore, training and support from the faculty should be innovative.

A recent addition to the literature are the recommendations from Herro et al. (2021), that the training should focus on how theory connects with practice, be discipline-specific, and include scaffold technology infusion. It should further be accessible, of a high quality, and possibly incentivised.

2.4.5 Frameworks relating to teacher educator digital competency development

This section describes three frameworks that relate to the teacher educators' digital competency professional development, either wholly or in part.

2.4.5.1 InFo-TED model

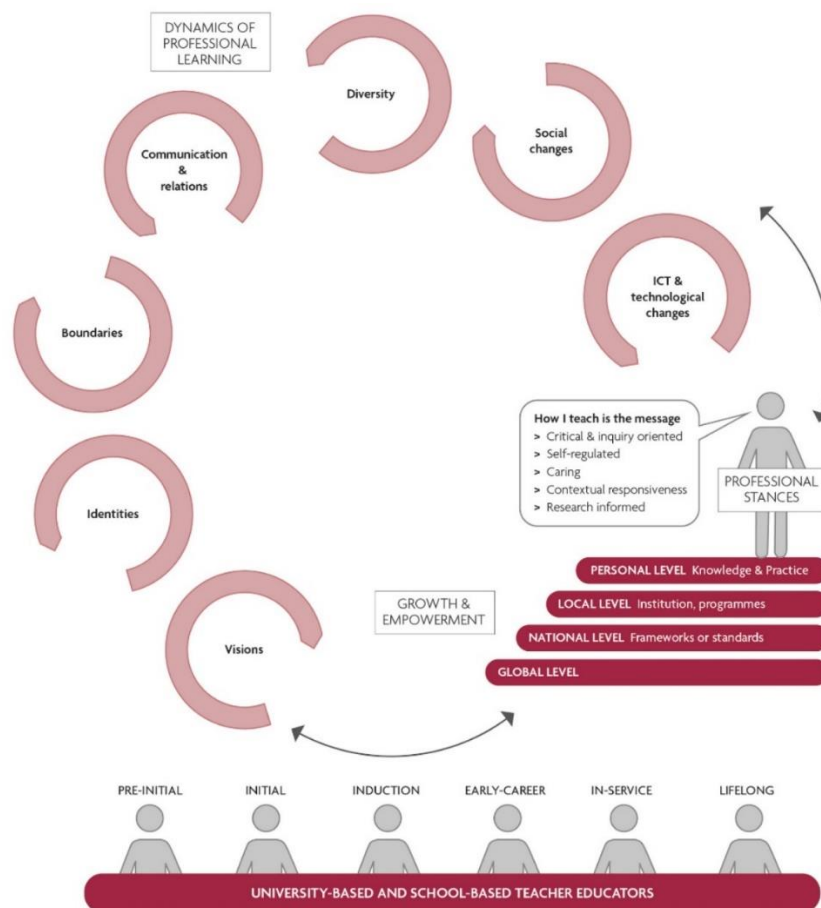


Figure 2-7 The InFo-TED model of teacher educator professional development

Source: Kelchtermans et al. (2018)

An example of a model that partly addresses digital competencies is one by InFo-TED, an international forum dedicated to promoting the professional development of teacher

educators. The model takes a practice-based approach with the intention to provide a map and a common language, to be descriptive rather than prescriptive, and to communicate rather than assess (Kelchtermans et al., 2018). The model is illustrated in Figure 2-7, showing ICT and technological changes, such as the need for better digital competencies, as one of the dynamics that teacher educators require professional learning for. Teacher educators' technology professional learning should manifest in their professional practice by them being critical and enquiry orientated, self-regulated, caring, contextually responsive, and research informed.

2.4.5.2 Nine design principles by Vanderlinde

The second framework consists of nine design principles that can shape teacher educators' personalised and workplace learning (Vanderlinde et al., 2017). The didactical focus of the framework is to enable teacher educator networks and communities of practise. Although not directly aligned with the goal of digital competency development, it was conceptualised to support professional development in a blended learning environment. Table 2-8 outlines the principles together with an example of a practical implication of each, as described by Vanderlinde et al. (2017). These principles compare well with the research included in this review with regards to teacher educators' digital competency professional development, especially number 2, 4, 5, and 7.

Design principle	Practical implication
1. Ownership of content and process	Self-identify interests and needs for learning activities
2. Work in professional learning communities	Build on the qualities of collegial and collaborative relationships
3. Knowing each other and sharing	Foster trust and openness in socialising
4. Informal and formal learning in the workplace	Participate in e.g. personal workplace practise and structured programmes
5. Attention for teacher educators' multi-layered and multiple identities	Embrace the diverse roles and identities of the profession
6. Changing practices takes time	Ensure sufficient time for learning activities that allows autonomy and freedom
7. Take into account the pressures on teacher educators' time	Structure and protect learning
8. Forming networks	Connect virtually and face-to-face to share ideas, plan initiatives, etc.
9. Striving for integration	Integrate diverse viewpoints, experience, and personal development to offset a fragmented teacher education curriculum

Table 2-8 Nine design principles shaping teacher educators' learning

Source: Vanderlinde et al. (2017)

2.4.5.3 Teacher educator technology professionalism framework

Finally, a framework by Gondwe (2021) conceptualises teacher educator technology professionalism specifically. The goal of the framework is twofold: to create a better distinction between the general professional development and technology professional development, and to help clarify the substance of teacher educators' professionalisation to support discussions about teacher educators' technology professionalism.

Figure 2-8 shows the four suggested dimensions of this framework: (1) teacher educators' professionalism – their roles, responsibilities, knowledge, and how and why they came into the profession, (2) teacher educators' professional development – the reasons, content, methods, and evaluation associated with their learning, (3) technology professionalism – a holistic approach that includes knowledge, attitudes, and behaviours, and, in the smallest circle, (4) technology professional development – a similar approach as layer (2). Digital competency development can be seen as a version of the inner, fourth layer, as the definition of technology professionalism is intentionally left open by the researcher.

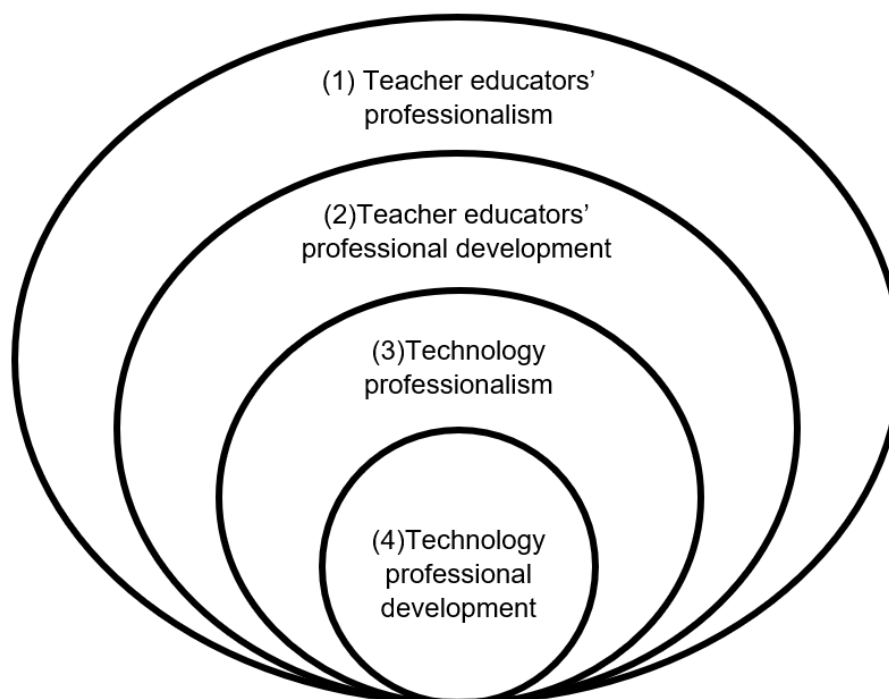


Figure 2-8 Framework for teacher educator technology professionalism

Source: Researcher, recreated from the original by Gondwe (2021)

2.4.6 Institutions' approach to teacher educators' digital competency development

There is a lack of support and relevant policies and strategies required to bolster teacher educators' professional identity, professional development, and reflective practice regarding their digital competencies (Viberg et al., 2019). Furthermore, while teacher educators appear content with technological support, they reported receiving little to no technological-pedagogical support to improve their digital competencies (Lindfors et al., 2021). A tenuous relationship has been established between institutional support and teacher educators' digital competencies. This is due to the discovery of weak positive links between the digital competence of teacher educators, positive management, and management's development support (Instefjord & Muntheb, 2017). This could, however, also be the result of low support from management or because those already poised for development are receiving the support.

Various suggestions have been made for ideal institutional approaches to digital competency development. An African study recommended that management makes teacher educators aware of how important digital competencies are and encourages personal and induction initiatives to improve these competencies (Fulgence, 2020). Teacher educators themselves also contributed ways that their digital competency development can be supported by their institutions. An example is to formalised it by integrating digital competencies into annual performance reviews and applications for promotions and tenures (Foulger et al., 2017). Lindfors et al. (2021) found that teacher educators expect institution leaders to encourage and reward their efforts to improve their digital competencies. It is worthwhile to note that this was not requested from management, which would leave the ball in the teacher educators' own courts to develop their PDC through continued professional learning. Teacher educators believe that growth, change, leadership, and promotion within the institution is the only way for TETCs to flourish (Foulger et al., 2017).

Taking a general view of higher education, it is important to note that digital competency advancement is critical throughout the institution. Institutional leaders should support digital competency advancement at all levels for the following three reasons. First universities are where foundational innovation in education is set to take place (Fernández-Batanero et al., 2021). Secondly, students' digital competency

levels reflect both the institution's capabilities and future professionals' digital competencies (Rivas et al., 2019). After all, universities are the crucial training ground for the professional lives that the students will embark on after their studies (Bilbao Aiaastui et al., 2021; Peñate Sánchez, 2020). Finally, the Covid-19 pandemic has compelled higher education to reflect even deeper about its digital capital (Bilbao Aiaastui et al., 2021; Oluwatimilehin et al., 2021), i.e. their digital technologies and competencies (Ragnedda & Ruiu, 2020).

2.5 Conceptual framework of the study

2.5.1 Introduction

Two theoretical frameworks are used in the conceptual framework of the research: Activity theory and Existence, Relatedness, and Growth (ERG) theory. Both frameworks are briefly described below, followed by an explanation of how they are applied in the conceptual framework of this study.

2.5.2 Activity theory

Activity theory provides an object-orientated, artefact-mediated framework within which complex human actions can be explored and understood (Coghlan & Brydon-Miller, 2014; Mills et al., 2010). The theory was reformulated by Engeström (1987) into what is known as second generation Activity theory. It includes 'community' as a factor through which an activity is mediated, a contribution made by Leont'ev (1978). The researcher visualised it in Figure 2-9.

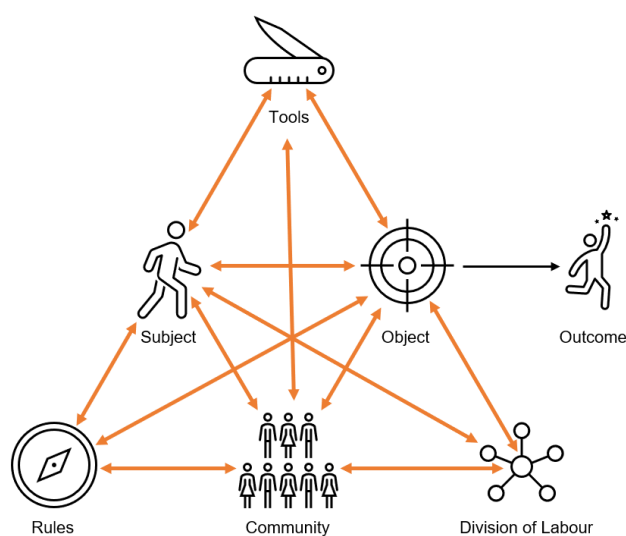


Figure 2-9 Second generation Activity theory

Source: Researcher, adapted from Engeström (1987) and Leont'ev (1978)

The orange lines depict the activity system generated when the **Subject** (the teacher educators) participates in the initiative at their Faculty of Education. They move towards the **Object** (all aspects of what the teacher educators are trying to achieve by participating, including to advance digital competencies) to bring about an **Outcome** (the adjusted curriculum-components). This is mediated by **Tools** (all artefacts used to complete participation in the initiative) and the **Community** (actors involved in or influencing the initiative). Tools can take many forms and are embodied work that provide the subject with prompts (Coghlan & Brydon-Miller, 2014). **Community** influences the **Subject** through implicit and explicit **Rules** and affects the **Object** through **Division of labour** (Coghlan & Brydon-Miller, 2014).

Although both the **Subject** and **Object** have agency and show development through the activity (Kaptelinin & Nardi, 2006; Mills et al., 2010), the **Subject's** attributes can be substantially altered (Mills et al., 2010). This is because the operation defines their consciousness (Coghlan & Brydon-Miller, 2014) – they reconstruct internally what they do externally (Vygotskiĭ & Cole, 1978). Activity theory is therefore fundamentally concerned with the **Subject's** development and motivation. These are two crucial factors the research will probe, i.e. the teacher educators' motivation for engaging in the initiative and the way they develop by engaging in it (including their PDC). The **Object** drives the activity because it hints at its underlying motive (Coghlan & Brydon-Miller, 2014).

2.5.3 Existence, Relatedness, and Growth (ERG) theory

ERG theory is Alderfer (1969)'s more flexible, simplified answer to the better known Maslow (1943) Hierarchy of Needs. It explores the motives behind individual behaviour and can therefore explain or predict personal development choices (Caulton, 2012). It is often cited in managerial sciences to probe variables of motivation in the workplace (Clayton, 2020; Juneja, n.d.; World of Work Project, 2019).

Instead of the strict, hierarchical structure of Maslow (1943) five needs, the ERG theory hypothesises that three factors – **Existence, Relatedness, and Growth** – drive motivation (Alderfer, 1969). Maslow (1943) Hierarchy of Needs further requires a lower need to be fulfilled before a higher one will be pursued. In contrast, ERG theory recognises that more than one component can be at work at a given time (Alderfer, 1969). The theory also posits that frustration-regression is at play (Alderfer, 1969), e.g.

people without growth opportunities are likely to fixate on the lower need, i.e. relatedness. Individuals, however, might differ about what constitutes a higher or lower need based on their unique outlook on life (Alderfer, 1969).

Table 2-9 shows how ERG theory's three types of needs correlate with Maslow's Hierarchy of Needs to resolve the problematic overlapping of Maslow's safety and esteem categories (Alderfer, 1969). It also provides examples of how each type typically manifests in a professional environment.

Maslow (1943)'s Hierarchy of Needs	Alderfer (1969)'s three-factor ERG theory	Examples of ERG theory manifestations
Self-actualisation	Growth	Personal growth, advancement, and learning (Juneja, n.d.)
Esteem		
Love/belonging	Relatedness	Interpersonal connections including public recognition (Juneja, n.d.)
Safety	Existence	Humans' basic safety needs including autonomy (Clayton, 2020)
Physiological		

Table 2-9 Comparison of ERG theory to Maslow's Hierarchy of Needs

Sources: Alderfer (1969), Clayton (2020), Juneja, (n.d.), and Maslow (1943)

Figure 2-10 is the researcher's depiction of ERG theory, with a house representing **Existence** needs, a group of people representing **Relatedness** needs, and a growing plant representing **Growth** needs. The smaller, grey icons indicate how more than one need can be activated at a given time. The green, purple, and red arrows indicate the regression, progression, and strengthening mechanisms of the theory.

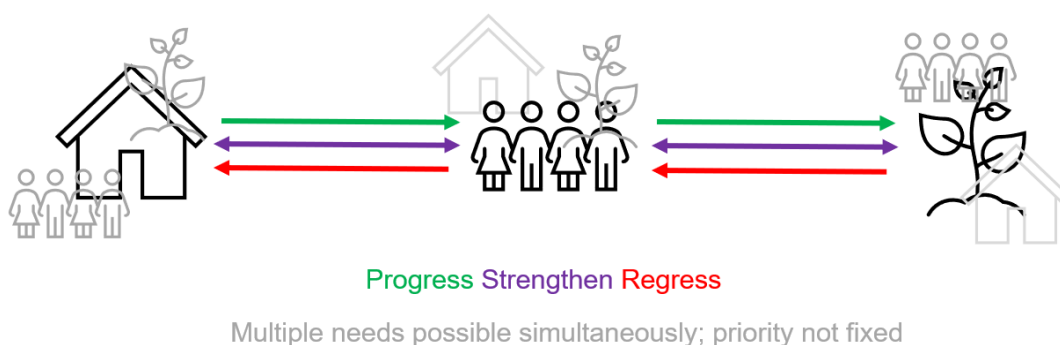


Figure 2-10 Visualisation of ERG theory by the researcher

Source: Researcher, adapted from Alderfer (1969)

Criticism of ERG theory is that, despite it being more robust than Maslow's framework, it does not provide directional advice (World of Work Project, 2019). This does not

impact on the framework's use in the research because it is employed for its explanatory rather than its pragmatic potential.

2.5.4 Conceptual Framework

This study investigated the way specific individuals engage in an activity, i.e. the initiative, which means Activity theory provided a well-matched theoretical base. It was augmented with ERG theory, used in professional working environments, to explore the actions of the teacher educators as part of their professional role.

The research's conceptual framework appears in Figure 2-11. It shows how the **Object** is complemented by the three needs of ERG theory, **Existence**, **Relatedness**, and **Growth**. This allows for more nuanced expressions of the construct of motivation which will enrich the study data. It also addresses Activity theory's inadequacy in dealing with the individual experiences of participants in the same activity (Mills et al., 2010).

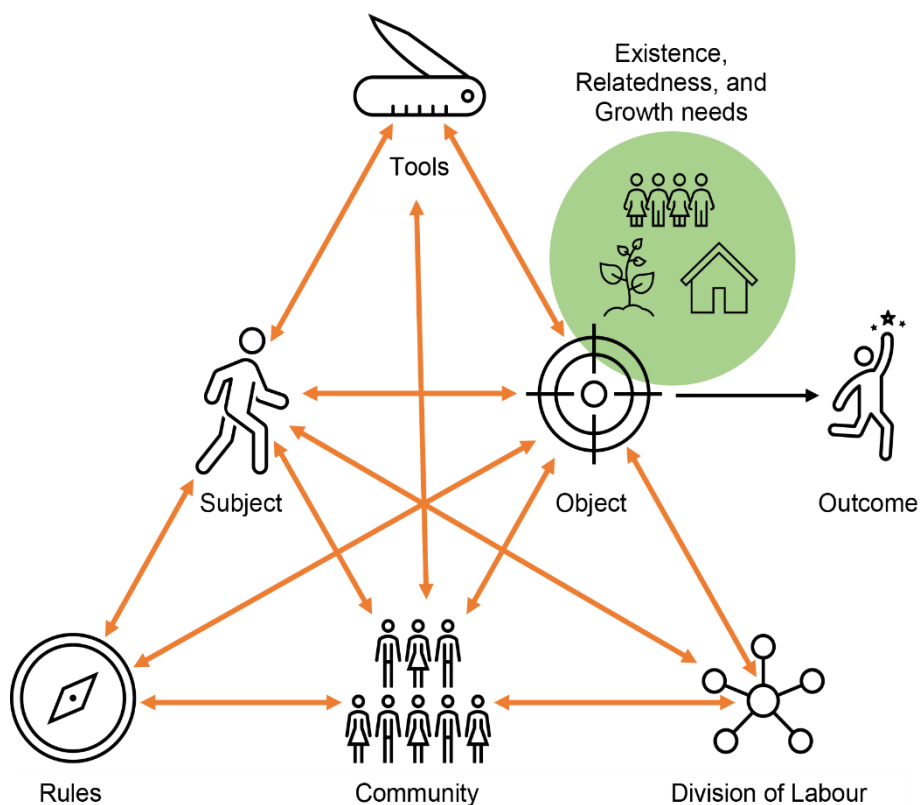


Figure 2-11 Conceptual framework consisting of Activity theory and ERG theory

Source: Researcher, adapted from Engeström (1987) and Alderfer (1969)

2.6 Gaps in the literature

The following five gaps were identified in the literature: (1) how teacher educators integrate the teaching of digital competencies into their curriculum (Admiraal et al., 2017; Baran et al., 2019; Instefjord & Muntheb, 2017; Lindfors et al., 2021; Uerz et al., 2018), (2) their ability to act as models for pre-service teachers' digital competency development (Admiraal et al., 2017; Instefjord & Muntheb, 2017), (3) their role as second-order teachers in incorporating digital components into education (Lindfors et al., 2021; Uerz et al., 2018), (4) the development of their own PDC (Baran et al., 2019; Lindfors et al., 2021), and (5) the link between their technology competencies and their professional roles (Gondwe, 2021).

2.7 Conclusion

This literature review provides a holistic representation of the existing knowledge in which this research is situated. The first section sets the scene by exploring the concepts, approaches, and frameworks that drove digital competency in education. Next, the spotlight is shone on teacher educators and digital competency development by looking at relevant frameworks, competencies, expectations, and experiences. The deep dive into teacher educators' professional development uncovers the nature of, the need for, recommendations for, frameworks relating to, and institutions' approaches to their professional development. Finally, the merging of Activity theory and ERG theory into the study's conceptual framework is discussed before the gaps in the literature are illuminated.

The researcher concludes this section with a visualisation of the three sections of the discussed literature using a digital tool. This is done to complement the research by emphasising the need for digital competency development.

The three images were created by the researcher using DALL·E 2, an artificial intelligence programme that creates original images based on language prompts (Romero, 2022). Use of this programme serves to reiterate the importance of digital competence, rather than simply having access to technological tools. Despite the programme's high sophistication, successful output is dependent on the user's understanding of how it processes language and visuals so that effective sentences can be crafted. It also required the conceptual work to be done by the researcher beforehand, highlighting the limitation of digital tools in education for their own sake

(as was stated at the start of Chapter 1). Care was taken to be inclusive to counter the programme's biases (Romero, 2022). The images appear in Figure 2-12, followed by an explanation of the prompts that were used to create them.

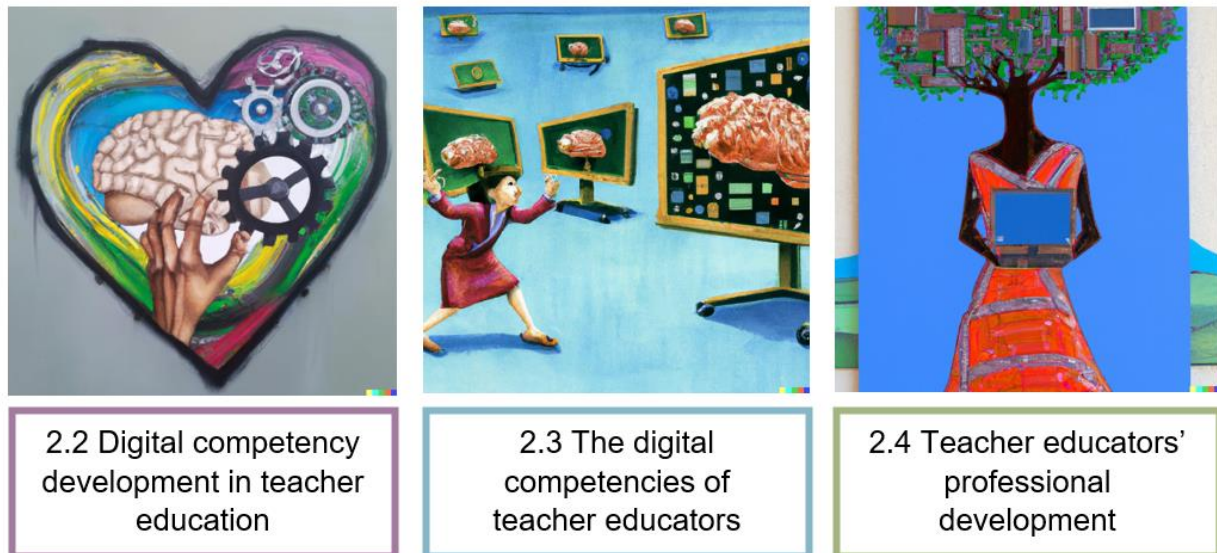


Figure 2-12 Visualisation of the three sections of the discussed literature

Source: Researcher, using DALL·E 2

How the images were created: The researcher conceptualised ways of expressing each of the sections and researched relevant symbolism. Multiple reiterations and adjustments to prompts were required. Finally, a choice was made between various options for each prompt output.

Final prompt of left image: *“a painting that shows a merging gear, heart, hand, and brain”*. The aim was to illustrate ‘competencies’ through the use of a hand (skills), a brain (cognition), and a heart (attitudes and beliefs); and ‘digital’ through the use of a gear (i.e. technology). The merging expresses the evolving concept and framework of digital competencies, while the creative, painted style of the image is reminiscent of work done by children in schools (education).

Final prompt of middle image: *“a painting of a female teacher trying to catch pc boards shaped like brains”*. The active (‘trying to catch’) persona of the teacher educator was brought into the context of digital competencies; the latter is illustrated through the concepts of ‘pc boards’ and ‘brains’.

Final prompt of right image: *“a painting of a female teacher becoming a tree built from pc boards”*. The symbolic connection between ‘growth’ (i.e. human development) and trees was leveraged, while also including the concept of technology (pc boards).

3 CHAPTER 3: METHODOLOGY

3.1 Introduction

In conducting this research, the researcher had to make a series of thoughtful decisions, which will be discussed, justified, and explained in this chapter. These choices are captured using the ‘research onion’, a visualised conceptualisation of the layers of research methodology (Saunders, 2019) in Figure 3-1.

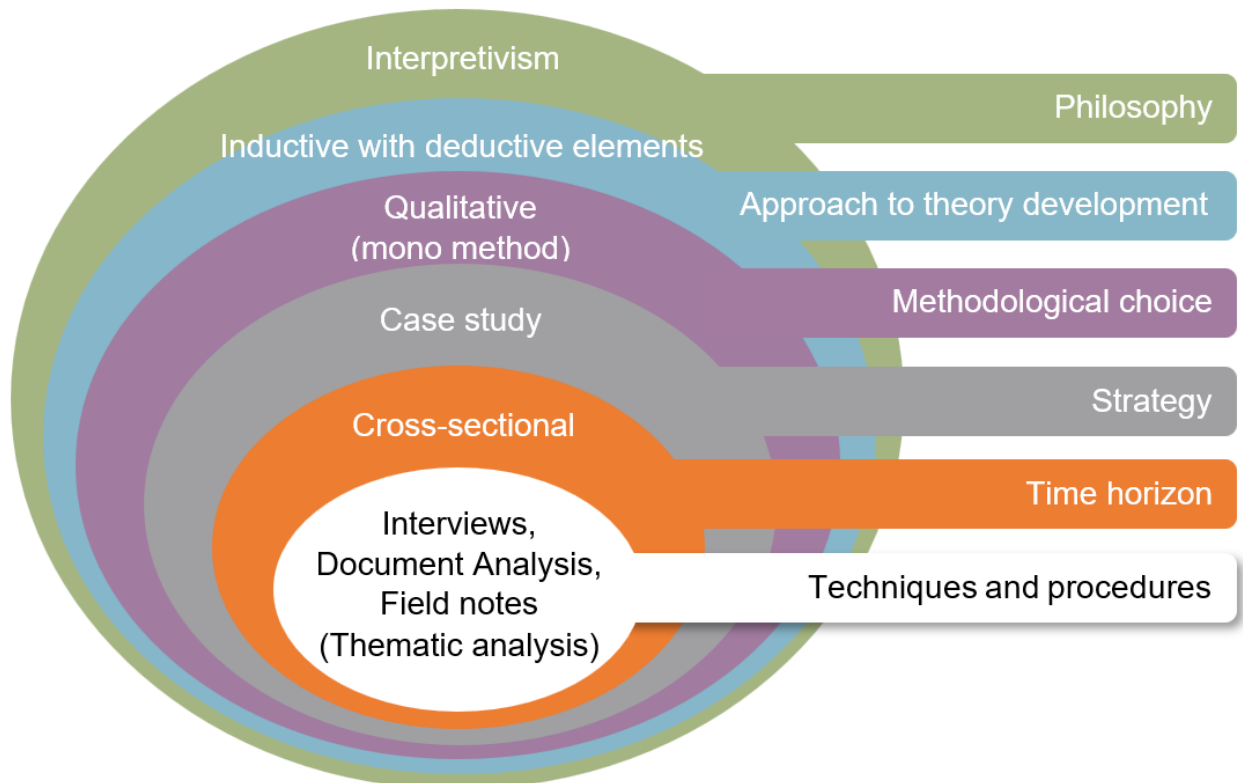


Figure 3-1 The research methodology visualised within the research onion

Source: Researcher, adapted from Saunders (2019)

The research **philosophy**, interpretivism, is discussed before its relativist ontology and a subjective epistemology are explored. After that, the study's **approach to theory development**, inductive with elements of deduction, is outlined. The next section discusses the mono method qualitative **choice**, followed by the research **strategy** – a single-case, exploratory case study. Data were collected **cross-sectionally** using three **collection methods**: semi-structured interviews, field notes, and document analysis (as represented in the two inner circles of the research onion). The **thematic analysis** for the interview transcripts and how the field notes on document analysis findings were incorporated are discussed thereafter. This chapter

ends off by illustrating the research's alignment, quality assurance, and ethical considerations.

3.2 Philosophy

An interpretivist philosophy guided the research by looking at how the social world is experienced and understood (King et al., 2019). The goal was to obtain deep insights from the lived realities as experienced by specific individuals in a particular context (Alharahsheh & Pius, 2020; Mills & Birks, 2014), i.e. teacher educators at a specific faculty engaging in an infused approach to advance digital competencies. These teacher educators were ideal sources because they were “close to the point of application” as stipulated by Willis (2007, p. 111). This ensured strong contextual data.

The researcher's values and opinions are integral, even desirable, to the process (Braun & Clarke, 2022; Galdas, 2017). The main challenge for the researcher is to be transparent and reflexive (Galdas, 2017). To this end, the researcher critically reflected on personal preconceptions, the analytical focus, and the relationship dynamics (Polit & Beck, 2014) in a journal throughout the research.

The interpretivist philosophy of the research allowed the researcher to investigate the teacher educators' engagement in the initiative as a whole instead of only probing parts thereof (Alharahsheh & Pius, 2020). Important dimensions of causality could also be explored (Yanow & Schwartz-Shea, 2015), such as examining teacher educator motivation to understand what caused them to engage in the initiative.

3.3 Ontology

Ontology refers to the assumptions the researcher makes about reality, and it affects what is being researched and how it is seen and approached (Saunders, 2019). This research adopts a relativist world view that holds that there are multiple versions of reality that are not equal or reducible to each other (O'Grady, 2014). The researcher could, therefore, explore the individual meanings (Denicolo et al., 2016) ascribed by teacher educators about their engagement in an infused approach to advance digital competencies. This view of reality compelled the researcher to keep an open mind and focus on reality as that which is experienced by the participants, without the constraints of fixed ideas or theories (Denicolo et al., 2016).

Relativism has been compared with holding a common-sensical view, i.e. that truth is that which multiple reasonable people can agree on (O'Grady, 2014). This led to an

objection to ontological relativism, most notably by Devitt (1997), that common sense supports realism instead of relativism. While all philosophers, however, sustain common sense to a certain degree, their interpretations differ (O'Grady, 2014). Common sense is therefore not sufficiently universal to be considered a credible objection to relativism.

While a key view of relativism is that no single concept can absolutely explain reality (Smith, 2006), there are two diverging interpretations. The first is known as the strident case, which rejects all attempts to narrow down true descriptions, preferable approaches, or valid assessment of valuable human behaviour (Harré & Krausz, 1996). The ontology of this research, however, aligns with the second interpretation, known as the reasonable case, which considers all descriptions, approaches, and value judgements equal (Harré & Krausz, 1996). It holds that there is meaning in deconstructing assumed departure points for research, such as the concepts of rationality, agency, cognitive processes, and significant actions (Smith, 2006). This was done by probing the teacher educators' motivations, actions, thoughts, and communities while engaging in the initiative.

A core facet of relativism is that a structure, such as thought, can be used to share different versions of the world (O'Grady, 2014). This then needs to be communicated through language and discourse (Smith, 2006). Most of the collected data therefore consists of the verbal accounts of participants.

3.4 Epistemology

The epistemology of research reflects assumptions about how knowledge can be known and communicated to others (Saunders, 2019). The research has a subjectivist epistemology, where the basis of factual knowledge is personal experience and only the individual can make valid judgements (O'Leary, 2007). This epistemology rejects the idea of a material reality; therefore, the research data consists wholly out of the accounts of the social actors (Blaikie, 2004), i.e. the teacher educators.

This subjectivism epistemology also meant that the researcher could not separate personal values when interacting with the participants' diverse narratives (Saunders, 2019). The researcher therefore acknowledged and reflected on these values throughout, incorporating them into the research (Saunders, 2019). The researcher also considered the subjectivist epistemology in relation to the research participants

by remaining mindful of their subjectivism (Demirdirek, 2010). Far from being seen as a hurdle to credibility, subjectivism is crucial for case studies because the aim is to gain insight into participants' perspectives (Demirdirek, 2010). It therefore provides case studies with methodological strength and reflexivity.

A challenge presented by subjectivism is that its strong focus on subjective perceptions can exclude the social and natural aspects that have influenced that subjectivity (Ratner, 2008). This has been mediated by recognising the social constraints along with the subjective activity (Ratner, 2008), such as those expressed through the **Rules** component of the conceptual framework. A subjectivist epistemology therefore allows for knowledge to be included about the teacher educators' experiences, perceptions, and interpretations as well as the physical conditions and social relations that have shaped it (Demirdirek, 2010).

3.5 Approach

The approach to theory development refers to the reasoning that will govern the way data are organised, themes are identified, and meaning is found (Salmons, 2016). This research primarily followed an inductive approach, starting from the particulars to constructing the interpretations to illustrate those particulars (Preissle, 2008). It also, however, incorporated elements of a deductive approach during the coding stage. Ideas conceived during the research planning therefore helped direct the study (Vogt et al., 2014).

The goal of inductive reasoning is "to find order in chaos, to find the whole from the pieces" (Salmons, 2016, p. 164). This approach allowed the researcher to focus on subjective interpretations in a specific context (Saunders, 2019). Deductive reasoning at the coding stage meant that the researcher (1) analysed the data for premises, categories, and principles in the research design, and (2) identified a priori codes from concepts and keywords in the problem statement, research questions, theoretical framework, and literature review (Salmons, 2016).

3.6 Methodological choice

Qualitative research design is a broad umbrella term for a style of enquiry which makes a generic description difficult to pin down (Flick, 2007; Lichtman, 2014; Mills & Birks, 2014). Overall, it can be said to be guided by certain attitudes (Flick, 2007, p. 14):

“... of openness towards who and what is studied, of flexibility in approaching a field and moving in it, of understanding a subject's or a field's structure rather than of projecting a structure into what is studied, and so on.”

Knowledge in qualitative research grows through many related, small-scale studies that “start to tell a bigger broader story” (Braun et al., 2022, p. 435). The researcher remained mindful that the people (the teacher educators) and events (those related to the initiative) in this research ‘story’, were unique, non-generalisable, and invited multiple perspectives and interpretations (Cohen et al., 2018). To improve the quality of the research, the researcher became a careful observer, took a questioning stance about work and life contexts, and maintained a tolerance for ambiguity as suggested by Merriam and Tisdell (2016).

Qualitative research’s core characteristic is arguably the activated role of researchers (Merriam & Tisdell, 2016) which affects their relationship with the participants (Mills & Birks, 2014), their approach to making sense of the data (Lichtman, 2014), judgements made during the research process (Flick, 2007), how their voices are infused in the context (Lichtman, 2014), their reflective contributions (Lichtman, 2014; Mills & Birks, 2014) and their own identity, values, and beliefs impacting on the research process (Denscombe, 2010). Reflexivity, therefore, played an important role in this qualitative research, by considering how the researcher’s background impacts on the study direction (Creswell & Creswell, 2018). The researcher kept a work journal throughout the project with which the analysis and reporting was framed (Kvale, 2018). During the interview stage, these notes helped the researcher to see past experiences in a different light and reflect on the research process (Kvale, 2018).

The research took on a qualitative design because the researcher looked at an activity in its natural setting and interpreted it according to the meanings ascribed to it by the people involved (Denzin & Lincoln, 2018; Merriam & Tisdell, 2016), i.e. the teacher educators at a specific Faculty of Education and their engagement in an infused approach to advance digital competencies. It took an in-depth rather than a broad view (Lichtman, 2014) by focusing on the stories of a few participants. Qualitative research further emphasises process and delivers a richly descriptive product (Merriam & Tisdell, 2016), which the research has been designed to capture. These thick descriptions countered simplistic explanations and reductions (Cohen et al., 2018).

The dynamic and fluid nature of a qualitative approach made it possible for the specifics of the data collection and analysis to evolve during the research (Lichtman, 2014). The absence, however, of a fixed, detailed plan can lead to delays in completing the research. The researcher avoided this by maintaining a disciplined approach and carefully managing any changes to the research plan, such as the adjustment of the sampling criteria.

Qualitative research challenges include the undue influence of researchers because of the instrumental role they play, the theoretical framework they select, and their own interests (Merriam & Tisdell, 2016). The researcher maintained a reflexive attitude about how these aspects might affect the data collection and interpretation, as advised by Merriam and Tisdell (2016). Furthermore, the researcher was mindful to keep the research process faithful to the research goals (Cohen et al., 2018), as shown in the research alignment in section 3.10).

3.7 Research strategy

A single-case, exploratory case study design was followed. Single-case studies in non-positive paradigms can yield substantial insight (Boddy, 2016). This design, however, sometimes attracts concerns about the case being too unique (Yin, 2014). The researcher mediated this by clearly situating the studied initiative amongst similar infused initiatives through the literature review (Admiraal et al., 2017; Buss et al., 2018; Foulger et al., 2019) and in the discussion below.

The initiative was conceived as the faculty's response to the Professional Development Framework for Digital Learning by the Department of Basic Education (2017). The stakeholders decided to integrate the digital competency development into the existing teacher educator curriculum, instead of creating an additional stand-alone technology module. This aligns with the approach proposed by Foulger et al. (2019). The initiative relies on voluntary participation from teacher educators, who are guided by the initiative stakeholders to redesign an existing curriculum activity or project to incorporate the development of one of more digital competencies. The adjusted activity is then uploaded on the university LMS and a digital badge is attached to it. It, therefore, activates the mechanism of gamification because a pre-service teacher completing the curriculum activity up to a predefined standard activity will be awarded this badge. The end goal is for the pre-service teachers to be given

accreditation listing the digital competencies attained during their teacher training. This serves as early professional development and can support them in their job searches.

The research was well-suited to a case study because it aimed to holistically capture a complex learning and teaching situation in its natural context and in relation to its surrounding communities (Hamilton & Corbett-Whittier, 2013; Thomas, 2021). The choice of case study is also supported by the case being a rarity or outlier (Hamilton & Corbett-Whittier, 2013; Thomas, 2021). Such infused approaches to digital competency enhancement in teacher education has only fairly recently started to gain traction (Foulger et al., 2019). The researcher was also already somewhat familiar with the context of the case to be studied (Thomas, 2021) through a previous research project.

The research features a clear, bounded case that is defined by place and time (Bloomberg, 2018; Cohen et al., 2018). The case is that of teacher educators that are currently engaged in this specific initiative at their faculty, and that teach a curriculum component that has been part of the initiative since its inception in 2019. The case is interwoven with its context (Yin, 2014), which ranges from each teacher educator's individual context to their broader context, represented by the national framework that prompted the initiative. Their context is unique and dynamic and still unfolding (Cohen et al., 2018; Yin, 2014).

The study sought to illuminate a real example of real people, which is easier for a reader to understand than abstract explanations (Cohen et al., 2018). It explored the thoughts, behaviours, motives, values, and attitudes (Swanborn, 2010) of a specific professional community (Hamilton & Corbett-Whittier, 2013). The unit of analysis is, therefore, the experiences of the teacher educators.

The researcher used multiple data sources and tools in aiming for rich data and subsequent depth (Hamilton & Corbett-Whittier, 2013; Yin, 2014). Multiple perspectives ensured this richness (Hamilton & Corbett-Whittier, 2013) because the diverse and contrasting realities and interpretations of the five participants were revealed (Swanborn, 2010). This inclusion of multiple meanings of multiple realities makes a case study a good fit for the relativist world view of this research (Yin, 2014).

An exploratory case study was chosen because the researcher sought to discover new dimensions from the data that might reflect in similar cases (Bloomberg, 2018).

As an outsider, the researcher also benefitted from the independence and flexibility of an exploratory case study (Streb, 2010). A good working knowledge of the research topic is important even in an exploratory case study (Yin, 2014). For this reason, an in-depth preliminary literature review was conducted before starting the data collection. Exploratory case studies further allowed the researcher's knowledge to evolve during the interview stage which led to more nuanced questions (Kvale, 2018). An example is when the researcher found better ways to probe participants about their role as second-order teachers in advancing digital competencies (Q12.2).

Lack of generalisability is considered the greatest challenge of case study research (Tight, 2017). The case's exemplary knowledge can, however, yield insights that could be connected to the experiences of others (Bloomberg, 2018), although case studies need not always seek to generalise the findings (Thomas, 2021). Generalisability was not a high priority for this research because of its rarity and subsequent lack of cases to generalise it to. On the other hand, by being an exemplary case, the study's generalisability is significantly increased (Tight, 2017).

3.8 Time horizon

The research's cross-sectional design took a snapshot of the five teacher educators' lives by collecting data at one point in time (Hawkins, 2017), i.e. over four weeks. This strategy suited the research because time was not a study variable and the required data could not be directly observed (Lavrakas, 2008). It is easy, relatively quick, and helps to avoid the attrition issues common in longitudinal studies (Hawkins, 2017; Lavrakas, 2008). The main disadvantage is its inability to test causal relationships (Hawkins, 2017; Lavrakas, 2008); however, this was not an explicit goal of the intended research. The researcher also remained mindful of the sampling procedure to ensure representativeness (Hawkins, 2017).

Although the data includes the participants' memory of the initiative from its inception four years earlier, the 'snapshot' is intended to reflect their evolving impressions. It was also meaningful that that four-year period was 2019-2022; therefore, in terms of the Covid-19 pandemic, the period included a pre-, during, and post-pandemic segment. This is relevant because four participants referred to the pandemic in relation to their engagement and mention is made of the pandemic in the findings.

3.9 Methods

3.9.1 Sampling

3.9.1.1 Sampling approach and criteria

The study used purposive sampling, a form of non-probability sampling where it is logically assumed that the sample represents the population (Lavrakas, 2008). It contrasts with probability sampling which innately calls for random selection (Vehovar et al., 2016). The use of the term ‘sampling’ in case study research is often discouraged (Thomas, 2021; Yin, 2014) in favour of the word ‘selection’. This is because the goal is not to show the quality of the whole (Thomas, 2021) while the word ‘sampling’ can create misleading associations with statistical generalisation (Yin, 2014).

Case studies often use purposive sampling because the case inherently accounts for the sample (Jupp, 2006). This case was chosen because it is a clear, practical example (Thomas, 2021) of an infused approach to advance digital competencies in teacher education. The participants, therefore, constituted the teacher educators that engaged with this initiative at their faculty.

Researchers, however, must ensure that their purposeful sampling strategy is still justified for the case they are studying (Bloomberg, 2018). The researcher therefore deliberately looked for the following specific participant characteristics (Lewis-Beck et al., 2004): (1) they are teacher educators at a specific Faculty of Education, (2) they are currently engaged in this initiative to advance digital competencies, and (3) their curriculum component has been part of the initiative since its inception in 2019. They are seen as being currently engaged if they teach an active curriculum component on the university learning management system (LMS) that is linked to the initiative. This means their ‘engagement’ can range from having a central role, e.g. that of initiative coordinator, to more peripheral involvement, e.g. as a teaching assistant that started teaching the curriculum component later. The sample consisted of five participants.

The sampling criteria was broadened slightly during the data collection phase. This is in line with the adaptability required in case study research, and this change was viewed as an opportunity (Yin, 2014). It allowed for greater diversity in participant perspectives which enriched the data considerably (Hamilton & Corbett-Whittier, 2013). Table 3-1 shows the participants’ differing levels of criteria. While all of them

are currently teaching a subject containing a badge activity, they did not all design a new activity as part of the initiative.

Participant	Level of engagement in the initiative
A	Was part of the initiative conception and provided support for other participants; assigned badges to two existing technology-related activities
B	Redesigned an existing curriculum component to incorporate technology
C	Redesigned an existing curriculum component to incorporate technology
D	Took over module from the teacher educator that redesigned an existing curriculum component to incorporate technology
E	Acted as coordinator for the initiative; took over module from the teacher educator that assigned the badge to an existing technology-related activity

Table 3-1 The differing levels of engagement of the participants

Purposive sampling's clear advantage, i.e. the researcher's freedom to identify the right participants (Jupp, 2006) also points to its main challenge, i.e. the researcher's subjectivity in selecting participants (Jupp, 2006; Lavrakas, 2008). This can affect the validity of the conclusions (Jupp, 2006). It is, however, considered suitable to use purposive sampling for a sample of a few participants that does not prioritise inference to the population (Lavrakas, 2008), such as the intended research. The selection criteria was also kept internally consistent with the research goals (Jupp, 2006). Most importantly, the sample turned out to include most of the initiative participants that matched the selection criteria. The only potential research participants excluded from the study were those that opted not to participate.

3.9.1.2 Participation process

Potential participants were invited to participate in the study via email. It contained attachments that provided an overview of the research goals and explained what was expected from them should they volunteer to participate. This email was sent by the initiative coordinator in adherence to the local POPI (Protection of Personal Information) Act, which restricts the sharing of personal contact details. The participants emailed the letters of consent to the researcher, who was then able to schedule a suitable interview directly with each of them. The documents required for the document analysis were collected either from the participants or from the programme coordinator.

3.9.2 Data collection instruments

Data about the case was collected through three instruments: semi-structured interviews, field notes, and document analysis. These are discussed in detail in the following sections. Using multiple and diverse data collection methods triangulated the

data to enrich and improve it (Swanborn, 2010; Yin, 2014). While this required the researcher to develop a broader set of data collection techniques (Yin, 2014), it was welcomed as an opportunity to grow the researcher's inquiry skillset.

3.9.2.1 Semi-structured interviews

Qualitative interviews are knowledge-producing conversations that aim to discover (as is the case in this exploratory research), understand, or even to construct something new (Brinkmann, 2013). While time-consuming to conduct, interviews can deliver the richest data of the study to enable an in-depth understanding – especially in this research's semi-structured format (Hamilton & Corbett-Whittier, 2013). This section describes the interview content and how the interviews were conducted, recorded, and transcribed.

i. Interview content

The researcher compiled a set of 32 open-ended questions to guide the interviews in a semi-structured approach. It started with the core set of questions that align directly with the four secondary research questions and ended with seven questions about their experience of their profession in general. The choice for a longer set of questions considered the sensitivity of the researcher, and outsider researcher, to the context of the participants (Kvale, 2018). The list of questions appears in Appendix A, and each question's alignment with the research is shown in section 3.10.

i. Conducting the interviews

The comprehensive set of questions created a solid scaffold for the developing interviews. This structured 'net' was especially valuable in adapting the order and the probing techniques for specific participants that did not adhere to the original sampling criteria, i.e. that had redesigned the curriculum component themselves. It allowed for the freedom to gather meaningful knowledge that still aligned with the research goals. This open interviewing style might make it more difficult to compare and analyse the data systematically (Kvale, 2018). The researcher countered this by making notes of how each interview flow differed from the previous ones.

The researcher, as the primary tool in interviews, remained critically aware of personal presuppositions and was sensitive and open to what was said and not said (Kvale, 2018; Yin, 2014). While accepting ambiguity, the researcher clarified whether these reflected a failure in communication or real contradictions in the participant's reality

(Kvale, 2018). The researcher also listened to and interpreted the interview answers both on a factual and a meaning level, and also aimed to read 'between the lines' (Kvale, 2018). Care was taken to facilitate meaningful social interaction and the participants were briefed and debriefed before and after the interview (Kvale, 2018).

A potential weakness of interviews is their subjective nature; however, different interpretations can offer new dimensions if it is a subjective perspective rather than an unacknowledged bias (Kvale, 2018). The researcher's journal and critical attitude to the interpretations helped to make these unique perspectives known. Furthermore, the interplay between the researcher and participant's personal viewpoints can provide a well-defined understanding of the participant's experience (Kvale, 2018). The researcher, however, made a point to consistently clarify the participant's statements where needed (Kvale, 2018). Clarifying meaning also improved the interview quality because it made the analysis easier and helped to validate the findings (Kvale, 2018). An example is the probing questions to Participant A to clarify whether what was being said related to the teacher educators' or the pre-service teachers' professional development.

ii. Recording the interviews

The interviews took place through the online Zoom video-conferencing platform. The main reason for conducting virtual interviews was that the researcher and the participants live in different cities. Online interviews, however, also offer participants positive experiences in terms of ease, time, and costs, while still ensuring rich data collection (Gray et al., 2020). Furthermore, video recordings allowed the researcher to access information about the body language and social dynamics during the transcription (Kvale, 2018). This was useful in adding notable facial expressions and hand gestures into the transcription.

The researcher was mindful to safeguard the quality of the recording, as this would impact on the quality of the transcripts (King et al., 2019). This was done by selecting a high-quality teleconferencing tool, speaking clearly and at a good pace, and ensuring a stable internet connection. The researcher's active meaning-making can mitigate small 'jumps' because of an unstable internet connection during the live conversation (which happened during one interview). It was, however, clear to the researcher that these micro interruptions would complicate the later transcription and risk the integrity

of the transcription. For this reason, that interview was paused and only resumed once a solution to the unstable connection was found.

After each interview, the video recording files were saved on a secure, cloud-based location. This meant that the files were not vulnerable to the failure or theft of devices.

iii. Transcribing the interviews

The transcriptions were done through a combination of automatically generating transcriptions and a careful editing process. The initial transcriptions were generated using the voice transcription capability of Google Inc's video sharing platform Youtube. The researcher ensured that the videos and their confidential content remained secure by uploading them as unlisted, private videos, and by deleting each video as soon as the transcription was rendered. This yielded good quality but not perfect transcriptions. The researcher then meticulously compared the initial transcriptions to the video recordings, and the field notes, to make corrections and to add notable nonverbal information. An example of the latter is the throwing up of hands by a participant to add emotion to, and put additional emphasis on, the phrase, "my work is done".

During this editing process, the researcher made editing choices to make the later analysis easier (Kvale, 2018). A reflexive, denaturalised transcription approach was followed to support the content analysis process (Da Silva Nascimento, 2019). This included the removal of interjections and repeated words that were not considered useful for the research purposes (Kvale, 2018). A few discourse markers were kept when they added meaning to the surrounding text. Re-starts to sentences were also removed, unless it contributed to an emerging thought of a participant. The researcher used parentheses to indicate phrases adjusted for clarification or missing or inaudible words. One participant used Afrikaans occasionally, which was translated and indicated as a translated phrase in square brackets. The researcher safeguarded the quality of the transcriptions by avoiding decontextualisation (King et al., 2019; Kvale, 2018). Important contextual information such as tone of voice and the intention of humour were added in square brackets.

This thorough process of ensuring a coherent, authentic account of the interviews was also the researcher's way of starting the first phase of the thematic analysis process (Braun & Clarke, 2022).

3.9.2.2 Field notes

While field notes are mostly associated with ethnographical studies, they were used to supplement the interviews with information about the interaction (Phillippi & Lauderdale, 2017; Tenzek, 2017). The main benefit of field notes is that the context of the interview is enriched (Phillippi & Lauderdale, 2017; Tenzek, 2017). It was, however, not seen as objective data, as it maintained a close connection between the researcher's subjective interpretation and the actual event (Ravitch, 2018).

The researcher took field notes in a disciplined way to identify the concepts and language used by the insiders in this specific setting (Emerson et al., 2011), by making notes on a printed copy of the research questions in a two-column layout (shown in Figure 3-2).

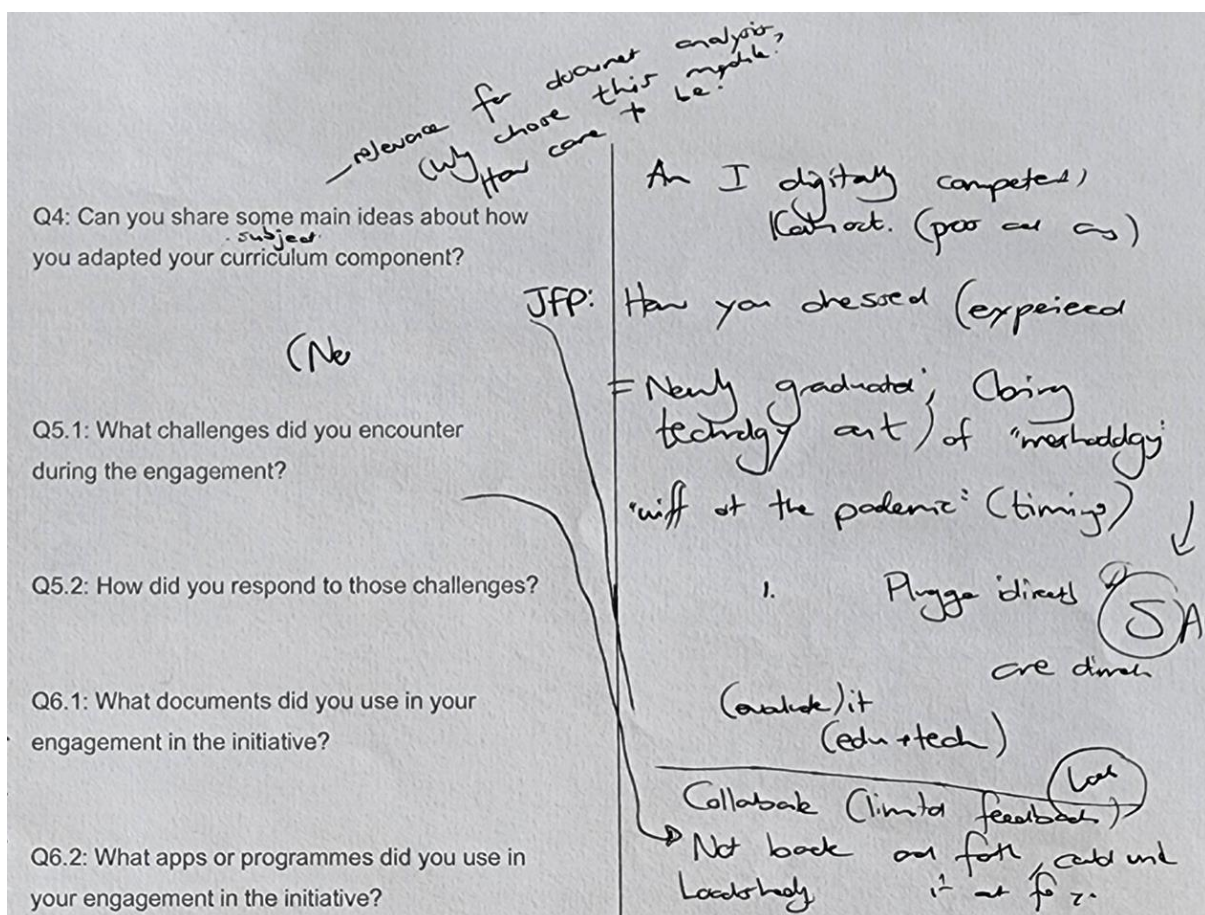


Figure 3-2 Excerpt from field notes in two-column layout

Source: Researcher

The researcher also improved the reliability of the field notes by writing up these short notes into comprehensible, complete content right after each interview, while it was still fresh in the mind (Kvale, 2018; Ravitch, 2018; Tenzek, 2017). Questions and

thoughts that came up during the interview were also processed in this write-up (Tenzek, 2017). The researcher further noted changes to interview questions and the reasons they were changed (Phillippi & Lauderdale, 2017). An example of each of these appears below:

Processed question or thought

The question jotted down as “Holistically teach – other?” was resolved as “Q2.1 The phrase ‘holistically teach’ was possibly used by two other participants – confirm during coding.”

Changes to an interview question

“Q13.6 was omitted for two reasons: (1) it was felt that it was not necessary to pursue the ‘competitive profession’ angle for this participant because related information had been collected, and (2) the ‘motivation’ aspect is considered unique for this participant due to the unique nature of their initiative involvement.”

There are generally two types of field notes: descriptive (Ravitch, 2018; Tenzek, 2017) and reflective or evaluative field notes (Phillippi & Lauderdale, 2017; Ravitch, 2018; Tenzek, 2017). Ravitch (2018) further differentiates between descriptive and inferential notes. Ravitch (2018), however, also cautions researchers about the blurred line between these two types and its risk to research quality. The researcher therefore reflexively engaged with the field notes in a systematically and structured way, as advised by Ravitch (2018).

To show this engagement and the range of field notes that were generated, a selection of the field notes has been included below:

Descriptive

“Q10.2 Pause before answering (pauses being rare in this interview)”. This field note is specific and detail orientated (Tenzek, 2017).

Inferential

“Q12.2 The participant’s blank expression could answer the question by itself, i.e. that the concept of ‘second-order teaching’ is not something that the participant has reflected on before. This was also confirmed after further explanation and probing.” This field note consists of an assumption beyond the data (Ravitch, 2018).

Reflective/Evaluative

“Q13.6 The participant replies, ‘If you’re into that, okay... if that’s the most important thing you want’ in a tone of voice that shows that promotion is not something they themselves aspire to. Could the tone also allude to a negative perception of overly ambitious teacher educators? Or that this participant thinks there is a deeper purpose? This was an initial thought; however, it

could also be because of common associations with the phrase ‘if you’re into that’. This field note shows speculation of the reason behind a behaviour (Tenzek, 2017), i.e. a certain tone of voice.

3.9.2.3 *Collecting data through documents*

In contrast to interviews, documents are readily available, cost-efficient, cost-effective, and stable data sources that cannot be influenced by the researcher (Frey, 2018; Swanborn, 2010). The document analysis component aims to contribute to the addressing of the research questions and to expand on the interview findings while also helping to avoid bias (Frey, 2018).

The document analysis studied documents produced by the participants. The goal was to further explore the **Rules** and **Community** elements of Activity theory in the research’s conceptual framework (further described in Section 3.9.3.3). For each of the participants, one of the following three types of documents were analysed:

- 1) The participants’ planning document, provided to them at the start of the initiative, which outlines useful pedagogical and technological frameworks to guide the teacher educators (an example appears in Figure 3-3).
- 2) The adjusted curriculum component as uploaded on the university LMS, which contains the instructions to the pre-service teachers on how to complete the activity (an example appears in Figure 3-4). (The initiative’s own ethical clearance supported access to these curriculum components.)
- 3) In the case of the participant who was the initiative coordinator, a document summarising the current digital competencies badges.

Name: [REDACTED] Module: [REDACTED] • Design Thinking • Subject Integration • Mobile / Active Learning Content	• Student only focus on their own subject area. • Teacher-centered activities are created. Current practice
Digital Competencies 3, 4, 5, 6 & 8. Tools Various tools chosen by students. Can confirm after task.	New activity • Student will engage in the integration of different disciplines in a learning activity. • Active / Mobile Learning activities.

Preparation

- Students are introduced to Design Thinking.
- Students are grouped to other disciplines
- Task is provided.
- [REDACTED] for Collaboration.

Rollout

Semester 1 - 2020

Allocate Badge

[REDACTED] - Peer assessment mark of 75+

R						
M						
A						
S						
	1	2	3	4	5	6
	R	U	A	A	E	C

Feedback

Formative peer feedback with Lecturer moderation?

Badge Name Mobile Teacher

Figure 3-3 Example of a document studied (received in digital version)

Group assignment 2022 Marking rubric

Unit 2 Literacies in the wider school context

ClickUP links will close at 23:00 on Friday, 1 July 2022.

Only submissions will be accepted.

Competence criteria

Well done Excellent	Really good Above average	Average Acceptable Satisfactory	Lacks substance Must improve	Inadequate Not satisfactory	Outcome not met No task
5	4	3	2	1	0

Task descriptor/criteria	
1	Meetings: audio-visual recording, notice, agenda, minutes – group role play
	Acceptable audio-visual recording
	Correct meeting procedure followed?
	Full participation of group members during discussion
	Role of chairperson and others adequately clear
	Clear evidence of the purpose of the meeting
	Accurate documentation: PDF copy of meeting notification, agenda, and minutes
	Minutes of recorded meeting: according to brief; evidence of all decisions made
	Uniqueness/originality of ideas put forward for project
	Subtotal: 40

Figure 3-4 Example of a document studied

No inclusionary or exclusionary criteria were required for the document selection because these are the only type of documents used by teacher educators in engaging in the initiative. Two documents, however, that were received related to modules that underwent no changes because of the initiative. They therefore did not represent data that specifically shed light on the initiative. For this reason, they were studied for background on the module, but were not included in the document analysis. Documents were received in the following formats: PDF's, Word documents, screenshots, and digital images. A list of the documents appears in Table 3-2 below.

Participant	Document(s) analysed	Format
Participant A	Filled out planning document	PNG image in a Word document
Participant B	Assignment document, assignment marking rubric, screenshots from LMS	PDF's, PNG images
Participant C	Filled out planning document	PNG image in a Word document
Participant D	Assignment guidelines	PDF
Participant E	Digital competencies badges summary	Microsoft Excel

Table 3-2 Summary of documents analysed for each participant

An advantage of document analysis is the stability of the data – unlike with interviews, researchers cannot influence the sources (Morgan, 2022). These documents alone, however, would not have yielded all the crucial research data and were therefore employed as part of a triangulation strategy (Morgan, 2022), used to support the interview data where the bulk of the data was collected.

Limited data can be a weakness of data analysis (Morgan, 2022). This was a concern for the researcher when it was initially difficult to collect the required documents. When the participant sampling criteria were adjusted, however, it allowed for different types of documents to be included. Sufficiency in the amount of documents can be reached when themes can be developed (Morgan, 2022). As the document analysis was specifically aimed at uncovering data related to the **Rules** component of the conceptual framework, its data was well-positioned to contribute to the theme development.

The researcher ensured that all the analysed documents correlated to the four factors Flick (2018) notes as important in choosing documents: authenticity, credibility, representativeness, and meaning. Each document was authentic because it was shared by each participant or by the initiative coordinator as a document related to participation in the initiative. It is therefore a primary source of information about the initiative, i.e. what they created because of their participation. The documents were credible because their producers, the teacher educators, were reliable sources of the information contained in them (Flick, 2018). The documents showed the participants' interpretation of how to embed the initiative goal into their taught subjects, and therefore represented typical examples of the initiative (Morgan, 2022). Lastly, the documents were meaningful because they were significant, clear and understandable (Morgan, 2022). The planning document outlined the required information elegantly, and instructions to pre-service teachers were written for easy understanding by the intended reader.

3.9.3 Data analysis process

The following section describes how the data from the interviews were analysed and how the field notes and document analysis data were incorporated in the complete dataset. The researcher was committed to high quality analysis and carefully showed in this section that all evidence was attended to and that the most significant aspects of the case study were addressed (Yin, 2014).

3.9.3.1 Analysis of the interview transcripts

The transcribed interviews were processed through thematic analysis to identify “patterns of experience” (Ayres, 2008, p. 867). The researcher segmented, categorised, summarised, and reconstructed the data to encapsulate the dominant

ideas from the data set and described them within its enveloping design (Ayres, 2008). The data was specifically analysed following the reflective thematic analysis process outlined by Braun and Clarke (2022), which is discussed and illustrated below. The approach that guided this analysis was primarily inductive while deduction also played a role because of the way the interview questions were designed. Examples of initial codes that were developed inductively as a result of the interview questions are ‘modelling digital aspects’, ‘perceived impact on the initiative’, ‘motivational elements’, and ‘PDC growth’.

The findings of a thematic analysis cannot be evaluated in terms of its accuracy, but rather in being either strong or weak (Braun & Clarke, 2022). The analysis aimed for strength by being compelling, thoughtful, rich, and nuanced (Braun & Clarke, 2022). Flexibility is one of the advantages of thematic analysis; however, therein also lies its challenge (Braun et al., 2022; Hawkins, 2017). Table 3-3 contains three common pitfalls highlighted by Hawkins (2017) with suggestions to avoid them, as was followed by the researcher.

Common pitfalls	The researcher’s avoidance strategies
Themes lack sufficient depth	Showed a specific and detailed understanding of the located themes
Examples instead of analytical points are presented	Clearly aligned the data with the research questions
The systematic approach is not clearly explained	Incorporated the systematic progression of the analysis into the final report to clearly support the theme identification, as shown in the following section

Table 3-3 Common pitfalls of thematic analysis with avoidance strategies

Source: Adapted from Hawkins (2017)

The computer-assisted qualitative data analysis software (CAQDAS) Atlas.ti was used to support the thematic development. ‘Supported’ here is apt because of misplaced expectations of such tools. While it provides the means to compile, disassemble, and reassemble data, the researcher still needed to create and assign compelling codes before carefully analysing the outputs for meaningful patterns (Yin, 2014).

Braun and Clarke (2022) describe their six components as ‘phases’ rather than steps to encourage an active, situated approach. The researcher’s experience of the six phases is visualised in Figure 3-5 to show how this approach merges a robust process with flexibility (Braun & Clarke, 2022). Each phase is then discussed.

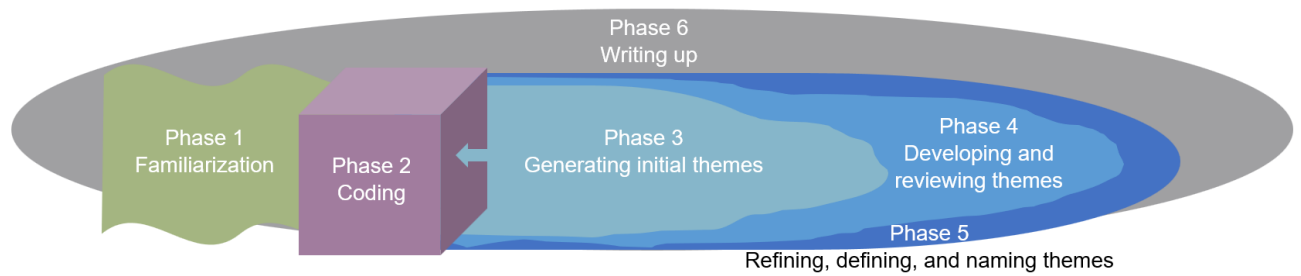


Figure 3-5 The researcher's experience of the six phases of thematic analysis

Source: Researcher; from the phases suggested by Braun and Clarke (2022)

Phase 1: Familiarisation with the dataset

The first phase entailed a deep familiarisation with the content. The researcher became immersed in the data by reading each of the interview transcripts twice and watching the video recordings once (Braun & Clarke, 2022). The latter was particularly important to observe the subtle facial expressions, gestures, and tone of voice to reflect on their emotions and the potential meanings attached to their words. The researcher engaged critically with the transcripts (e.g. by asking questions such as, *What does the participant's choice of words reveal about their attitude to digital competencies?*) and made notes of insights relating to specific text or the content as a whole (Braun & Clarke, 2022). A hand drawn mind map was also produced for each participant, in line with the recommendations of Braun and Clarke (2022). An excerpt of one of these maps appears in Figure 3-6.

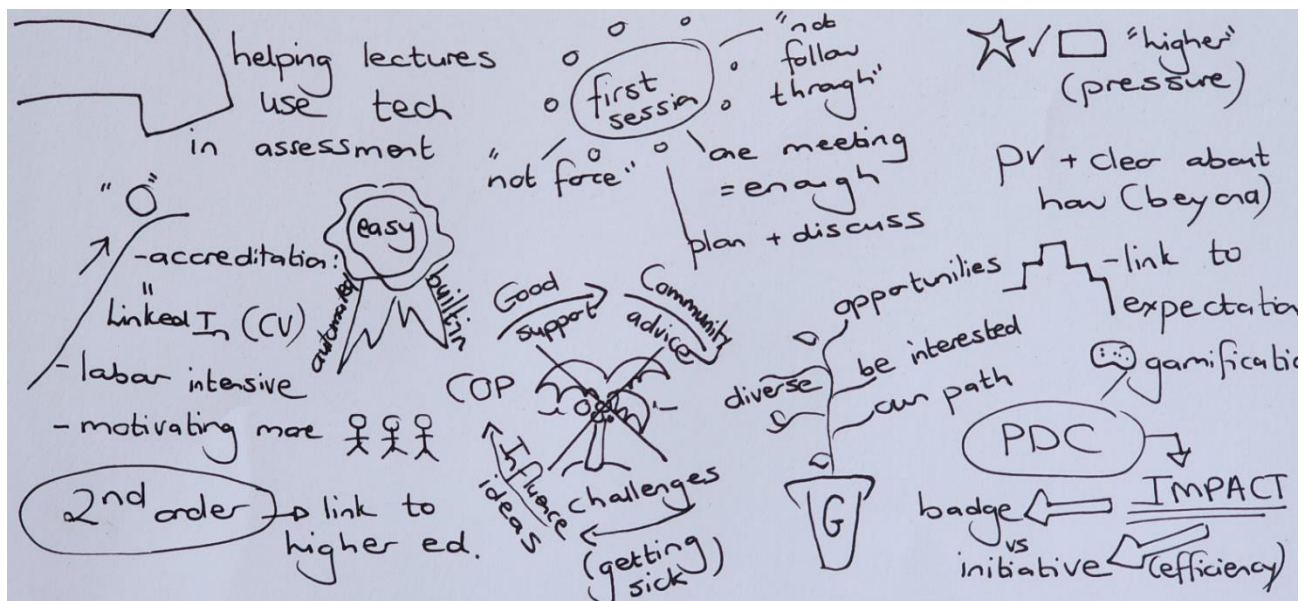


Figure 3-6 Excerpt from hand drawn mind map created as part of phase 1

Source: Researcher

Phase 2: Coding

Although the coding was approached in an organic and evolving way, the researcher also worked with a systematic coding process to ensure insight and rigour (Braun & Clarke, 2022). The coding was done in three rounds to heighten its quality, because the quality thereof would directly affect the strength of the developed themes (Braun & Clarke, 2022). The focus was on identifying components in the transcripts that illustrated a particular meaning. Thinking in this 'singular' rather than 'multi-faceted' way kept the researcher from cherry-picking data or prematurely collating themes (Braun & Clarke, 2022).

The first two rounds of coding were completed in Microsoft Word using the comment function. This encouraged reflection and multiple codes. The researcher was cautious not to use the coding software too early in the process, because the codes might become locked in too soon (Braun & Clarke, 2022). The initial round was often 'blunt', becoming more nuanced with later interviews and coding rounds. The second round was done to fine-tune the previous round after consulting the researcher's reflective journal and the mind map created for each participant during phase 1. Figure 3-7 shows a portion of a coded transcript during phase 2.

three years ago, and maybe it's difficult because I think you're involved in so many innovative things in general, it's difficult to isolate maybe your experience of the initiative, but how has it been meaningful for you?

Participant B: What's been meaningful to me is the fact again that we are not just throwing a module at it. That was something that scared me in the initial phases of this, is that we are going to throw a module at this policy, there's going to be another... I don't know, let's say a (subject name) like we have with the intermediate phase that is now this e-Learning methodology. I mean, if we now all of a sudden have 2,000 students in a faculty that we now want to teach 13 competencies to, we can make a semester module out of it with two big assignments and of course they can learn nothing throughout the process. So not being the traditional university that says, 'here we go, do module development, outcome assessment', that was really cool.

The fact that newer ideas such as gamification came about. The fact that departments were sitting around the table saying, 'how's this going to work' – different departments. We're talking about interdisciplinary, cross-disciplinary transdisciplinary thinking, before it became the buzzword, that's the meaningful part. The fact that you can see a colleague who is working with you say, 'I'm going to be the person to take this flame and walk in front, I'm going to be that person' and not necessarily being that person, but being able to see someone getting to do this, someone is involved in this, and they love to do it, that's the meaningful part of this. I mean an entire career can get its roots there, that's the meaningful part of it, with all the rest of us just keeping on doing our jobs and making a difference at the end.

Researcher: I think it must have been uniquely special for you because you were more comfortable with tech than your colleagues and to see them move into that space that must have been...

Participant B: Absolutely, yeah, and to see them being scared and being confused and being like, 'Oh, I didn't think (university LMS) gonna have to do something for this', and then to say, 'I think (university LMS) is the best thing to do this with anyway, so let's just run with it'. Seeing that scaredness being just plugged away because the process works.

Researcher: How did (the initiative) help you, or would you say that you were pretty much in a really, good innovative space already?

Participant B: You know, innovation is a is a tough job, especially when people think that that you are innovative. Yes, I have some innovative ideas, and, yes, it sometimes pops up in the middle of the night and so on, but it really does help when there is a process, someone else's innovative idea or someone else's guidance within your innovation just gives it some less fluff. You can innovate all over the place, but here's a focus. The other thing that's nice about this, is the fact that now when you innovate you say, 'but how can I also include this thing, how can I bring this with?' If I am going into a new version of a module, how can I bring this idea with so that we develop not only my module, but we also developed this initiative, because this initiative developed me, it's kind of that back and forth between the two.

Researcher: And in terms of your own Professional Digital Competence, I don't think there was a lot of needle-moving there given how advanced you were at that space...

1 Ilse De Vries
Describe colleagues' participation, able to be a witness (impressed, proud)/Support colleagues by praising them

Reply

2 Ilse De Vries
Division of Labour/Roles ('the rest of us just doing our jobs')

Reply

3 Ilse De Vries
Feelings about initiative - other TE (love to do it)

Reply

4 Ilse De Vries
Benefit of initiative ('career can take root')
16 December 2022, 14:08

Reply

5 Ilse De Vries
Support other TE (motivate them)/Tools

Reply

6 Ilse De Vries
Feelings about initiative - other TE (scared, confused)

Reply

7 Ilse De Vries
PDC Growth - other TE/Rate initiative ('process works')

Reply

8 Ilse De Vries
Attribute of initiative (provides a process, makes it easier even more innovative people)

Reply

Figure 3-7 Transcript after two rounds of coding done in Microsoft Word

Source: Researcher

The third round of coding was done while transferring the codes to copies of the uncoded transcriptions uploaded to Atlas.Ti. The researcher allowed sufficient time to pass between the second and the third rounds to ensure a fresh perspective for additional coding and for new connections to be made.

Certain codes were available beforehand because it had been explicitly incorporated in the data collection strategy (Ayres, 2008). This included the elements of the conceptual framework and concepts, such as modelling, that were revealed during the literature review (Gibbs, 2018). The researcher ensured that the coding was guided by the research questions and purpose throughout (Braun & Clarke, 2022). Figure 3-8 shows the most prominent codes at the end of phase 2, as displayed through the Quotation Manager function of Atlas.ti.

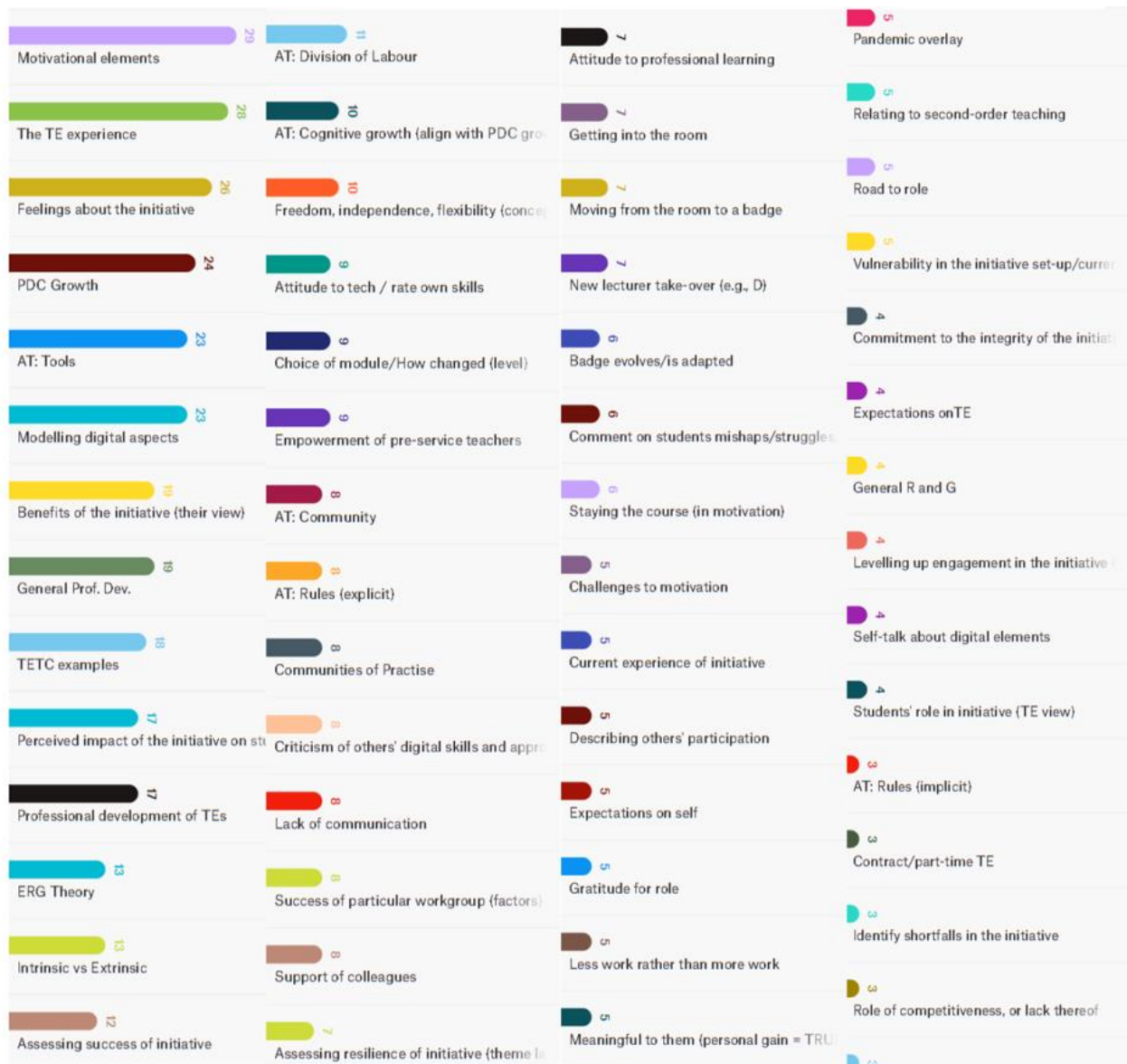


Figure 3-8 Most prominent codes after phase 2, as displayed in Atlas.ti

Source: Researcher's work in Atlas.ti

Phase 3: Generating initial themes

During the third phase the researcher started creating candidate themes by identifying clusters of codes that share meaning (Braun & Clarke, 2022). While the word 'emerge' is often used for how themes come into being, Braun and Clarke (2022) hold that 'develop' captures the process better. This is because it is up to the researcher to translate the data into meaning for the intended readers.

Sessions of deep engagement with the codes were offset by days-long breaks to create the necessary distance (Braun & Clarke, 2022). This allowed for nuanced,

compelling candidate themes to be considered. The tools the researcher used during this phase were the Quotation Manager of Atlas.ti, the reflective journal, and pen and paper to draw potential clusters.

At times the researcher often moved back to phase two when a new code presented itself during reflection. This is aligned with the guidance of Braun and Clarke (2022) that the analysis does not progress in a strictly linear way but rather moves back and forth between the phases as the cognitive process deepens. There were also instances where an already rich code was upgraded to a candidate theme (Braun & Clarke, 2022), e.g. Stages of motivation.

In the same way, there was not a clear delineation between phases three, four and five. The conceptual framework (Activity theory augmented with ERG theory) provided a valuable backbone for the analysis and allowed the themes to connect to each other meaningfully. This was done by aligning themes with the five main elements of the framework (**Subject**, **Object**, **Tools**, **Community**, and **Outcome** [with **Outcome** augmented by ERG theory]). The researcher, however, still had to capture patterns that would authentically fit within each element to best address the research question (Braun & Clarke, 2022). The researcher used visual mapping throughout the theme development, as advised by Braun and Clarke (2022). Figure 3-9 represents the development of the theme clusters as a result of the third phase.

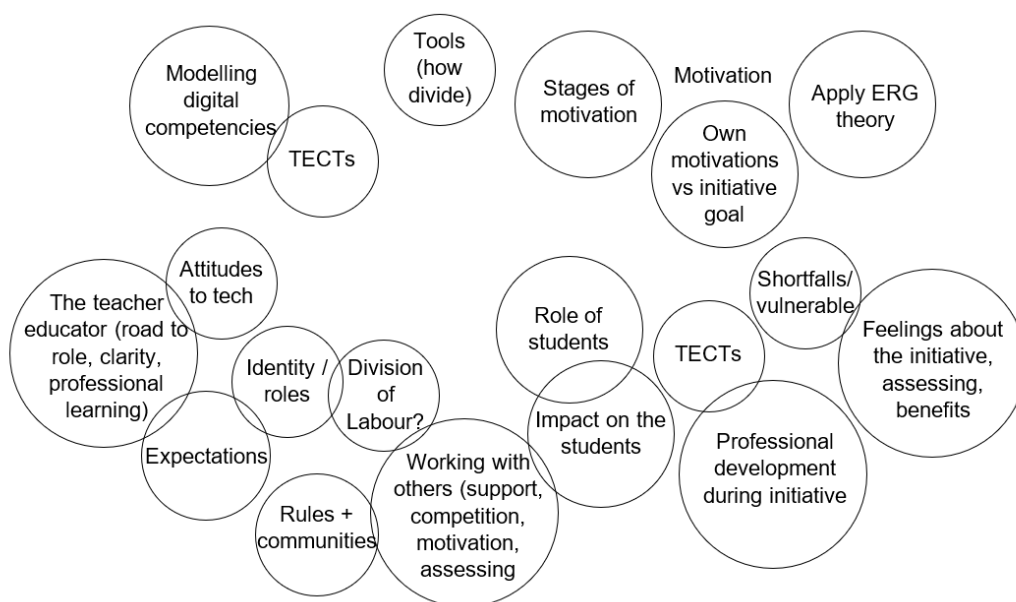


Figure 3-9 The initial theme clusters generated during phase

Source: Researcher

Phase 4: Developing and reviewing themes

Phase four was specifically recursive because it required the researcher to re-engage with all the quotations and the whole data set (Braun & Clarke, 2022). The researcher therefore worked closely within the Quotation Manager of Atlas.ti to ensure that the data fit authentically within the developing themes in an inductive way. This tested the viability of each candidate theme and challenged the researcher to further improve them, which included the collapsing, splitting, and discarding of candidate themes (Braun & Clarke, 2022). An example is the content for the candidate theme 'Working with others', which was either let go or absorbed into themes related to the **Object** or **Community**. Figure 3-10 shows how the themes took shape and were positioned within the conceptual framework as a result of the fourth phase.

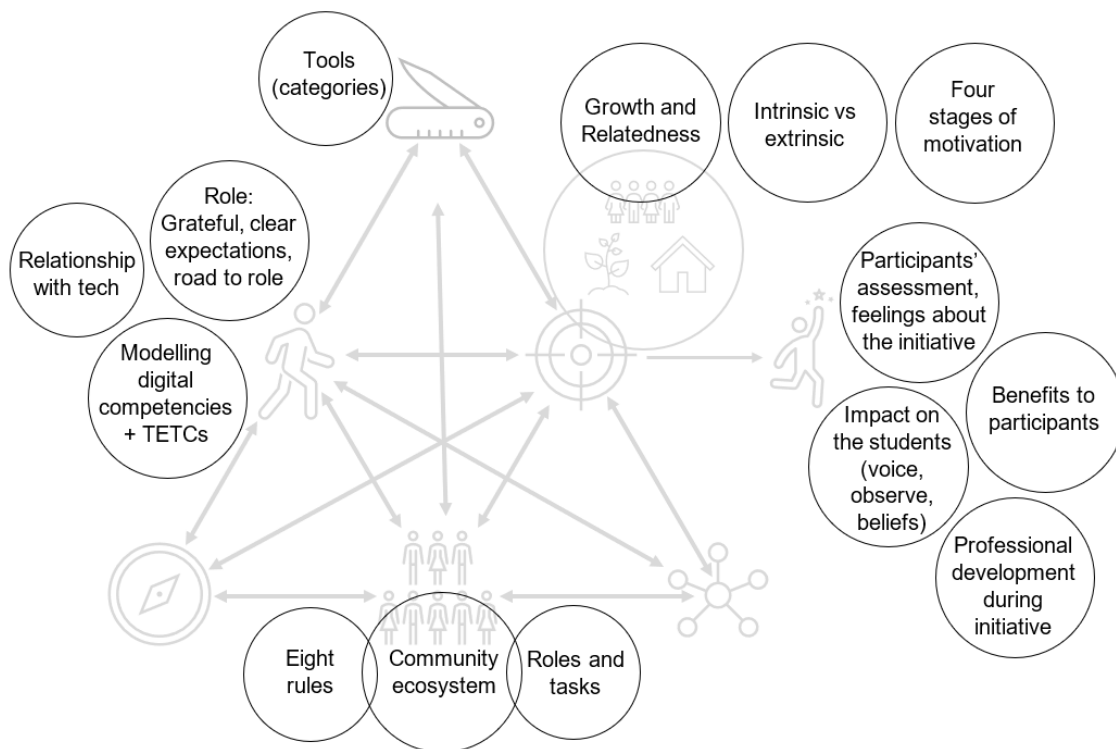


Figure 3-10 The themes as developed and reviewed during phase 4

Source: Researcher

During this phase it became clearer which candidate themes proved resilient and how each one of those might be situated within the five main elements of Activity theory (**Subject**, **Object**, **Tools**, **Community**, and **Outcome**) and ERG Theory's three components. An example is linking the theme about modelling digital competencies and its three sub-themes within the **Subject**. In assigning sub-themes throughout the

process, the researcher was mindful that they should each tell their own story while being horizontally aligned in meaning to the other sub-themes (Braun & Clarke, 2022).

Phase 5: Refining, defining and naming themes

This phase represents the final fine-tuning of the analysis, during which Braun and Clarke (2022) also suggest conceptualising a brief synopsis of each theme. This is to ensure that each theme tells a distinct story and fits well into the story of the overall data. Below are the descriptions of two themes to illustrate this mental process:

Intrinsic vs extrinsic motivators: Participants revealed individual reasons for engaging in the initiative while aligning themselves with the goals of the initiative.

Teacher educators' views of the initiative: Participants contributed diverse feedback that supports the success of the initiative as well as its vulnerabilities and challenges.

This is also the phase where the themes were given concise, catchy, and informative names (Braun & Clarke, 2022). The visualisation of the final themes appears in Figure 4-1 at the start of Chapter 4.

Phase 6: Writing up

Braun and Clarke (2022) present phase six as all writing done during the research, including the literature review. They also combine advice relating to the writing of Chapter 4 and Chapter 5 in crafting a story about the research that makes sense and persuades the reader. The researcher, therefore, applied their guidance in producing both chapters. Writing up the analysis (Chapter 4) started early as part of the researcher's early reflections on potential codes and promising themes. The researcher also noticed that the 'final' writing up was not final, because the analysis process was still ongoing during this phase (Braun & Clarke, 2022). In the same way, contributions to Chapter 5 at times spilled over into the writing of Chapter 4 as reflections and potential conclusions arose.

3.9.3.2 Analysis of the field notes

The field notes were included in the analysis process in the following four ways: First critical nonverbal information was inserted into the interviews as soon as they were transcribed – a process referred to as *adding back* (Phillippi & Lauderdale, 2017). This information helped guide the coding of the transcriptions by adding context.

Secondly, the field notes formed part of the first phase of thematic analysis (Braun & Clarke, 2022), namely familiarisation. It helped the researcher delve deeper into the data but also create distance from it (Braun & Clarke, 2022). The field notes offered the following key reflections by the researcher during this phase: (1) possible miscommunication between the researcher and participant, (2) questions that could have been interpreted in a different way by a participant, (3) how the researcher's choice of words could have affected a participant's answers, (4) researcher bias in how certain interactions unfolded, and (5) how the unique role of a participant affected the interpretation of an answer. Data affected by these reflections could then be evaluated to determine how it needed to be incorporated into the dataset to ensure dependability (Denscombe, 2010).

Thirdly, the field notes partly informed the second phase, that of coding (Braun & Clarke, 2022), by facilitating reflection on the coding approach and priming the researcher for potential codes to look out for. After the coding of the interview transcripts, the field notes were analysed to identify these initial ideas for codes. They were cross-referenced with the existing codes to determine whether any important ones were omitted. This analysis also prompted further thought on existing codes, which could be adjusted.

Fourthly, the field notes contributed to the eventual findings. It did so through reflections that helped (1) generate potential themes during phases three and four of the thematic analysis, (2) guide the application of the conceptual framework, (3) identify interrelationships and connections that could enhance the depth of the findings (Phillippi & Lauderdale, 2017), and (4) identify potential ways to present the findings.

3.9.3.3 Analysis of the documents

The goal of the document analysis was to investigate the **Rules** component of Activity theory in the conceptual framework, i.e. the community of practice's influence on the activity as applied through implicit and explicit rules that the **Subject** follows (Coghlan & Brydon-Miller, 2014). The researcher asked the following question, instead of adding it as a complex question to the participants: *What explicit and implicit rules influence the teacher educators' engagement in the initiative to advance digital competencies?* Each rule is also explained or justified and the **Community** which mediates each rule is identified. Relevant data not related to **Rules** was also captured.

The documents were analysed in two phases at two different points of the analysis of the overall data set. (1) During phase 1 of analysing the interview transcripts, the documents were also studied to create familiarity. This served a dual purpose: information in the document could deepen the understanding of the transcript data, and the knowledge from the transcripts could heighten the researcher's interpretation of the documents. Care was taken to not conflate the content from the two data sources, but to see it as two separate processes. (2) Each document was analysed just before the coding of that participant's interview transcript to give context to the badge activity. The identified data points were then combined as an overall document analysis data set. Next, the frequency and significance of the identified rules were collated, resulting in six rules. Although only three rules were identified more than once, significance takes precedence over frequency in case studies to discern the authentic dynamics of the situation (Cohen et al., 2018). Three other rules were therefore added. The dataset and analysis notes appear as Appendix B.

The data from the document analysis was incorporated in the findings in the following ways: (1) The six rules were added to the rules identified and coded during the analysis of the interview transcripts. In this way, this data became part of the overall data set considered during Phase 3 of the thematic analysis process. It was, however, only applicable to the **Rules** component of the conceptual framework. (2) Data not related to **Rules** was accessed during Phase 4 to ascertain if any of the data points provided further strength to the preliminary themes.

3.10 Alignment

Table 3-4 demonstrates the alignment between the research's title, problem statement, research questions, conceptual framework, instruments, and analysis. It also visualises the conceptual framework elements as applied in the data collection strategy of each secondary research question. It becomes clear that the first two secondary research questions activate most of these elements. The benefit of using two theoretical frameworks is illustrated in the visualisation of Secondary Research Question 1. This question was designed to probe teacher educators' motivations and data was collected through the lens of elements from both Activity theory and ERG theory.

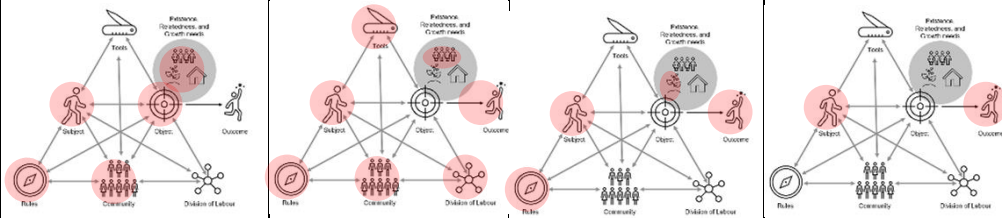
Title	Teacher educators' engagement in an infused approach to advance digital competencies at a Faculty of Education.			
Problem	A lack of knowledge about how teacher educators engage in infused approaches to advance digital competencies at their faculties.			
Primary Research Question	How do teacher educators engage in an infused approach to advance digital competencies at a Faculty of Education?			
Secondary Research Question	(SRQ1) What motivates teacher educators to engage in the Faculty of Education's infused approach to advance digital competencies?	(SRQ2) How do teacher educators experience engagement in the initiative in terms of the process, tools, support, and challenges?	(SRQ3) How does the engagement in the faculty's initiative impact on teacher educators' views of their own professional development?	(SRQ4) How do teacher educators perceive their role and responsibility as second-order teachers in advancing digital competencies?
Interview questions with conceptual framework elements	Q2.1 (Ob,E,Re,G) Q2.2 (E,Ob) Q2.3 (Re,Ob,C,Ru) Q2.4 (Re,Ob,C,Ru) Q2.5 (G,Ob) Q2.6 (G,Ob) Q13.2 (E,Ob,S) Q13.3 (G,Re) Q13.4 (Re) Q13.5 (G) Q13.6 (E) Q13.7 (E)	Q3 (A,S) Q4 (A,S) Q5.1 (A,Ru) Q5.2 (A,Ru) Q6.1 (T) Q6.2 (T) Q6.3 (T) Q7 (C,Re) Q8 (D) Q9 (Ru) Q10.1 (Ou,Ru,G)	Q10.1 (Ou,Ru,G) Q10.2 (G,S,Ou) Q10.3 (G,S,Ou) Q10.4 (G,S,Ou) Q11 (Ou)	Q11 (Ou) Q12.1 (S) Q12.2 (S)
Visuals of applied elements in conceptual framework				
Instruments	Interview Field notes	Interview Field notes Document analysis	Interview Field notes	Interview Field notes
Analysis	Thematic coding Identify key nonverbal behaviour and connections	Thematic coding Identify key nonverbal behaviour and connections	Thematic coding Identify key nonverbal behaviour and connections	Thematic coding Identify key nonverbal behaviour and connections

Table 3-4 Alignment of the research

3.11 Quality assurance

While quality criteria in qualitative research is “fluid and emergent” (Lincoln, 2010, p. 275), the following four criteria will be addressed for the intended research: credibility, dependability, transferability, and confirmability (Denscombe, 2010).

Credibility refers to the researcher's ability to show the accuracy and correctness of the data (Denscombe, 2010; Jensen, 2008b). The researcher did this through triangulation by using multiple data gathering techniques, i.e. interviews, field notes, and document analysis. This was based on the recommendations of Denscombe (2010) and Jensen (2008b).

Dependability refers to, and heightens, cohesion between participants' contributions and the interpretations thereof (Jensen, 2008c). Other researchers should be able to clearly see the procedures and decisions taken and judge if they were reputable and reasonable (Denscombe, 2010). The researcher ensured dependability by providing sufficient methodological information in a detailed, literature-supported way, as guided by Denscombe (2010) and Jensen (2008c).

Transferability enables others to surmise whether the findings are relevant and applicable to similar settings (Denscombe, 2010). As advised by Jensen (2008d), the researcher ensured this through purposeful sampling and thick descriptions of the participants and the context.

Confirmability regulates the researcher's involvement in the meaning-making process by proving that their interpretations are grounded in the constructs of the participants (Jensen, 2008a). To this end, the researcher clearly described how data was collected and analysed, as suggested by Jensen (2008a).

3.12 Ethical considerations

Ethics in research value human participants by minimising harm to them and respecting their autonomy (Hammersley, 2018). This research was committed to an ethical approach in four ways, which was explained in the letters of consent that participants had to complete (Appendix C). First participation was voluntary and participants had the right to refuse and to withdraw from the study (Hamilton & Corbett-Whittier, 2013; Tight, 2017). Secondly, participants were provided with clear information about the purpose of the study to facilitate informed consent (Hamilton & Corbett-Whittier, 2013). Thirdly, participant information was kept confidential (Hamilton & Corbett-Whittier, 2013; Tight, 2017). This was done by keeping all participant details and interview recordings in a secure place during the research. After the research was completed, the digital recordings of the interviews and non-essential documentation of the participants' was stored safely. Finally, the identities of the

participants were protected through anonymously integrating their feedback into the research (Hamilton & Corbett-Whittier, 2013) using pseudonyms, i.e. referring to them as Participant A, B, C, D, and E. These three elements were explained to the participants in the consent letter (Appendix C).

The researcher also received written permission from the faculty dean to conduct the research and requested formal ethical clearance from the university (Appendix D). An ethical clearance certificate was also granted before submission. Furthermore, the initiative itself has had ethical clearance since 2019, which includes providing access to the curriculum components.

3.13 Conclusion

This chapter situates the research within an interpretivist philosophy and discusses its relativist ontology and subjective epistemology. It then outlines the primarily inductive approach with an added deductive element during the coding phase. Next, the qualitative nature of the research is explored before its single-case, exploratory case study strategy is justified. Thereafter, the sampling and data collection are discussed – how the field notes were compiled, how the documents were selected for analysis, and how the semi-structured interviews were conducted, recorded, and transcribed. It then includes a detailed and illustrated explanation of how the six phases of reflective thematic analysis (Braun & Clarke, 2022) were followed, as well as how the field notes and document analysis were incorporated in the findings. The chapter concludes with the research alignment, the four criteria for quality assurance, and the ethical considerations.

4 CHAPTER 4: RESULTS AND FINDINGS

4.1 Introduction

The findings are mapped out according to the elements of the research's conceptual framework, as visualised in Figure 4-1. Starting with the **Subject** (the teacher educator participants), it then describes the **Object**, or the goal, which captures the motivation of the participants (Mills et al., 2010). This is followed by an exploration of the findings that relate to the **Tools** and the **Community**, the latter of which is further mediated by the **Rules** and **Division of Labour** aspects. Finally, the findings linked to the **Outcome** are outlined.

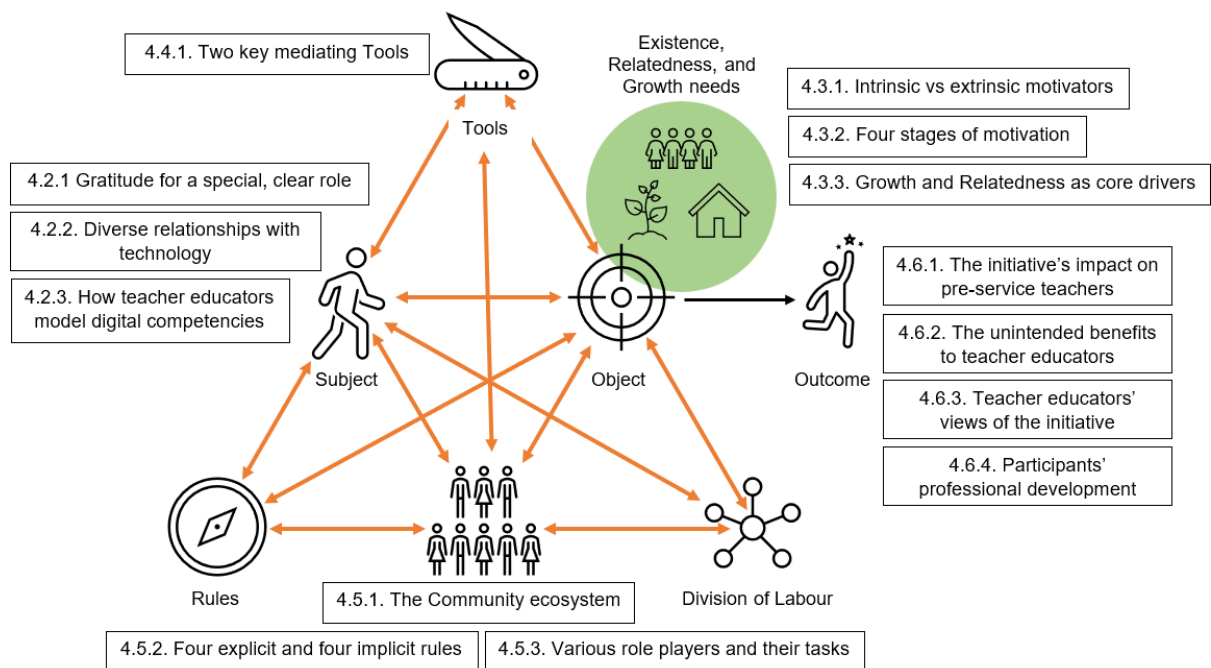


Figure 4-1 The research findings overlaying to conceptual framework

Source: Researcher, adapted from Engeström (1987) and Alderfer (1969)

The researcher opted not to use numbers to denote frequency in the themes, as generally advised by Braun and Clarke (2022). This is because interview contexts differ and the idea of prevalence in qualitative studies is complex. It can, however, be understood that, given that there are five participants, the use of “all” points to five participants, “almost all” four, “most” three, and “a few” two. In section 4.5 “three” is used as part of the introduction and not as part of a theme.

4.2 Analysis of the Subject of the activity system

The **Subject** of the activity system under study is five participants who are teacher educators, or, as Participant B describes it, “a teacher of adult children”. They can act as the **Subject** because they share at least one goal (Mills et al., 2010), that of adjusting a curriculum component to include digital competency development. (Section 4.3 highlights the diversity of their goals).

These teacher educators provide the point of view for the activity (Coghlan & Brydon-Miller, 2014), i.e. engaging in this initiative. Each sub-theme therefore helps to create a rich picture of the participants to understand how they experience their work role, how they relate to technology, and how they model digital competencies in general. This enriches the eventual findings on the participants’ motivation (section 4.3) and their professional development (section 4.6.4) through engaging in the initiative.

This section starts by giving an overview of the participants, followed by three key sub-themes that were identified and interpreted in relation to the **Subject** element: Gratitude for a special, clear role; diverse relationships with technology; and how teacher educators model digital competencies.

Table 4-1 provides details about each participants’ years of experience in teacher education and their department at the Faculty of Education. It also describes their level of engagement in the initiative and the badge activity that they redesigned, took over, or are currently teaching.

Participant description (years of experience in teacher education; department)	Level of engagement in the initiative	Badge activity/ies currently teaching
Participant A (6 years; Mathematics and Computer Integrated Education) <i>*1 years’ experience teaching in high schools</i>	Was part of the initiative conception and provided support for other participants; assigned badges to two existing technology-related activities	Pre-service teachers participate in activities incorporating mobile technology for teaching and learning; Pre-service teachers integrate technologies in teaching
Participant B (19 years; Afrikaans Education)	Redesigned an existing curriculum component to incorporate technology	Pre-service teachers upload all assessment material digitally for an existing assessment
Participant C (30 years; Science Education) <i>*6 years’ experience teaching in high schools</i>	Redesigned an existing curriculum component to incorporate technology	Pre-service teachers create a narrated PowerPoint video teaching a topic from the curriculum
Participant D (3 years; Humanities Education)	Took over module from the teacher educator that redesigned an existing	Pre-service teachers enhance their digital competence and

Participant description (years of experience in teacher education; department)	Level of engagement in the initiative	Badge activity/ies currently teaching
<i>*1 years' experience teaching in high schools</i>	curriculum component to incorporate technology	skills as part of their professional practices
Participant E (4 years; Computer Integrated Education)	Acted as coordinator for the initiative; took over module from the teacher educator that assigned the badge to an existing technology-related activity	Pre-service teachers design an interactive learning intervention in their speciality field that incorporates a variety of apps

Table 4-1 Participant overview and level of engagement

4.2.1 *Gratitude for a special, clear role*

Almost all the participants expressed a deep gratitude for being in the role of teacher educator, describing it as “a special situation to be in” (Participant A) and being “one of the fortunate people” (Participant C). A few participants noted the difficulty in finding a suitable position after their teacher training and appreciated the opportunity to work at the university. They started as assistant lecturers, with the progression to a full lecturer position described as a “waiting game” (Participant D). All the participants also affirmed that they believed they were making a difference in their role, ranging from “eight and a half (out of ten)” (Participant B) to affecting only a few students.

All the participants reported a clear understanding of what is expected of them in their role, with Participant E admitting that there might be “blanks” owing to the newness of the role. There were contrasting remarks about the extent to which they felt responsible for the performance of their pre-service teacher students. Participant E felt this caused a lot of pressure, while Participant D found it a refreshing change from working in schools that accountability was shared with students.

Almost all the participants started at the university early in their career – some started after having just completed their teacher training, and a few started after a short period of teaching in schools. The latter few indicated that a career at a university was by far preferable. Some participants are currently in contract positions. While one had just started out at the university, another had been in their position for many years. Although Participant D highlighted the advantages of a contract position, all of them appeared to prefer a permanent role.

4.2.2 *Diverse relationships with technology*

The participants revealed their relationship with technology, and technology in teaching, through a variety of comments. These included self-assessments (“I am not

a digital foreigner like my mom”) (Participant D), ways of speaking to students (“look at this (programme), it’s really misbehaving”) (Participant A), self-talk (“okay, you can learn these things”) (Participant D), expressing their attitudes to digital learning, and sharing what they found most meaningful about the initiative. The researcher aimed to capture this diversity in Table 4-2 by summarising each participant’s relationship with technology with a concise descriptor and its key features.

Descriptors of relationships with technology	Key features
Participant A: The innovative collaborator	Thrives in challenging digital situations and seeks out opportunities for innovation yet emphasises the crucial role of collaboration and guidance from others
Participant B: The digital enthusiast	Enjoys the challenge of digital learning and is excited about new technology such as added elements on the university LMS
Participant C: The “fan of face-to-face”	Prefers in-person teaching but can appreciate useful technology such as subject-specific simulation software
Participant D: The hesitant digital native	Has a strong belief in own capabilities but feels daunted by the range of current technologies and anxious when presented with an unknown tool
Participant E: The steady learner	Appreciates being exposed to advanced digital learning concepts such as gamification

Table 4-2 Summary of participants’ diverse relationships with technology

4.2.3 How teacher educators model digital competencies

All the participants exhibited a strong commitment to modelling teaching skills to their pre-service teacher students (“You are in the ambassador of your own teachings”) (Participant B), with most participants making specific reference to the modelling of digital competencies (“I never want to look like a hypocrite”) (Participant D). Three sub-themes were identified; modelling using digital tools; modelling successful approaches to technology; and modelling thinking about technology.

This section was enriched by comparing the identified modelling aspects with the Teacher Educator Technology Competencies (TETCs) (Foulger et al., 2017) (introduced in section 2.3.1.2). Findings about how teacher educators experience their role as ‘second-order teachers’ in advancing digital competencies are also provided.

4.2.3.1 Modelling using digital tools

Participants modelled digital competencies through digital tools in a variety of ways: (1) by using PowerPoint correctly (“it’s not there for you to paste everything on”) (Participant E), (2) by enforcing digital assessment methods to make administration easier (i.e. using the university LMS), (3) by incorporating subject-specific software into the lessons, (4) by making innovative use of digital tools that are not specifically

used for teaching, and (5) by creating new tools for use by the pre-service teachers (e.g. a game board with QR codes).

4.2.3.2 *Modelling successful approaches to technology*

Participants modelled the following successful approaches to technology: (1) ignoring technology is not an option (assignments must be uploaded through the LMS instead of physically handing them in), (2) sometimes technology should consciously not be used (“when not to tech”) (Participant A), (3) one needs to prepare ahead of time when using new technology for teaching (e.g. becoming familiar with a projector the day before the lesson), and (4) learners’ use of technology should be scaffolded to make them feel safe (“students didn’t feel that they were hanging in (the) air during the pandemic”) (Participant B).

4.2.3.3 *Modelling thinking about technology*

How participants model thinking about technology is illustrated through the following identified guidelines: (1) meaningfully compare technology to its physical equivalent (e.g. science simulations, YouTube videos), (2) evaluate technology integration consistently (e.g. through assessing lesson plans or the choice of videos), (3) see technological problems as a growth opportunity (“I love it when technology fails me”) (Participant A), (4) know it is acceptable to show a knowledge gap in front of learners but actively model problem-solving afterwards (“I’m gobsmacked and I will say, ‘okay, I will have to go and research this’”) (Participant B), and (5) be aware that a teacher’s attitude to technology can influence learners positively or negatively (“students are going to be scared of this as well”) (Participant A).

4.2.3.4 *Comparisons with the TETCs*

Table 4-3 compares the way participants (A, B, C, D, E) were found to model digital competencies to their pre-service teacher students to the eight modelling criteria that appear in the TETCs (Foulger et al., 2017) (noted in section 2.3.4.2). It shows that criteria 2a was most supported by the findings, followed by 1a, 5c, and 7a.

The TETC Related criteria linked to modelling	A	B	C	D	E
1 c) Model approaches for aligning the content being taught with appropriate pedagogy and technology.	x		x	x	
2 a) Model using technology for accessing, analysing, creating, and evaluating information.	x	x	x	x	x
5 c) Model using technology to differentiate learning in teaching and learning.	x	x		x	
6 b) Model a variety of assessment practices that use technology.	x	x			

7 a) Model online and blended learning methods and strategies.	x	x		x	
8 a) Model global engagement using technologies to connect teacher candidates with other cultures and locations.					
9 a) Model the legal, ethical, and socially-responsible use of technology for teaching and learning.		x			x
12 c) Model basic troubleshooting skills during teaching.	x				

Table 4-3 Comparing participants' digital competencies modelling to the TETCs

4.2.3.5 Participants' experience of their 'second-order' role

Along with Question 12.1 that directly addresses the modelling of digital competencies, Question 12.2 served to enrich these insights and to position the concept of modelling within the findings of SRQ4. It appears below:

Q12.2: As a teacher educator, you are a second-order teacher because you indirectly influence how school pupils are educated. How do you experience your role as a second-order teacher in affecting the digital competencies of school pupils?

Overall, the teacher educators did not show an awareness of the phrase 'second-order teaching'. A few participants were able to give examples of how their actions could impact future school learners ("If I can I train one good teacher, I can train sixty good learners") (Participant A), with Participant E stating that some of those future learners will become their future pre-service teachers, who will then have better digital competency skills.

4.3 Analysis of the Object of the activity system

The **Object** of an activity relates to the **Subject's** understanding of the purpose of the activity (Mills et al., 2010). It, therefore, provides insights into what motivated the teacher educators to start and continue their engagement in the initiative. In analysing the data relating to the motivations of the participants, three themes were developed: Intrinsic vs extrinsic motivators; four stages of motivation; and **Growth** and **Relatedness** as key drivers.

4.3.1 Intrinsic vs extrinsic motivators

In identifying teacher educator motivation to engage in the initiative, two layers became evident: intrinsic, i.e. that which satisfies an inherent need of the teacher educator, and extrinsic, i.e. the attainment of an external goal. Intrinsic motivators were determined based on the main, most direct driver for the teacher educator to engage. These were sometimes unexpected; however, upon closer inspection these motivations align well with the components of ERG theory: **Existence**, **Relatedness**, and **Growth** (as illustrated in section 4.3.3). Intrinsic factors became evident in

participants using phrases such as “to tell you the entire truth” (Participant C), through confirmation by participants during follow-up questions, and in repetitions (Participant B mentioned the motivation “work smarter not harder” three times during the interview). The identified intrinsic motivators were (1) to manage the module more efficiently using technology (Participant B), (2) to help a student with research (Participant C), (3) to continue their existing involvement in the initiative (Participant A), and (4) to incorporate the initiative in the participants' doctoral studies (Participant E).

Participants' extrinsic motivations were primarily associated with how their pre-service teacher students would be supported through their participation in the initiative. It can be argued that the need to empower their students is an intrinsic motivator given that it lies at the core of their chosen profession. It was, however, crucial to differentiate between the factors that brought them ‘to the room’ (section 4.3.2.1) and motivations that were either secondary or came into play later, such as completing the badge activity (section 4.3.2.2).

Words such as “nice to see”, “also”, and “besides that” were useful in identifying potential extrinsic motivators. These motivators, however, were only qualified as an extrinsic motivator when a stronger, intrinsic motivator for each participant was identified. A distinction is made between core extrinsic motivators and peripheral extrinsic motivators.

The core extrinsic motivators were (1) to pursue their professional mandate to train pre-service teachers to be “holistically prepared to teach” (Participant B), (2) to provide pre-service teachers with the opportunity to have their digital competencies accredited (Participant A), (3) to give pre-service teachers the career advantage of being “technologically literate” (Participant B), (4) to offer pre-service teachers “useful” teaching (Participant C), (5) to empower pre-service teachers by expanding their use of the university LMS (Participant B), (6) to bolster the teacher educator's impact on each pre-service teacher's growth (Participant A), (7) to initiate teacher professional development during pre-service teachers' studies instead of when they are employed (Participant A), and (8) to support colleagues to incorporate technology into their assessments (Participant E). A peripheral extrinsic motivator was the additional

benefits of digital assessment, i.e. lower cost to students, environmental impact, avoiding loss of or damage to assignments (Participant B).

4.3.2 Four stages of motivation

The analysis found that different motivations were activated at different stages of participating in the initiative. This shows how a participant can have more than one motive, and also how motivation can change during the course of an activity (Coghlan & Brydon-Miller, 2014). Four stages were identified: Getting to the room (from non-engagement to interest); moving from the room to a badge (from interest to completion; staying the course (from completion to maintenance); and pushing the limits (from maintenance to a higher level of engagement). The motivations indicated during each stage, or sub-theme, are visualised in Figure 4-2 and presented below.

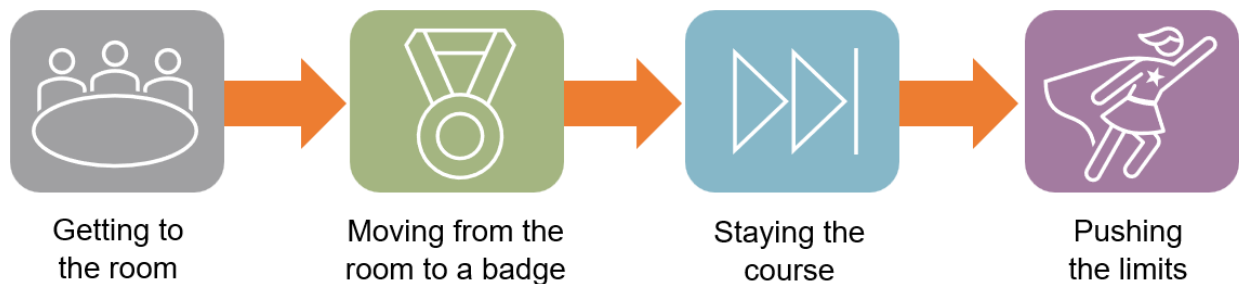


Figure 4-2 The participants' four stages of motivation during the initiative

Source: Researcher

4.3.2.1 Getting to the room

The title of this stage comes from Participant A's description of the initiative's first meeting, and the researcher and the participant's subsequent use of the phrase in statements such as "what brought me to the room...". This phrase takes on a metaphorical meaning because some participants did not attend a group meeting. It can be understood as the aspect that drove the participant to act, such as showing up at the initial meeting (Participant C), making contact with the coordinators on an individual basis later in the initiative (Participant B), or, in the case of Participant D, having the courage to take over a "nerve-wracking" digital module. A few participants were motivated by strong expectations they placed on themselves, either because of the nature of their module or an "adapt or die"-attitude when it comes to digital competencies. A few participants' motives hinged on workplace relationships – either to help a student (Participant C) or by being given "clear steps" and support from a

supervisor (Participant D). Participant B saw the initiative as a dependable way to ensure digital transformation in their department.

4.3.2.2 Moving from the room to a badge

Not all the teacher educators that showed interest in the initiative completed their badge activity. Participant E described those that did not complete it as "going quiet and just carrying on" and suggested a lack of time as a reason. This stage looks at what motivated the successful participants to move from the initial meeting to completion. For Participant B this was not an easy task, as redesigning the module for digital-only assessment proved "very time-intensive". The participant, however, was guided by a conviction that time and effort would be saved in the long run. A few participants cited the crucial role of the collaboration and support generated during the initiative's first group meeting, which "sparked" (Participant A) inspiration and healthy competition with peers. Participant C noted the importance of being intrigued by and persuaded of the initiative's usefulness to complete the badge activity.

4.3.2.3 Staying the course

After the completion of the badge activity, the initiative "runs in the background" (Participant A). This is an advantage and a vulnerability of the initiative, as also noted in section 4.6.3.2. The question can be asked, *what keeps the badge, and therefore the initiative, top of mind for the teacher educator?* The answer appears to be ongoing information sharing. Participant A relished the sharing of badges' success stories with colleagues during "random convos (conversations) over a cup of tea". Participant C felt frustrated by not receiving communication about the students' performance. Participant D, who took over the module, showed immediate eagerness to make better use of their badge when information about the initiative was provided during the interview.

4.3.2.4 Pushing the limits

A few participant comments point to potential aspects that could motivate them to "push the limits", i.e. to engage in the initiative beyond their current level. A powerful motivator for Participant A would be if pre-service teachers showed a visible appetite for more badge activities. A few participants showed eagerness at the prospect of using either exciting subject-specific applications or new LMS-related tools, e.g. "I wish all the time (for) new stuff" (Participant B).

4.3.3 Growth and Relatedness as core drivers

The components of ERG theory – **Existence**, **Relatedness**, and **Growth** – were used to provide a more nuanced understanding about participants’ motivations in engaging in the initiative (Alderfer, 1969). This was done by evaluating whether, and to what extent, each component was present for each participant. To guide the evaluation, the researcher created three levels, as visualised in Figure 4-3: activated (lowest level, indicated with a small green circle), medium-level (indicated with a medium-sized green circle), and strong (highest level; indicated with a big green circle).

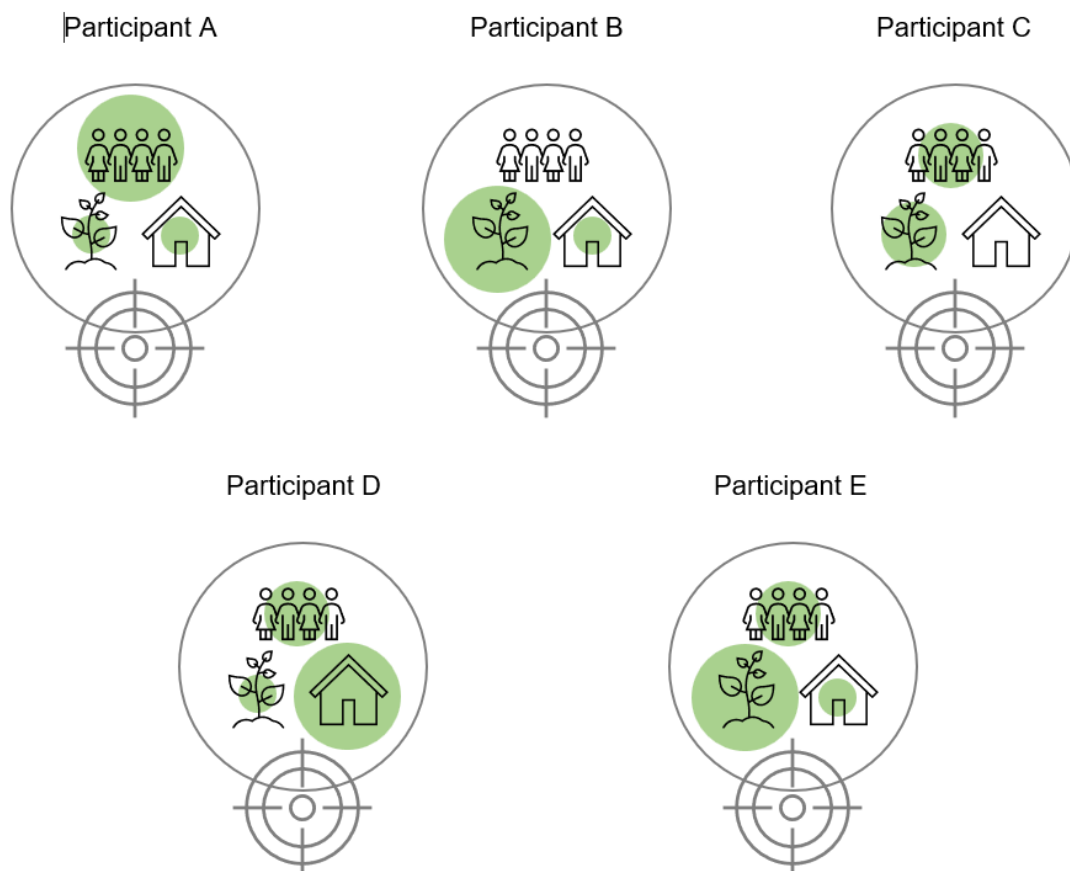


Figure 4-3 Participant motivation as seen through the lens of ERG theory

Source: Researcher

As described in the section on the conceptual framework, the house represents **Existence**, the people **Relatedness**, and the plant **Growth**. The target icon represents the **Object** in the conceptual framework, which is merged with ERG theory to represent the **Subject**’s motivation. This visualisation also shows how more than one component of ERG theory can be present for an individual at a given time (Alderfer, 1969).

Participant A exhibited a strong **Relatedness** motivation in wanting to support a colleague, help other participants, and engage in healthy competition with peers. **Growth** was activated but at a low level given the participant's already technology-driven subjects. **Existence** was also activated because the participant believed that participation in the initiative was required as part of their role.

Participant B showed a strong **Growth** motivation in wanting to improve teaching by completely overhauling the way the curriculum component was being assessed. The participant expressed the desire to perform work duties more efficiently by participating in the initiative, activating **Existence**. No link to **Relatedness** was found.

Participant C's core motivation was **Relatedness**, present at a medium level, to support a student. A further motivation was that the initiative seemed useful, an attribute which generally prompts this participant to learn new things. **Growth** was therefore activated at a medium level. No link to **Existence** was found.

Participant D became involved with the initiative in taking over the relevant module. The motivation to take on a daunting module with new technology to secure a job is strongly linked to an **Existence** need. **Relatedness** was present at a medium level, as the valued support of the participant's supervisor was mentioned repeatedly. The participant noted an internal drive to take on challenges; therefore, **Growth** was also activated.

Participant E had a strong **Growth** motivation because the participant based an important post-graduate degree on the initiative. To pursue further learning and research is a requirement of being a university teacher educator, and therefore **Existence** was activated indirectly. The participant also noted the motivation to support other teacher educators to start using technology in their assessments. Therefore, **Relatedness** played a medium-level role.

Overall, the strongest motivation for participant engagement throughout the initiative was **Growth**, closely followed by **Relatedness**.

4.4 Analysis of the Tools of the activity system

4.4.1 Two key mediating Tools

Tools in an activity system refers to embodied work that guides the **Subject** towards a goal (the **Object**) through prompts (Coghlan & Brydon-Miller, 2014). The **Tools** that

the teacher educator participants used mediated how they undertook the activity with new and existing tools. The use of new tools (e.g. the digital tools used by the teacher educator and the pre-service teachers) changed the way that work was done (e.g. new way of assessing) (Coghlan & Brydon-Miller, 2014). All the **Tools** contributed to how the activity was completed (towards the diverse goals in the **Object** as discussed in section 4.3) as well as to the eventual **Outcome** (discussed in section 4.6).

Figure 4-4 shows two key tools identified: ‘a structured way of work’ and meetings. They are considered most important because ‘a structured way of work’ facilitated the completion of an entirely new task (Coghlan & Brydon-Miller, 2014) and the prominence of ‘meetings’ came across in all the interviews.

A structured way of work	A mental tool (Coghlan & Brydon-Miller, 2014) that guided the participants in adapting existing curriculum components using the (required) Professional Development Framework for Digital Learning and (optional) educational frameworks such as the SAMR framework and Bloom’s Taxonomy. The tools are represented by the planning template created for use by participants.
Meetings	A tool categorised under ‘forms of work organisation’ (Coghlan & Brydon-Miller, 2014), these included the first group meeting, smaller brainstorming meetings, optional individual sessions, and informal discussions with colleagues.

Table 4-4 Two key tools that drove the initiative

Work was also supported by using digital tools, physical tools (e.g. printed planning form, planning paper), and their module documents (e.g. study guides, assignment guidelines, marking rubrics). Digital tools can be divided into those used directly by the teacher educators (i.e. university LMS, Google Forms, Google search function, PowerPoint, LinkedIn) and those used by the pre-service teacher students completing the badge activity (i.e. Google Drive, PowerPoint, WhatsApp, YouTube, self-selected apps).

4.5 Analysis of the Community of the activity system

The **Community** element entails the organisation in which the **Subject** acts (Coghlan & Brydon-Miller, 2014). In affirming their existence as part of wider communities, three participants made casual reference to the famous John Donne quote, “no man is an island entire of itself”.

4.5.1 The Community ecosystem

The relevant organisations were pinpointed by identifying the **Rules**, which mediate the relationship between the **Subject** and the **Community**, and by exploring the

Division of Labour, which in turn mediates the relationship between the **Object** and the **Community** (Coghlan & Brydon-Miller, 2014). This culminated in Figure 4-4, created by the researcher, which maps out the overall **Community** ecosystem.

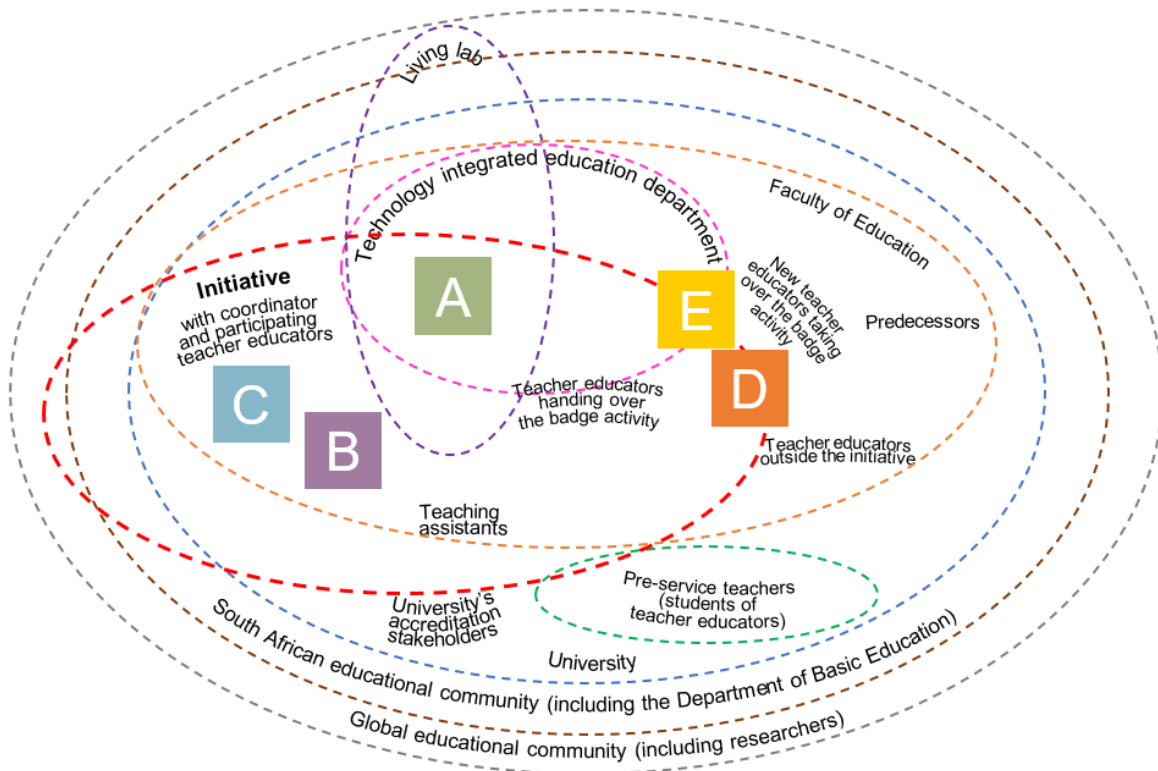


Figure 4-4 The community ecosystem, mediated by Rules and Division of Labour

Source: Researcher

The ovals represent the different communities with which the participants interacted directly (e.g. other participants in the initiative), and indirectly, i.e. the wider communities in which the initiative played out (e.g. international researchers through their frameworks). Dotted lines delineate each oval to show the dynamic nature of each community. They are colour coded for easy identification when discussed in section 4.5.2 (**Rules**) and section 4.5.3 (**Division of Labour**). The initiative as a community is depicted in red at the centre of this community ecosystem. The figure also shows the participants (A, B, C, D, and E) in relation to the communities they belong to and illustrates how they can play multiple roles (see section 4.5.3).

4.5.2 Four explicit and four implicit Rules

Eight **Rules** associated with the initiative at the faculty were identified, primarily through the analysis of the documents and through the interview transcripts. Table 4-5

contains the eight **Rules** and their associated organisation/s (**Community**). It also indicates if the rule was identified by analysing the documents (DA) or the interview transcripts (ITA), or both. The table further shows whether the rule is Explicit (E) and has to do with documented standards (e.g. information contained in the planning template), or Implicit (I) and referring to accepted norms (e.g. the voluntary nature of the initiative) (Coghlan & Brydon-Miller, 2014). (The complete document analysis summary appears with the document analysis dataset as Appendix B.)

Rule	Community	Source	Type
One or more digital competencies from South Africa's <i>Professional Development Framework for Digital Learning</i> needs to be incorporated	South African educational community (including the Department of Basic Education)	DA + ITA	E
There should be a predetermined, specific criterion for awarding the badge	People involved in the conceptualisation of the badge (<i>living lab</i>)	DA + ITA	E
There needs to be commitment to a roll-out date from the participant to ensure success	People involved in the conceptualisation of the badge (<i>living lab</i>), <i>initiative coordinators</i>	DA	E
The activity must be intrinsically better in terms of educational value i.e. improvement to the curriculum component	<i>Initiative coordinators, other initiative participants</i>	DA + ITA	I
The new badge activity needs to be meaningfully different from the old version in terms of digital competency development <i>Exceptions: Two participants' curriculum components were already related to technology</i>	People involved in the conceptualisation of the badge (<i>living lab</i>), <i>initiative coordinators</i>	DA + ITA	I
Participants are encouraged to use educational frameworks to guide the creation of their new activity, as indicated by the SAMR and Bloom's Taxonomy sections on the planning form <i>Possible exceptions: Not all participants completed this planning form</i>	Global educational community (including researchers)	DA + ITA	E
The digital competency has to be integrated into the existing curriculum component, rather than being an add-on component	People involved in the conceptualisation of the badge (<i>living lab</i>)	ITA	I
Participation in the initiative is based on teacher educators wanting to do it, i.e. not being forced	People involved in the conceptualisation of the badge (<i>living lab</i>), <i>initiative coordinators</i>	ITA	I

Table 4-5 The eight identified Rules that govern the activity system

4.5.3 Various role players and their tasks

The **Division of Labour** element represents how the **Subject** collaborates with internal and external stakeholders towards an **Outcome** (Coghlan & Brydon-Miller, 2014). Various role players in the initiative were identified, which is outlined in Table 4-6 together with the tasks performed. It shows how a specific individual can play

multiple roles in the initiative, as is also illustrated in Figure 4-4. For example, apart from currently performing the tasks of the initiative coordinator, Participant E is also a new lecturer that took over a badge activity. In another example, Participant A was an initiative participant as well as a “fly on the wall” in the living lab conceptualisation of the initiative. The specific communities associated with each role player grouping has also been colour coded to indicate its position in the community ecosystem depicted in Figure 4-4.

Role players	Tasks performed
Staff from the department closely associated with the living lab (the head of which was the initial coordinator of the initiative), outside stakeholders (included Participant A) <i>Part of community: Living lab</i>	Conceptualised the initiative in response to the South Africa’s <i>Professional Development Framework for Digital Learning</i> by the Department of Basic Education
Head of department and teacher educators from the technology-integrated education department (closely associated with the living lab) (included Participant A and E) <i>Part of community: Technology-integrated education department</i>	Provided advice during the creation of the badge activities; checked in afterwards
Initiative coordinator <i>Part of community: Initiative</i> (included Participant E)	“Took the flame” and “ran with” the initiative concept; coordinated the initiative; provided advice during the creation of the badge activities; checked in afterwards; planned for the awarding and accreditation of the badges
Participating teacher educators <i>Part of community: Initiative</i> (included all participants)	Planned and rolled out the badge activity, supported other participants (by motivating, sharing ideas, and informing each other of useful tools and elements on the LMS), assigned badges to existing activities, taught the badge activities afterwards
Teaching assistants to the participating teacher educators <i>Part of community: Faculty of Education</i>	Assisted in administrative tasks relating to the initiative
New teacher educators taking over the badge activity <i>Part of community: Faculty of Education</i> (included Participant D and E)	Taught, assessed, and administrated the curriculum component
Teacher educator handing over the badge activity in a supervisory role <i>Part of community: Faculty of Education</i>	Encourage; show the basic ropes of digital tools
Teacher educators outside of the initiative <i>Part of community: Faculty of Education</i>	Provide or receive technological support
University’s accreditation stakeholders <i>Part of community: University</i>	Consulted with initiative coordinator on the accreditation of the badges
Teacher educators outside of the initiative of the participating teacher educators <i>Part of community: Faculty of Education</i>	Influenced participants’ decision to participate in the initiative
Pre-service teachers (students of teacher educators) <i>Part of community: Pre-service teachers at the university</i>	Shaped the badge activities through their needs, mistakes, performance, and feedback

Table 4-6 Identified role players and the tasks they performed in the initiative

4.6 Analysis of the Outcome of the activity system

The **Outcome** in an activity system refers to the result of the activity, and can differ from the **Object** (the original goal) because of an **Object's** dynamic nature (Coghlan & Brydon-Miller, 2014). The analysis of the **Outcome** of the teacher educator participants' engagement in the initiative is presented in four main themes: The initiative's impact on pre-service teachers; the unintended benefits to the teacher educators; teacher educators' views of the initiative; and how participants developed professionally.

4.6.1 *The initiative's impact on pre-service teachers*

The participants' insights relating to the impact of the initiative on pre-service teachers were derived from feedback from the pre-service teachers themselves, the participants' own observations, and the participants' beliefs about the impact. These sub-themes are discussed below.

4.6.1.1 *Feedback from pre-service teachers*

Participant B cited the positive feedback from ex-students working in schools as the most meaningful aspect of engaging in the initiative. These ex-students reported that the assignment had a direct impact on their teaching as professionals, most notably in preparing them for emergency teaching during the Covid-19 pandemic. Teachers suddenly had to teach virtually and in digital formats. Other improvement areas were related to pre-service teachers' knowledge and comfort levels in using technology, e.g. a free LMS.

Participant E, the initiative coordinator, shared insights from a survey about the initiative. Examples of the survey questions were whether students' understanding of the content was improved and whether they were more likely to use technology in the classroom. Some pre-service teachers felt assessment was made easier, while others found the technology to be a barrier to their learning. Participant C said that students reported enjoying the activity.

4.6.1.2 *Observing pre-service teachers*

Participants C and D confirmed that they observed the impact of the initiative on pre-service teachers as seen in a better pre-service teacher work quality and their more advanced questions about technology. The pre-service teachers also showed improved skills in using digital tools such as PowerPoint and the university LMS.

4.6.1.3 Beliefs about the impact on pre-service teachers

A few participants stated that they believed their badge activity made pre-service teachers more reflective about technology, i.e. being aware of their own digital competencies; motivating them to learn more about technology; using more technology in their future teaching; and mindfully incorporating technology to ensure pedagogical integrity.

Participant C believed there would be a bigger impact if the students had the opportunity to repeat the activity. For this reason, this participant currently has students completing a similar activity to prepare them for the badge activity the following year.

A few participants alluded to their activities being like an “intricate” hurdle that the pre-service teachers cannot avoid; therefore, completion amounts to assured, if unmeasurable, impact. Participant A, however, expressed the need for more precise assessment of student growth. This participant suggested that it could be achieved by each pre-service teacher individually rating the specific activity afterwards to determine whether the knowledge was new and made a difference.

4.6.2 The unintended benefits to teacher educators

Engagement in the initiative proved a “fantastic” (Participant B) advantage to a few participants during the pandemic that started a year after the first badge activities were rolled out. This is illustrated through two examples. Participant B’s badge activity entailed the digitisation of an existing project’s assessment. This meant that this participant could focus on other challenges, such as virtual teaching. Participant C had framed the new technology-enhanced activity in a fictitious scenario of a fellow student being in hospital and unable to attend class. This later mirrored the pandemic realities.

Participant A stated that this resilience, i.e. that the badge activities were present before, during, and after the pandemic, proves the initiative’s success. It provides the following ongoing benefits for the teacher educators: (1) They have more time available due to streamlined assessment. (2) They can use the technological knowledge they acquired while researching and teaching the badge activity. (3) They have additional teaching material, which they can use in adjusted formats for other students. (4) They are better geared for blended learning – efficient digital assessment

allowed more time during the pandemic to invest in making video recordings, which are still being used in a blended approach.

4.6.3 *Teacher educators' views of the initiative*

Participants' views on the initiative can be divided into two sub-themes: Factors that contributed to the initiative's successful implementation and improvement areas for the initiative's future success.

4.6.3.1 *Factors that contributed to the initiative's successful implementation*

The initiative's infused nature can be seen as a key part of its successful implementation. Most of the participants pointed to its efficacy through descriptions such as "not a big process" (Participant E) and "not more work, it's just something that slots into my module" (Participant A), and in Participant B affirming that only one meeting was required to conceptualise module adjustments.

The workplace culture of the technology-integrated education department, closely associated with the conceptualisation of the initiative, could also be a factor. Participant A described it as a "wonderful world to be at" where they have the freedom to do "crazy stuff" (Participant A). This participant believed this was likely a unique feature of their department within the faculty. Participant E affirmed the outlier nature of their department through projects that are not seen at other universities, such as this initiative. Participant B, not from that department, also alluded to an inspiring, inclusive culture by referring to this department's staff as "those lovely, lovely people".

4.6.3.2 *Improvement areas for the initiative's future success*

Most participants mentioned challenges faced by the initiative, which included: 1) Low engagement from pre-service teachers was observed, either because they were not aware of or were not very motivated by the badges initiative (Participant A). 2) Lack of feedback about students' performance can cause demotivation in teacher educators ("I never knew whether it meant anything to anyone" (Participant C)). 3) The awarding of the badges still needed to be streamlined and the accreditation finalised with the relevant university stakeholders (Participant E). 4) A potential vulnerability of the initiative was that new teacher educators that take over a badge activity might not be informed of the badge, leading it to "die a slow death in the background" (Participant A). This possibility is proven by Participant D who was not aware of the badge associated with the module.

4.6.4 Participants' professional development

The **Subject** undertakes an activity on an external and internal level, i.e. physical actions lead to an internalisation that makes the **Subject** learn (Coghlan & Brydon-Miller, 2014). The researcher therefore explored the professional development of the participants during their engagement in the initiative. The word 'development' is used in this section to refer to professional growth that the participants underwent as they moved towards the **Object** and **Outcome**. This is to differentiate it from the use of **Growth**, the component of ERG theory that relates to what motivated participants to engage in the initiative.

The participants mentioned a rich variety of ways that they develop professionally in general: by identifying a gap and closing it through self-study; experimenting (e.g. with the university LMS online teaching tool); having informal discussions with colleagues; getting involved with colleagues' teaching projects or attending their classes; engaging in workshops; collaborating in projects with external stakeholders; and attending courses offered by the university and conferences. Most participants noted that they were responsible for identifying useful training from the available options offered by the university. Participant A emphasised the value of organic learning, cautioning that formalities can "kill a lot of things".

Most participants alluded to the self-driven nature of professional learning in their profession in general, highlighting that they see lifelong learning as an intrinsic part of their role as a teacher ("there's nothing that turns you into a lifelong learner than teaching" (Participant C), "just keep on transforming" (Participant A)). They all, however, mentioned ways in which peers play a role in their professional development, e.g. by engaging in regular chats about work; by encouraging them to attend formal training; by inspiring them through innovative teaching; by motivating them to challenge themselves ("watch me, I'll do it") (Participant A); and by actively being taught by peers.

The main development was detected in the area of PDC (professional digital competence), which was not a term that the participants were familiar with in general. Findings related to PDC development are explained under the sub-themes of PDC development in knowledge; PDC development in attitudes; and PDC development through people.

4.6.4.1 PDC development in knowledge

All the participants stated that they grew cognitively because of their participation in the initiative (“I do know more now than I knew at the beginning”) (Participant C). Most participants reported better knowledge about concepts and frameworks relating to technology and teaching, i.e. SAMR, gamification, the importance of ensuring that digital learning achieves the intended goal. A few participants noted a deeper understanding of digital competencies, e.g. the need to model them and how to apply them to strategic educational projects (“In the past I would have said, ‘ah, it’s easy, we’re going to TPACK this’” (about a project on digital literacy)) (Participant A). They also reported better skills in using technology, such as improved precision of Google searches, the ability to narrate a PowerPoint, better application of LMS functions, and knowing how to set up a Google Form.

4.6.4.2 PDC development in attitudes

A few participants reported feeling notably more comfortable with and resilient in using technology as a result of the activity adjusted in the initiative (“a little bit more relaxed... a bit less afraid of trying things myself, a little bit more motivated”) (Participant C). Participant D’s view on digital competencies also changed profoundly because of teaching the module redesigned during the initiative (“I didn’t use to see it as something that was very crucial”).

Participant A speculated that the initiative made other participants more confident, which improved their readiness to take on challenges during the pandemic. A few participants also shared how they observed colleagues’ fear about using technology diminish by taking part in the initiative or in assessing the badge activity.

4.6.4.3 PDC development through people

All the participants mentioned how their learning during the initiative was supported through their engagement with others, e.g. motivating and being motivated during the first group meeting; helping colleagues differentiate their assessment through technology; supporting colleagues in applying the technology (“I am an educator of teacher educators in some cases”) (Participant A); and being taught by their pre-service teacher students, through both the students’ mistakes and achievements.

4.7 Summary and conclusion

This chapter presents the findings of the research and shows how it was developed and interpreted using the conceptual framework as a lens. It starts off with an exploration of the participants as the **Subject** (from Activity theory) of the activity, before delving into their motivation as perceived through the **Object** (from Activity theory) and the three components of ERG theory (**Existence**, **Relatedness**, and **Growth**). The section on **Tools** and **Community** (from Activity theory) shows how these elements mediated the participants' engagement in the initiative. Finally, the findings under **Outcome** (from Activity theory) include the impact and benefits of the initiative as well as the views and professional development of the teacher educators.

5 CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter the researcher addresses the study's research questions and shares the contributions, limitations, recommendations, and researcher's reflections. Finally, the conclusion section ties up the research by metaphorically comparing its knowledge producing process to a lotus plant.

5.2 Responding to the research questions

This section starts off by demonstrating how the study's primary research question is addressed through individual discussions of the four secondary questions (SRQs). Each discussion brings in the core findings that relate to that SRQ, integrates the findings where meaningful, and infuses relevant literature. This approach to the conclusions is inspired by the reflective thematic analysis process of Braun and Clarke (2022), specifically phase six. The writing up of the research therefore contains both elements that are traditionally contained in Chapter 4 and Chapter 5.

5.2.1 Addressing the primary research question in a holistic way

This study explored the experiences of teacher educators in an infused approach (referred to as "the initiative") to advance digital competencies at a Faculty of Education. It did so by asking four secondary research questions (SRQs):

1. What motivates teacher educators to engage in the Faculty of Education's infused approach to advance digital competencies?
2. How do teacher educators experience engagement in the initiative in terms of the process, tools, support, and challenges?
3. How does the engagement in the faculty's initiative impact on teacher educators' views of their own professional development?
4. How do teacher educators perceive their role and responsibility as second-order teachers in advancing digital competencies?

The exploration of each one and its unique insights contributed holistically to address the primary research question: *How do teacher educators engage in an infused approach to advance digital competencies at a Faculty of Education?* The conclusion is that **teacher educators engage in an infused approach to advance digital competencies with complex and dynamic motivations, scaffolded by authentic**

experiences, in a fertile space for professional development, and supported by their modelling role. This is visualised in Figure 5-1. The specific insights yielded by each SRQ is outlined in the following four sections.

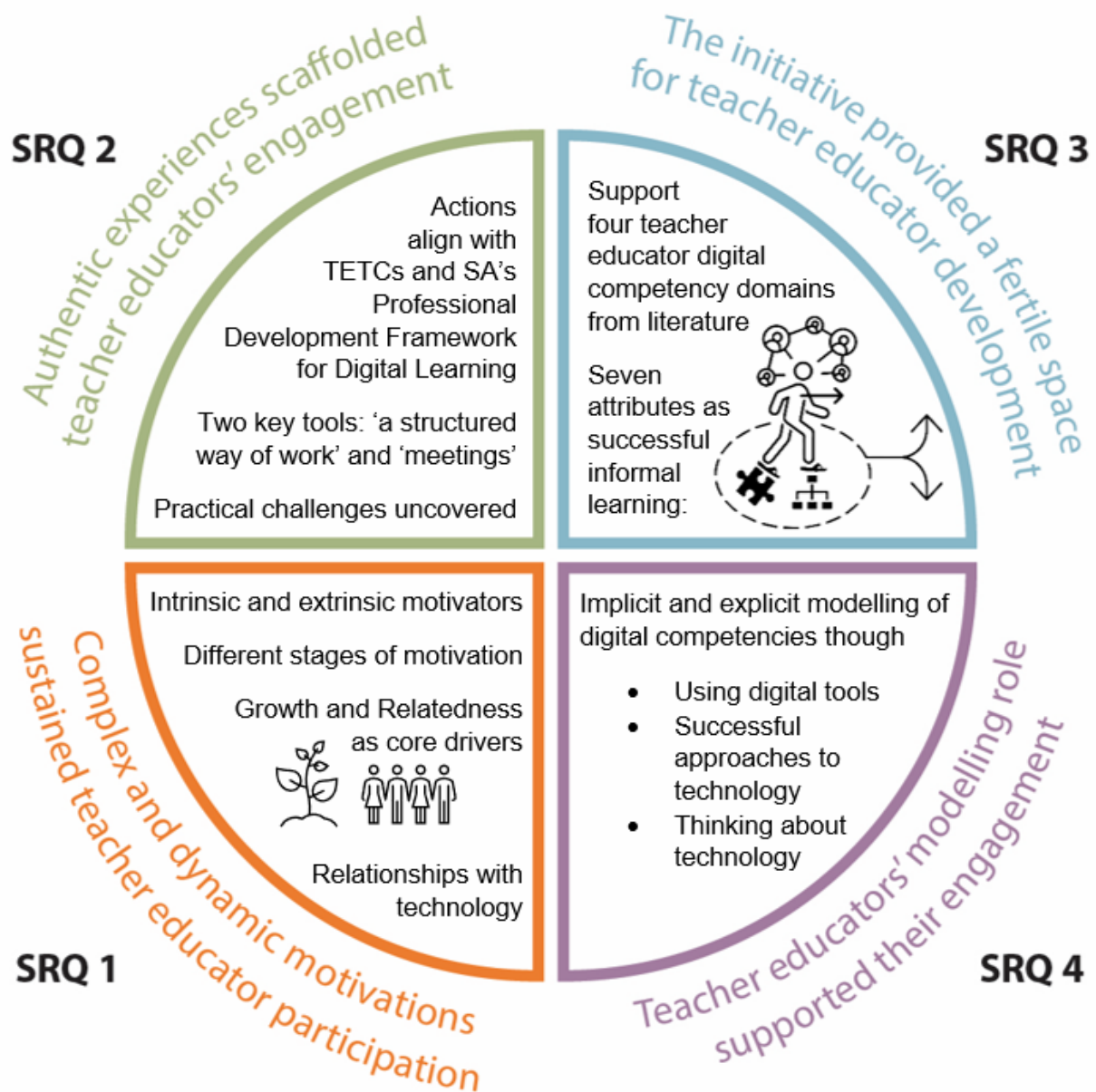


Figure 5-1 Visualisation of four SRQs addressing the primary research question

Source: Researcher

5.2.2 SRQ 1: Complex and dynamic motivations sustained teacher educator participation

Teacher educators' motivation to engage in the initiative can be understood in terms of their intrinsic and extrinsic motivators, different stages of motivation, the core drivers

of **Growth** and **Relatedness** (as strengthened by the key tools used in the initiative), and how they see themselves in relation to technology.

The findings show that it is important to differentiate between the intrinsic and extrinsic motives of teacher educators. This is because the intrinsic motives appear to point to the main reason why the teacher educators take action to engage in the initiative, as opposed to the motivation required to complete the activity. It also differentiates them from teacher educators that acknowledge the goal of the initiative as meaningful yet choose not to take action. This aligns with the research of Ping et al. (2018) that identified three motivations for teacher educators' professional learning: personal ambition, external requirements, and professional role transition.

Each of the participants had one clear and unique intrinsic goal that was personally valuable to them. This goal primarily drove their choice to participate, affirming that personal ambition is the most prevalent reason for professional development (Ping et al., 2018). Ping et al. (2018) further divide this into personal interest (Participants B, C, D, and E) and personal responsibility (Participant A and C). Another important feature of each intrinsic goal was that its completion could easily be envisioned because it was specific and contextual. In contrast, professional development expectations on teacher educators have been found to be vague (MacPhail et al., 2019) and teacher educators' own required PDC lacks specificity (Skantz-Åberg et al., 2022). While the teacher educators all connected their participation in the initiative to its goals, this was not primarily why they chose to act. This gap between the intrinsic and extrinsic motivators might, therefore, be explained by unclear expectations about how and when PDC should be developed. Being aware of this gap, however, offers an opportunity for higher engagement in similar initiatives by finding successful ways of bridging it or to activate individual, intrinsic motivators.

The extrinsic motivators aligned with the initiative goal can be summarised in two aspects: to provide useful, holistic education and to empower pre-service teachers with digital competencies (i.e. have a career advantage, prove their skills, use the LMS better). The coordinator was also motivated to support colleagues to incorporate technology into their assessments. These motivators represent the surplus pedagogical value identified by the teacher educators to motivate them to engage in digital teaching and learning (Amhag et al., 2019).

Different motivations were also identified at different stages of the teacher educators' engagement. Table 5-1 shows how the first two stages correspond to their intrinsic and extrinsic motivators. Collaboration and communication play a key role in driving participation during the middle stages. The final, or preferably, the ongoing stage could manifest as the creation of another badge activity, improving the current badge activity, drawing more student attention to the badge, or encouraging other teacher educators to participate in the initiative with a badge of their own. Based on the findings, it seems reasonable to suggest that teacher educators would be interested to expand their engagement if it involved the exploration of fascinating and highly suitable tools.

Stages of engagement	Motivators during each stage
From non-engagement to interest (4.3.2.1)	Intrinsic motivators (4.3.1)
	Extrinsic motivators (4.3.1)
From interest to completion (4.3.2.2)	Collaboration (4.3.2.2)
	Ongoing information sharing (4.3.2.3)
From completion to maintenance (4.3.2.3)	Student engagement, encouragement (4.3.2.4)
From maintenance to a higher level of engagement (4.3.2.4)	Relevant and useful digital tools (4.3.2.4)

Table 5-1 Motivators at different stages of engagement

Two tools emerged as key contributors to teacher educator motivation in completing their badge activity: 'a structured way of work' and meetings (further described in section 5.2.3/SRQ 2). Through the 'structured way of work' tool, the teacher educators engaged in structured training that promoted their motivation to use digital tools (Amhag et al., 2019). This tool further supported the teacher educators in achieving **Growth**, which was found to be the core motivator amongst the ERG components (Alderfer, 1969). The second tool, meetings, allowed participants to be motivated by their inclusion in learning communities with a digital culture (Ilomaki et al., 2016; Viberg et al., 2019). This tool was instrumental in the teacher educators realising their need for **Relatedness**, the second most important motivator (Alderfer, 1969). Two demotivators were also identified: a lack of communication about the impact of the initiative and concerns about the time required to participate in the initiative. The latter corresponds to findings in the literature that teacher educators do not have enough time for professional learning (Czerniawski et al., 2017) or do not commit quality time to take advantage of the possibilities offered by technology (Fulgence, 2020). These demotivators can be seen as constraints of the **Growth** and **Relatedness** motivators.

Table 5-2 shows how the researcher's association between these six findings strengthens the conclusion that teacher educators are motivated to engage in such initiatives through their need for **Growth** and **Relatedness** (Alderfer, 1969).

Main motivators from ERG theory	Motivating tools further supporting the achievement of ERG theory motivators	Constraints of ERG theory motivators (demotivators)
Growth (4.3.3) 	A structured way of work (4.4.1; Table 4-4)	Time concerns (4.3.2.2)
Relatedness (4.3.3) 	Meetings (4.4.1; Table 4-4)	Lack of communication (4.3.2.3)

Table 5-2 Main motivators with their motivating tools and constraints

How the participants viewed themselves in relation to technology can also be linked to their motivation in engaging in the initiative. University teachers that are confident in using technology are more likely to see its value for them and their students, and to integrate it into their practice (Heinonen et al., 2019; Herro et al., 2021). The description of participants' relationships with technology corresponds to the higher levels of confidence in using technology, as discerned by Heinonen et al. (2019) in analysing university teachers' beliefs about their role in developing technology-enhanced teaching (shown in Table 5-3). The conclusion can, therefore, be made that teacher educators that relate better to technology will likely be more motivated to engage in similar initiatives. It is, therefore, important to ensure individualised journeys during such initiatives and other professional development activities (Heinonen et al., 2019; Parrish & Sadera, 2019). This is something that the initiative succeeded in, as noted in section 5.2.4/SRQ 3.

Descriptive titles of research participants based on their relationships with technology (section 4.2.2; Table 4-2)	Teachers' beliefs regarding their role as developers of technology-enhanced learning (Heinonen et al., 2019)
Participant A: The innovative collaborator	Active developers
Participant B: The digital enthusiast	
Participant D: The hesitant digital native	Adaptive developers
Participant E: The steady learner	
Participant C: The "fan of face to face"	Cautious developers
(None of the participants fall into this category)	Reluctant developers

Table 5-3 Participants' relationship with technology compared with beliefs

Source: Adapted from Heinonen et al. (2019)

It becomes clear that teacher educators' motivations for engaging in such voluntary initiatives are complex and dynamic. The findings could be applied to elicit higher participation by (1) being aware of the potential gap between intrinsic and extrinsic motivators, (2) making collaboration and communication a core part of the process, (3) supporting completion through 'a structured way of work', and (4) enabling individualised pathways through the initiative.

5.2.3 SRQ 2: *Authentic experiences scaffolded teacher educators' engagement*

This section throws a broad net across the experiences of the teacher educators while also guiding insights through the following four facets: the process (as interpreted through the digital competencies of the SA framework (Department of Basic Education, 2017), the support (as represented and provided by the two key tools), and the main challenges.

The initiative process involved an infused approach, which takes a conceptual and developmental perspective on how technology is integrated (Foulger et al., 2019). This was done by grounding the initiative in South Africa's Professional Development Framework for Digital Learning (Department of Basic Education, 2017). This framework has been used to evaluate the teacher educators' experiences as part of an authentic process, as shown in Table 5-4.

Digital Competency + corresponding TETCs		Teacher educator initiative actions from findings presented in Chapter 4
PROFESSIONAL GROWTH AND KNOWLEDGE		
1	Adopt the habit of an enquiring mind regarding the educational value of using digital tools and resources. (TETCs 1, 4, 5, 6)	Showed sufficient curiosity about the initiative to investigate; investigated the potential for digital assessment; probed the potential of gamification; changed mind about the importance of digital competencies in education; showed general openness to technology
2	Be reflective about challenging current digital learning and teaching practices. (TETCs 1, 4, 5, 6)	Took a critical stance to blanket applications of TPACK; insisted that new teaching activity should be useful (rather than incorporating technology for the sake of it); modelled reflections about technology use in teaching
3	Understand the role of the teacher, the <i>pre-service-teacher students</i> , and the digital resources during digital learning. (TETCs 1, 4, 5, 6, 9)	Committed to student-centric learning; was very interested in the initiative's impact on students; gained a deep understanding of student challenges in compiling a frequently asked questions (FAQ) document
4	Participate in local and global professional learning communities. (TETCs 4, 10)	Participated in this initiative; participated in living lab

Digital Competency + corresponding TETCs		Teacher educator initiative actions from findings presented in Chapter 4
5	Select appropriate digital tools and resources when fulfilling the roles of the educator. (TETCs 1, 4, 6, 12)	Made more effective use of LMS; gained advanced skills in MS PowerPoint; guided students in exploring and selecting their own appropriate digital tools
CURRICULUM FOCUS		
6	Integrate digital tools and resources to enhance learning objectives in various learning environments. (TETCs 7, 9)	Integrated the selected digital tools, or the instruction to select own tools, into the current teaching activity
7	Develop <i>pre-service-teacher students'</i> global awareness and understanding using digital communication and collaboration tools. (TETCs 8, 9)	Embedded this competency in the badge activity outcomes
8	Transform learning through the innovative use of digital tools and resources. (TETCs 7, 10)	Engaged in gamification by creating a badge activity as part of the initiative
9	Enhance class management, assessment, and feedback processes using digital resources. (TETCs 1, 7)	Digitised module assessment; explored LinkedIn as a resource for accreditation
10	Integrate <i>pre-service-teacher students'</i> skills development in terms of digital literacies with curriculum-based learning. (TETC 1)	Infused the competencies of the SA framework into existing curriculum components
LEADERSHIP		
11	Demonstrate commitment to the vision for digital learning in the province, district, and the <i>university</i> . (TETC 11)	Was willing to coordinate the initiative, committed to assign badges to existing activities; pursued digital assessment despite the significant time investment
12	Accept responsibility for planning and implementing digital learning at the <i>university</i> . (TETC 11)	Became the initiative coordinator; placed imperative on self to stay involved
13	Initiate peer support and collaborative, work-place learning. (TETCs 10, 11)	Coordinated the initiative; supported and motivated colleagues

Table 5-4 Teacher educator actions aligned with SA framework and the TETCs

Sources: Adapted from Department of Basic Education (2017) and Foulger et al., (2017)

The teacher educators engaged in the initiative on different levels, as outlined in Table 4-1 (e.g. from a coordinator to a new teacher educator taking over a badge activity), which meant that they had different experiences of the process. This comparison is therefore based on what was collectively experienced by the group through these individual experiences, rather than on similar aspects experienced by many. The actions displayed during the initiative in the right column therefore describe individual behaviour, unless referring to obviously collective actions such as 'participated in this initiative'. For the purpose of comparison, the terms 'learner' and 'school' have been changed to 'student' and 'university' (in italics). Each digital competency is also accompanied by TETCs (Foulger et al., 2017) that contain a similar goal (in bold).

This comparison shows how the teacher educators themselves embodied the intention of the SA framework that was created to develop all teachers individually and professionally to teach with technology (Department of Basic Education, 2017). An

unforeseen benefit of the initiative was that teacher educators were better prepared for emergency teaching during the pandemic, which also improved their capabilities for blended learning afterwards. Furthermore, the initiative provided the teacher educators with more time due to digital assessment, better digital knowledge, and additional teaching material.

The nature of the support that the teacher educators received during the initiative is both represented and provided by the two key tools identified.

The first key tool that scaffolded the process was ‘a structured way of work’ (also explored in section 5.2.2/SRQ 1). Although it is embodied in the physical planning document, it was also provided during guided meetings with initiative stakeholders. It promoted changes in the teacher educators (Kaptelinin & Nardi, 2006; Mills et al., 2010), and, as a new tool, provided a fresh way of performing their work (Coghlan & Brydon-Miller, 2014), i.e. designing both new learning and learning that infuses digital competencies (Herro et al., 2021). This tool ensured the infused approach of the initiative (Foulger et al., 2017) while also building in frameworks that are required for participation (i.e. the Professional Development Framework for Digital Learning (Department of Basic Education, 2017) and frameworks that support it (e.g. SAMR).

The second tool that supported the teacher educators was meetings (also explored in section 5.2.2/SRQ 1). Collaborations and guidance took place through one-on-one and group meetings throughout the initiative. This tool addresses the isolation felt by teacher educators who feel they lack digital competency (Viberg et al., 2019). The crucial role of collaboration is also discussed in section 5.2.4/SRQ 3. The initiative took place in a strong ecosystem of various communities, most notably the stakeholders involved in its conception in the living lab and teacher educators from the technology-integrated education department. These organisations offered the faculty valuable knowledge and leadership through the initiative (Foulger et al., 2019). Two factors that support these infused approaches (Foulger et al., 2019) were therefore identified: administrative leadership and support, and dedicated professional development (in an informal way, as discussed in section 5.2.4/SRQ 3). It is now time for this faculty to focus on the third factor, i.e. sustaining efforts.

Three key practical challenges were uncovered in teacher educators’ engagement in the initiative. First they were unable to adequately gauge improvements in their pre-

service teacher students' digital competencies after completing the badge activities. Generally positive feedback was received through a survey and responses from the now in-service teachers. This corresponds to the findings of Buss et al. (2018) that technology-infused approaches improve pre-service teachers' digital competencies and their ability to teach with technology. Teacher educators, however, want to be updated clearly and regularly on the impact of the initiative. Secondly, it proved difficult to provide pre-service teachers with proof of their achievements in the initiative. This was because awarding the badges was very time-intensive and accreditation by the university still had to be mediated. The third challenge relates to new teacher educators taking over the modules in which the badge activities are embedded. Due to the initiative's infused and voluntary nature, new teacher educators might not be aware of the initiative which means the activity could be lost.

This section demonstrated the authentic way in which teacher educators experienced engagement in the initiative because their behaviours corresponded to the competencies of both the SA framework (Department of Basic Education, 2017) and the TETCs (Foulger et al., 2017). It showed how they were supported through tools ('a structured way of work' and meetings) and their key challenges were shared to allow reflection on the realities and possible improvements to this and future initiatives.

5.2.4 SRQ 3: The initiative provided a fertile space for teacher educator development

The teacher educators' views of their own professional development relate to two aspects: the individual development they observed and the nature of the initiative as a learning event. Participation in the initiative was not positioned as professional learning and none of the participants explicitly identified it as such. It does, however, have clear attributes of an informal professional learning event (Evans, 2019).

The teacher educators reported compelling development in their own digital competencies, a skillset which is commonly articulated in the literature as their PDC. PDC is, however, not clearly defined (Skantz-Åberg et al., 2022), despite abundant calls for teacher educators to develop it (Instefjord & Muntheb, 2017; Lindfors et al., 2021; Ottestad et al., 2014). Uerz et al. (2018) made a valuable contribution in addressing this issue by outlining four competency domains for teacher educators' teaching and learning with technology. These have been reinforced by the more recent work of Skantz-Åberg et al. (2022) and Gondwe (2021) to guide the conclusion relating

to the participants' individual PDC development. Bolstering descriptions of teacher educators' PDC in this way helps strike a better balance between its technical, professional, and pedagogical aspects (McGarr & McDonagh, 2019).

The first domain is general **technology competencies** (Gondwe, 2021; Skantz-Åberg et al., 2022; Uerz et al., 2018). Teacher educators applied new tools (i.e. Google Forms), made better use of organisational technology (i.e. the LMS), and gained advanced skills in common digital tools (i.e. Microsoft PowerPoint, Google Search).

The second domain looks at **how technology is used for pedagogy and education** (Gondwe, 2021; Skantz-Åberg et al., 2022; Uerz et al., 2018). This development was conceptual (i.e. SAMR framework, digital competencies, gamification), practical (i.e. ensuring that digital learning is effective), and critical (Skantz-Åberg et al., 2022), (i.e. reevaluating the efficacy of applying TPACK to all educational projects relating to technology).

The third domain covers **teacher educators' beliefs about education** in the context of technology changes (Gondwe, 2021; Skantz-Åberg et al., 2022; Uerz et al., 2018). Attitudinal changes included becoming aware of the importance of digital competencies (Fulgence, 2020) and feeling less afraid of using technology.

The fourth domain focuses on **innovation and professional development** (Gondwe, 2021; Skantz-Åberg et al., 2022; Uerz et al., 2018). The initiative itself encapsulates both these facets in guiding its participants towards new ways of working with and looking at technology.

How the professional development took place is also important in reflecting on the impact of the initiative. The following section therefore identifies the seven characteristics of the initiative as a learning event that contributed to its success: informal, integrated, self-initiated, structured, authentic, individualised, and – crucially – collaborative. These combined characteristics are visualised by the researcher in Figure 5-2.

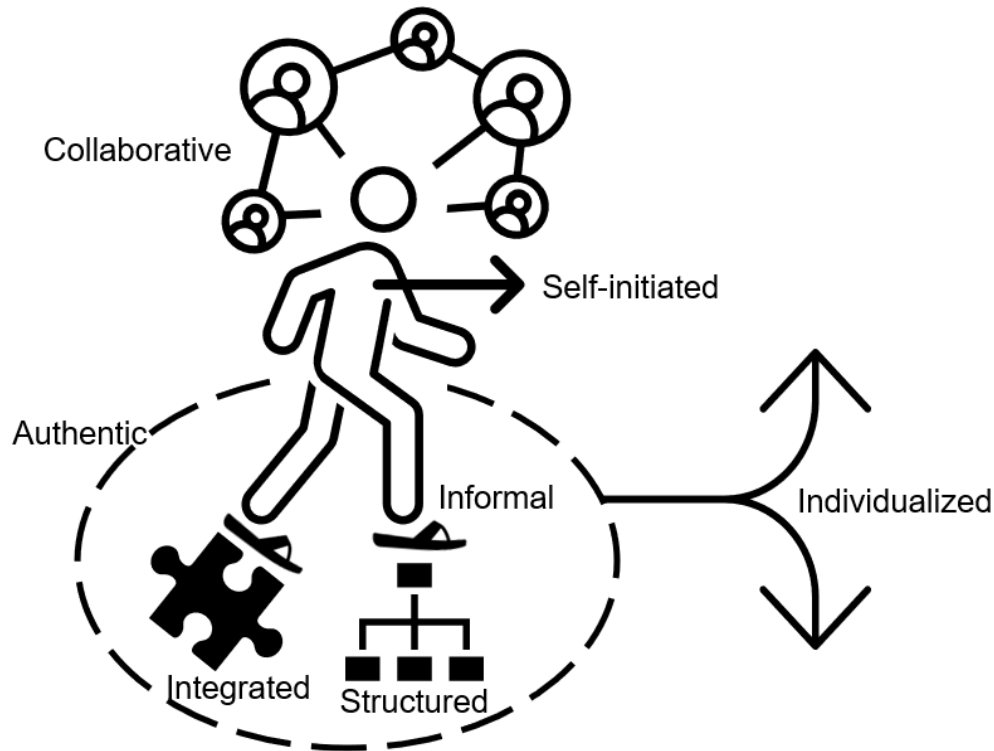


Figure 5-2 Seven characteristics of the initiative as a learning event

Source: Researcher

The figure in the middle represents the teacher educator who takes part in **self-directed** (arrow from chest) professional development that allows **individualised** journeys (arrows on right). Although the learning is **informal** (wearing sandals), it is **integrated** (puzzle piece) and **structured** (structure icon). The development is **collaborative** (people in network above head) and **authentic** because it takes place in the teacher educators' context (the dotted lined oval, inspired by the contextual circle added to TPACK (Mishra & Koehler, 2006)).

Informal: The organic rather than formal nature of the initiative was accentuated. An informal approach meant that learning happened without them being aware of it at the time (Evans, 2019) and proved more sustainable because of their complex work environment (Boyd et al., 2021).

Integrated: This integration avoids fragmentation of the curriculum (Vanderlinde et al., 2017) and can be perceived on four levels: integrating (infusing) the digital competencies into the modules by engaging in the initiative (Foulger et al., 2019), integrating professional learning into the initiative (Boyd et al., 2021; Vanderlinde et al., 2017), integrating PDC development into professional learning (Herro et al., 2021;

Vanderlinde et al., 2017) and integrating metacognitive competencies and beliefs into PDC development (Uerz et al., 2018).

Self-initiated: Participation was voluntary which has the potential for more long-term impact compared with imposed initiatives (Boyd et al., 2021). It also supports the observed behaviour and preference of the teacher educators to manage their own learning (MacPhail et al., 2019; Viberg et al., 2019). It could be useful to weigh up the advantages of its voluntary nature with the potential gains in making it a required activity during paid compensation time. A major benefit of the latter is offsetting time constraints as a hindrance to their PDC development (Amhag et al., 2019; Czerniawski et al., 2017; Fulgence, 2020; Lindfors et al., 2021; Vanderlinde et al., 2017).

Structured: The 'structured way of work' tool infused a functional level of formality into this informal learning event to mediate professional development (Coghlan & Brydon-Miller, 2014). Instead of just focussing on improving technology skills, the learning event could support the teacher educators' technological-pedagogical development (Lindfors et al., 2021). This is because the tool contains frameworks relating to using technology in education. This degree of structure, together with it happening in the workplace and being presented by other teacher educators, encouraged teacher educators to use technology (Amhag et al., 2019). The structure also protected learning within the busy schedules of teacher educators (Vanderlinde et al., 2017).

Authentic: A core strength of the initiative as a learning event lies in its embeddedness in the realities of the teacher educators' work context (Amhag et al., 2019; Herro et al., 2021; Lindfors et al., 2021; Parrish & Sadera, 2019; Uerz et al., 2018). They could more easily absorb new thought structures, such as the educational and digital competency frameworks, because they directly applied it to their practice (Lindfors et al., 2021). They were also exposed to real world examples of infusing digital competencies into the curriculum (Amhag et al., 2019).

Individualised: Each teacher educator could engage in the initiative in a way that suited their appetite for technology use and their curriculum adjustment needs. This shows that the initiative as a learning event offers much-needed individualised learning (Czerniawski et al., 2017; Fulgence, 2020; Heinonen et al., 2019; Parrish & Sadera, 2019; Uerz et al., 2018).

Collaborative: Teacher educators' interactions with others was a prominent feature of engaging in the initiative – they supported, motivated, and taught each other, and were also taught by their pre-service teacher students. The tool of 'meetings' was also identified as a driving force in achieving the initiative goals and outcomes (Coghlan & Brydon-Miller, 2014), including their professional development. This demonstrates the key role that collaboration plays in successful professional learning (Boyd et al., 2021; Czerniawski et al., 2017; MacPhail et al., 2019; Ping et al., 2018; Uerz et al., 2018; Vanderlinde et al., 2017; Viberg et al., 2019). This initiative also helped the teacher educators build networks with similarly minded colleagues (Amhag et al., 2019; Czerniawski et al., 2017; Vanderlinde et al., 2017). Their participation in a 'semi-digital culture' provided them with autonomy in developing digital competencies (Viberg et al., 2019) – both their own and that of their pre-service teacher students.

This section shows how initiatives such as these align well with the development of teacher educators' digital competencies, both in its required competences and in the way that the development takes place. It answers the need for more PDC development (Amhag et al., 2019) and focuses on how professional development actually works instead of on how training is traditionally designed (Gondwe, 2021). The latter is important given the unique development needs of teacher educators as a professional group (Kelchtermans et al., 2018) and the lack of attention paid to their upskilling as compared with other professions (Coghlan & Brydon-Miller, 2014; Murray et al., 2020; White et al., 2021). The teacher educators also identified strongly as lifelong learners, an attribute which can be capitalised on to support teacher educators' digital competency development.

5.2.5 SRQ 4: Teacher educators' modelling role supported their engagement

Second-order teaching refers to the way that teacher educators teach about teaching (Murray & Male, 2005). In terms of advancing digital competencies, this concept has to do with the way teacher educators incorporate the learning of digital competencies in their teaching so that pre-service teachers, in turn, can incorporate the learning of digital competencies in their own classroom teaching. The teacher educators in the study had spent all, or almost all, of their careers as teacher educators as opposed to teaching in schools. This can be an advantage to them in fulfilling their second-order

role as they will be less focused on transmitting school teaching skills (Murray & Male, 2005).

Overall, the participants were not familiar with the concept of their second-order role in teaching digital competencies, which is not surprising given its low occurrence in the literature as well as the complexity of the role (Viberg et al., 2019). The participants, however, do enact this role in how they model digital competencies. This is done both explicitly and implicitly (Boyd et al., 2021) through using digital tools, successful approaches to technology, and thinking about technology. Specific examples of each type are shown in Table 5-5. The participants also met seven of the eight expectations placed on teacher educators in modelling digital competencies, as articulated through the TETCs (Foulger et al., 2017).

Modelling type	Implicit modelling (from findings presented in Chapter 4)	Explicit modelling (from findings presented in Chapter 4)
Using digital tools	Use PowerPoint correctly; enforce digital assessment methods to make administration easier; incorporate subject-specific software into the lessons; make innovative use of digital tools that are not specifically used for teaching; create new tools for use by the pre-service teachers	Discuss the incorporation of educational and non-educational digital tools, as well as the creation of new tools
Successful approaches to technology	Manifest the approach that 'ignoring technology is not an option' by making it mandatory to upload an assignment through the LMS instead of physically handing it in; manifest the approach 'learners' use of technology should be scaffolded to make them feel safe' in own emergency teaching during the pandemic	Articulate thoughts about instances where technology should consciously not be used; tell the story of own preparation ahead of time when using new technology for teaching
Thinking about technology	Evaluate technology integration consistently; exhibit an aspirational attitude to technology (e.g. confidence/calmness instead of uncertainty)	Compare technology to its physical equivalent in a class discussion; demonstrate that technological problems can be a growth opportunity; show a knowledge gap in front of learners but actively model problem-solving afterwards

Table 5-5 Teacher educators modelling of digital competencies

Source: Adjusted from Boyd et al. (2021)

These findings help to address the lack of research into teacher educators acting as role models for teaching with technology (Instefjord & Muntheb, 2017). Furthermore, the specific examples can provide ideas for how teacher educators can respond to pre-service teachers' need for teacher educators to model digital competencies instead of just showing them digital tools (Admiraal et al., 2017).

5.3 Contributions of the study

The study makes the following seven contributions:

Theoretical contribution: The summative finding that teacher educators engage in an infused approach to advance digital competencies with complex and dynamic motivations, scaffolded by authentic experiences, in a fertile space for professional development, and supported by their modelling role (visualised in Figure 5-1).

Practical contributions: The following five contributions can provide value to the practices of faculties of education and/or their educational technology departments. The study

- guides ways that faculties can get more teacher educators involved in initiatives that seek to advance pre-service teachers' digital competencies, while engaging them in informal PDC professional development,
- considers how South African teacher educators manifest the competencies outlined in the Professional Development Framework for Digital Learning, which is intended to guide their teaching,
- offers a dimension of evaluation by comparing the actions of teacher educators in a South African context to an international framework that has high relevance to their specific profession, the TETCs,
- articulates teacher educators' professional learning in terms of their PDC development and shows how the attributes of initiatives such as those in the study can promote this development, and
- demonstrates how educational technology departments can activate their crucial role in such infused approaches to advance the digital competencies of pre-service teachers.

Methodological contribution: The application of Activity theory in the context of both teacher educators' approach to digital competency development and their professional development can be seen as innovative.

5.4 Limitations of the study

Two limitations have been identified for this study. The research design was adjusted during the sampling stage to allow sufficient research participants, as there were less viable candidates than planned for. Although this allowed diverse levels of 'engagement' in the initiative to be considered, there were less participants who

redesigned the badge activities they taught. For such initiatives to grow, it is useful to better understand why teacher educators with non-digital elements in their curriculum choose to engage in a structured effort to infuse digital competencies into teacher education. Future studies could focus on these specific participants, as noted in section 5.5.

The timing of the study enabled it to take a cross-sectional snapshot in a way that illuminated initiative engagement before, during, and just after the pandemic. This was very valuable in observing its evolution and resilience over three very different time periods. It also, however, points to a limitation in exploring the progression of such initiatives during stable academic years. Better insights on this could be yielded through a longitudinal study, as noted in section 5.5.

5.5 Recommendations

Five recommendations for future studies are made. First longitudinal studies could bolster findings on the motivation of teacher educators to engage, because it will include the varied voices of new participants. It can also investigate how the badge activities for each module is transferred and maintained by incoming teacher educators, an area that was identified as a vulnerability in the initiative.

Secondly, future studies could include more participants that take part in the redesign of existing curriculum components to integrate digital competency development.

In the third place, future studies could include teacher educators from different educational faculties in South Africa. This would incorporate more of the diversity of the country, both in its teacher educators and its unique teacher education environments.

Fourthly, future studies could aim to delve deeper into teacher educators' motivations. Findings on the diversity of intrinsic and extrinsic motivators can be enhanced in interviewing more teacher educators participating in similar initiatives. Action research, with its ability for dynamic improvement, could also be a useful approach to ensure consistent and sufficient communication (as a motivator).

Finally, future South African studies could consider using conceptual frameworks incorporating the TETCs and Professional Development Framework for Digital

Learning. It could further be augmented with an influential general professional development framework.

5.6 Reflections

The researcher works in skills development in the private sector and, therefore, found it rewarding to lift the veil on a higher education faculty by taking a focused, yet in-depth look at a robust and authentic ‘factory’ of teachers in South Africa in the context of digital competency development. The researcher also reflected that these teachers will be shaping the initial development of future adults that the researcher will later support.

5.7 Conclusion

This chapter addresses the four secondary research questions by discussing the findings and situating them in the literature. This shows how each one contributed to the holistic nature of this case study’s results. It concludes with seven contributions, two limitations, and five recommendations of the study, and the researcher’s reflection.

The researcher came up with the metaphor of a lotus plant to illustrate this chapter’s discussion of how the four SRQs contributed to new knowledge creation. This is visualised in Figure 5-3.

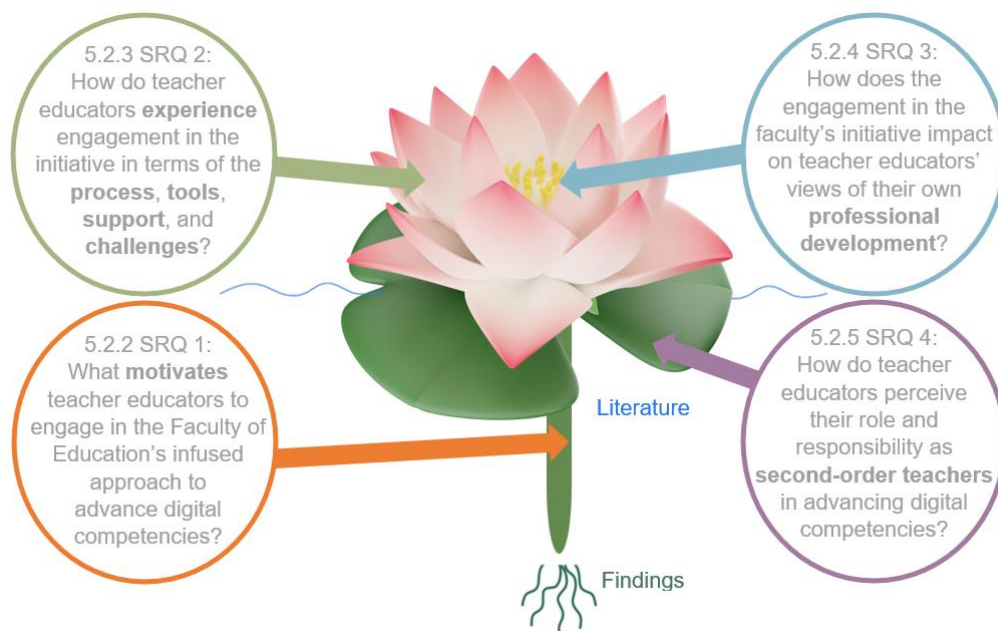


Figure 5-3 The study’s overall picture represented as a lotus plant

Source: Researcher; images from Envato

The combined parts of the lotus above the water's surface represent the primary research questions. Four parts were identified to illustrate the function of each of the secondary research questions in shaping the picture. The stem represents the teacher educators' motivations (i.e. where their engagement started and what sustains their engagement), the petals represent their experiences in terms of the process, tools, support, and challenges (i.e. what their engagement is enveloped, or scaffolded, by), the seedpod represents their professional development (i.e. the personal 'fruit' of their engagement), and the flat circular leaves at the base represent the teacher educators' role as second-order teachers (i.e. their engagement is partly 'kept afloat' by how they perceive their role).

The lotus represents knowledge, amongst other qualities (Smyth, 2021). One of its unique features is that its stem is rooted to the bottom of the riverbed. In the visualisation, these roots represent the findings that the conclusions (the stem, petals, seedpod, and leaves) are grounded in. The water in the river represents existing knowledge, i.e. related literature, with the lotus image representing new knowledge as a result of the study.

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Appendix A: Semi-structured interview questions

Q1.1: How long have you been at the faculty?

Q1.2: What subjects do you teach?

Q2.1: What motivated you to engage in the initiative?

Q2.2: To what extent do you view your engagement in the initiative as a necessary part of your job?

Q2.3: To what extent would you say you chose to engage in the initiative to connect with other people?

Q2.4: To what extent would you say you chose to engage in the initiative to gain professional credibility and respect?

Q2.5: To what extent would you say you chose to engage in the initiative to better yourself?

(Note: Omit if this was addressed in Q2.1)

Q2.6: To what extent would you say you chose to engage in the initiative to make a difference? *(Note: Omit if this was addressed in Q2.1)*

Q3: Briefly describe the initiative from start to finish and the process of your engagement in it.

Q4: Can you share some main ideas about how you adapted your curriculum component?

Q5.1: What challenges did you encounter during the engagement?

Q5.2: How did you respond to those challenges?

Q6.1: What documents did you use in your engagement in the initiative?

Q6.2: What apps or programmes did you use in your engagement in the initiative?

Q6.3: What other tools did you use in your engagement in the initiative?

Q7: What were the roles of the people involved in the initiative?

Q8: How did these people help or influence your engagement in it?

Q9: What guidelines did you have to follow throughout the initiative?

Q10.1: In which ways has engaging in the initiative been meaningful to you?

Q10.2: How has engaging in the initiative affected your understanding of digital competency development?

Q10.3: How has engaging in the initiative affected your professional development?

Q10.4: How has engaging in the initiative affected your own professional digital competence?

Q11: To what extent do you think your engagement in the initiative has improved pre-service teachers' digital competencies?

Q12.1: How do you experience your role in modelling digital competencies to your students?

Q12.2: As a teacher educator, you are a second-order teacher because you indirectly influence how school pupils are educated. How do you experience your role as a second-order teacher in affecting the digital competencies of school pupils?

Explain to participants: "The last seven questions aim to get an overview of your perspective on your profession in general."

Note: Omit questions if it has already been addressed in the participants' feedback.

Purpose: To explore and possibly establish a baseline with which to compare the earlier ERG theory-aligned questions (Q2.2-2.6). These are asked at the end of the interview to ensure they do not affect the data on the primary focus of the study.

Q13.1: What was your entry point to the profession? (e.g. from schools, academia, corporate)

Q13.2: Do you feel you have clarity on what is expected of you in your current role?

Q13.3: How do you experience professional learning and growth in your current role?

Q13.4: What is your experience of communities of practice and being professionally influenced by your colleagues?

Q13.5: To what extent do you feel you are 'making a difference' in your current role?

Q13.6: How would you describe the job security and promotion opportunities in your profession?

Q13.7: Would you say it is a competitive profession?

Appendix B: Document analysis summary document

Output from document analysis evaluation rubric per participant

Implicit and explicit rules of the initiative identified, and the community associated with it. Other dimensions relevant to the research were also identified.

PARTICIPANT A

Document Type Analysed: Filled out planning document (Digital Competencies Design Template)

Implicit Rule: That the new badge activity needs to be meaningfully different from the old version in terms of digital competency development. Participant populates the areas 'Current practice' and 'New activity' to indicate the changes. (However, is this really different for this activity – contrasts with data from interview).

Community: Initiative coordinators and participants.

Implicit Rule: That there will be changes to the badge activity between the planning and the roll-out phase as the badge develops. The participant initially indicated that competency #4 will be incorporated, but it does not appear that way in the summary document.

Community: Initiative coordinators and participants.

Implicit Rule: That the activity must be intrinsically better in terms of educational value. The participant describes improvements such as 'learner-centred', 'innovation', 'design thinking', and 'various tools chosen by students'. Participants can 'refresh' an activity in multiple ways, once forced/given the opportunity to relook at it (because older activities are often just left for years, and not updated in terms of new teaching theories). (Is this 'improvement' really true for this participant – contrasts with interview data).

Community: Initiative coordinators and participants.

Explicit Rule: That there needs to be commitment from the participant to ensure success. The participant completes the 'Time commitment ("Roll-out")' section.

Community: Initiative coordinators and participants.

Explicit Rule: That participants are encouraged to use relevant frameworks to guide the creation of their new activity. The participant maps out the planning in the SAMR and RUAAEC sections.

Community: Wider academic community, scholars.

PARTICIPANT B

Document Type Analysed: Curriculum component on the university LMS (includes Assignment Document, Assignment Marking Rubric, screenshots of the university LMS where the assignment is presented)

Explicit: Digital Competencies Framework (Competencies #1, 2, 5, 7 – also 11 and 12)

Community: Department of Basic Education/national players.

Implicit Rule: That the new badge activity needs to be meaningfully different from the old version, in terms of digital competency development. From the get-go, the rubric tells students that "Only (name of university LMS) submissions will be accepted", 'forcing' them

from their 'brick-and-mortar' comfort zone to being a digital worker in their teaching role. While the activities in the assignment are not necessarily digital, the format in which it needs to be provided is wholly digital. The module also requires them to use design (CANVA), presentation (PowerPoint), and document management tools (PDF), however, this was part of the pre-existing module. Use of storage devices such as a CD or USB stick were also required before. It can then be said that, even if all the digital elements are not new, the initiative allowed for this assignment to be framed within digital competency development.

Community: Initiative coordinators and participants.

Implicit Rule: That students need to be supported, evidenced the 'Image 1' showing students how to upload a Youtube video and the FAQ.

Community: Educational practices held by the wider educational community.

Note unrelated to Rules: Interesting how this module, that deals with aspects like etiquette and wider professional competence (building the professional), unintentionally brings in PDC (because they are now forced to look at how documents can be created, stored, and sent electronically; although it already has some digital elements, e.g., internet etiquette, designing of slides). This is unintentional, but meaningful.

PARTICIPANT C

Document Type Analysed: Filled out planning document (Digital Competencies Design Template)

The planning document provided is for a different badge activity than the currently active badge activity for this participant, i.e., for a badge that is no longer active. However, the document provides evidence for the cognitive process that guided Participant C's engagement in the initiative, as it would have been similar for the creation of both badge activities. Rules discerned from the initial planning document template correlate to data uncovered for Participant A's document analysis. Others are:

Implicit Rule: That the new badge activity needs to be meaningfully different from the old version, in terms of digital competency development. Abundant digital tools are listed, as is also the case with the currently active badge activity.

Community: Initiative coordinators and participants.

Further information about the activity and its outcomes was derived from interview data and from the Badges Digital Competencies Summary document. This information further informed the Rules that influenced this participant's engagement in the initiative, e.g.

Explicit Rule: That one or more digital competencies from the Digital Competencies Framework need to be incorporated (Competencies 5, 6, 8)

Community: Department of Basic Education/national players.

PARTICIPANT D

Document Type Analysed: Assignment guidelines (as downloadable from the university LMS)

Participant D took over the relevant module from the teacher educator that redesigned the module during that teacher educator's engagement in the initiative. Therefore, although the study guide contains evidence of changes made to the module as a result of the initiative, those changes do not reflect the engagement of Participant D, as the volunteering participant. However, when analysing the document for data on how the module was

changed during the initiative, the researcher considered whether the uncovered rules could also shed light on Rules and Community influencing Participant D's engagement. The following were deemed relevant:

Explicit Rule: That one or more digital competencies from the Digital Competencies Framework need to be incorporated (Competencies 1, 3, 5, 6)

Community: Department of Basic Education/national players.

Implicit Rule: That the new badge activity needs to be meaningfully different from the old version, in terms of digital competency development. This document embodies how this module was completely revamped (when compared to the description of the way the module was before, as given in the interview). It could point to the designing teacher educator's implicit understanding that this module could be something completely different (this possibility was verified by Participant A). This Rule influenced Participant D's engagement, who, as a recently graduated teacher, can clearly remember the original version.

Community: Initiative coordinators and participants.

Implicit Rule: That teaching about the SAMR model forms part of the teacher educators' engagement in the initiative through this module. The SAMR model also appears in the initiative template, which Participant D would not have encountered. It is possible that the designing teacher educator pulled some of the learnings of the initiative through to the assignment, to also guide the learners (as has been modelled to the designing teacher educator).

Community: Wider academic community, academic scholars.

PARTICIPANT E

Document Type Analysed: Badges Digital Competencies Summary document.

Explicit Rule: That there should be a predetermined, specific criterion for awarding the badge. There are a range of badge accreditation criteria: (1) by assignment or per module, (2) for participation or for a set mark. Set marks range from 60% to 75% (60, 73, 75, 75). (60% perhaps lower because it measures the uploading primarily, also PP and video on device). This allows the participating teacher educators to make their own assessment/use their own discretion of where the pre-service teacher will have gained a sufficient digital competency level.

Community: People involved in the inception of the badge.

Explicit Rule: That one or more digital competencies from the Digital Competencies Framework need to be incorporated (Competencies 1, 2, 3, 5, 7, 8, 9, 10)

Community: Department of Basic Education/national players.

Explicit Rule: That one or more digital competencies from the Digital Competencies Framework need to be incorporated. An average of 4.8 digital competencies are linked to each badge (for one module, competencies #12 and 13 are also listed, although the initiative officially focuses on the first 10). It is noteworthy that competency #4 is not currently represented ('Participate in local and global professional learning communities').

Community: Department of Basic Education/national players.

Initial planning document (Digital Competencies Design Template): Not received / Document not completed as part of this participant's engagement in the initiative.

RULES EVALUATION

Rules mentioned more than once:

(3) Implicit Rule: That the new badge activity needs to be meaningfully different from the old version, in terms of digital competency development.

Community: Initiative coordinators and participants.

(5) Explicit Rule: That one or more digital competencies from the Digital Competencies Framework need to be incorporated

Community: Department of Basic Education/national players.

Explicit Rule: That participants are encouraged to use relevant frameworks to guide the creation of their new activity. The participant maps out the planning in the SAMR and RUAAEC sections.

Community: Wider academic community, scholars.

Rules mentioned once, but significant:

(1) Explicit Rule: That there should be a predetermined, specific criterion for awarding the badge.

Community: People involved in the inception of the badge.

(1) Explicit Rule: That there needs to be commitment from the participant to ensure success.

Community: Initiative coordinators and participants.

(1) Implicit Rule: That the activity must be intrinsically better in terms of educational value.

Community: Initiative coordinators and participants.

Rules that can be omitted:

(1) Implicit Rule: That there will be changes to the badge activity between the planning and the roll-out phase as the badge develops.

Community: Initiative coordinators and participants.

(1) Implicit Rule: That students need to be supported.

Community: Educational practices held by the wider educational community.

(1) Implicit Rule: That teaching about the SAMR model forms part of the teacher educators' engagement in the initiative through this module.

Community: Wider academic community, academic scholars.

Appendix C: Participant letter of consent



Faculty of Education

INVITATION TO PARTICPATE IN A RESEARCH PROJECT:
Teacher educators' engagement in an infused approach to advance digital competencies at a Faculty of Education.

I am currently enrolled for a Masters' degree at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a significant research project in the field of education.

The title of my approved research project is:

Teacher educators' engagement in an infused approach to advance digital competencies at a Faculty of Education.

This research project is concerned with how teacher educators engage in a faculty initiative to advance digital competencies. Although the initiative is aimed at the competencies of pre-service teachers, the research also frames the initiative as an informal learning opportunity for teacher educators.

You are hereby invited to participate in this research project, which aims to explore the following:

1. Teacher educators' motivations to engage in the Faculty of Education's infused approach to advance digital competencies.
2. Teacher educators' experience in engaging in the initiative in terms of the process, tools, support, and challenges.
3. The impact of engaging in the faculty's initiative on teacher educators' views of their own professional development.
4. Teacher educators' perceived role and responsibility as second-order teachers in advancing digital competencies.

The scope of your participation entails:

1. Participating in a one-on-one online interview about your experiences in engaging in the initiative. The interview will be about 90 minutes and will include a break.
2. Making available documents you created as part of your participation in the initiative at your Faculty of Education. I would like to analyse the following documents: (1) your initial planning document, and/or (2) the completed curriculum component as uploaded on the university LMS. This is for the purposes of document analysis to explore the initiative process, rather than for assessment.

The interviews will take place in October and November 2022. I will contact you to arrange a time that aligns well with your work responsibilities.

Kindly note that this is a voluntary participation research project and that permission to participate is further protected by the University of Pretoria. Your participation in this research project will in no way either advantage or disadvantage you or any other participant.

Each participant will be free, at any stage during the process and including the stage at which they authenticate the transcripts of their interviews, to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. Any and all data collected from them up to that point in the research project will then be destroyed.

All the information obtained during the research project will be treated confidentially. No person will have access to the raw data, including the Department of Education. Both the interviewee name and the name of the institution in which he or she works will not be revealed in this report.

The findings and the recommendations of this research project will be shared with you. This research presents you with an opportunity to become even more reflective in your teaching practise, especially with regards to advancing digital competencies and your own professional digital competence. It could also be helpful to heads of faculty in supporting teacher educators through professional development.

If you decide to participate in this research project, kindly indicate this by completing the consent form at the end of this letter.

Thanking you in anticipation.

Yours in service of education,

Ms I de Vries

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LETTER of CONSENT

RESEARCH PROJECT: Teacher educators' engagement in an infused approach to advance digital competencies at a Faculty of Education

I, _____, hereby voluntarily and willingly agree to participate as an individual in the abovementioned MEd research project. I understand that I can withdraw at any time without negative consequences.

The research purpose and scope has been explained to me by the researcher, Ilse de Vries, a student enrolled for a MEd degree at the University of Pretoria. I have clarity on the data collection methods and how my information will be treated to ensure confidentiality and anonymity.

I understand that participation in the research entails:

1. Participating in a one-on-one online interview of 90 minutes which will include a break.
2. Making available documents I created as part of my participation in the initiative at your Faculty of Education, i.e., (1) the initial planning document, and/or (2) the completed curriculum component as uploaded on the university LMS.

I also agree to the following request by the University of Pretoria:

We also would like to request your permission to use your data, confidentially and anonymously, for further research purposes, as the data sets are the intellectual property of the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

Full name

Signature

Date

Appendix D: Permission letter from faculty dean



Faculty of Education

Dean of Teaching and Learning Preliminary Approval

21 August 2022

Ms I de Vries
Department of Science Mathematics and Technology Education
Faculty of Education
University of Pretoria

Dear Ms I de Vries

PERMISSION FROM DEAN'S OFFICE FOR RESEARCH PROJECT EDU100/22

The letter serves to confirm that I am supportive of the following Masters research project:

TEACHER EDUCATORS' ENGAGEMENT IN AN INFUSED APPROACH TO ADVANCE DIGITAL COMPETENCIES AT A FACULTY OF EDUCATION

I have no objection to the research team requesting the staff/students from the Faculty of Education to participate in this research project, **subject to ethics approval by the Faculty of Education Research Ethics Committee.**

Kind regards



Professor CT Sehoole
Dean: Teaching and Learning
Faculty of Education