

Micro-credentials for employers: Guidelines in reskilling workforce impacted by
the changes caused by disruptive technologies.

by

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ABBREVIATIONS AND ACRONYMS

| Acronyms | Terms |
|-----------------|--|
| 4IR | Fourth Industrial Revolution |
| AI | Artificial Intelligence |
| COVID-19 | Coronavirus diseases of 2019 |
| HEI | Higher Education Institutions |
| IoT | Internet of Things |
| LMS | Learning Management Systems |
| MC | Micro-credentials |
| ML | Machine Learning |
| MOOC's | Massive Open Online Courses |
| NQF | National Qualification Framework |
| QCA | Qualitative Content Analysis |
| UTAUT2 | Unified Theory of Acceptance and Use of Theory Model 2 |

Micro-credentials for employers: Guidelines in Reskilling Workforce Impacted by The Changes Caused by Disruptive Technologies

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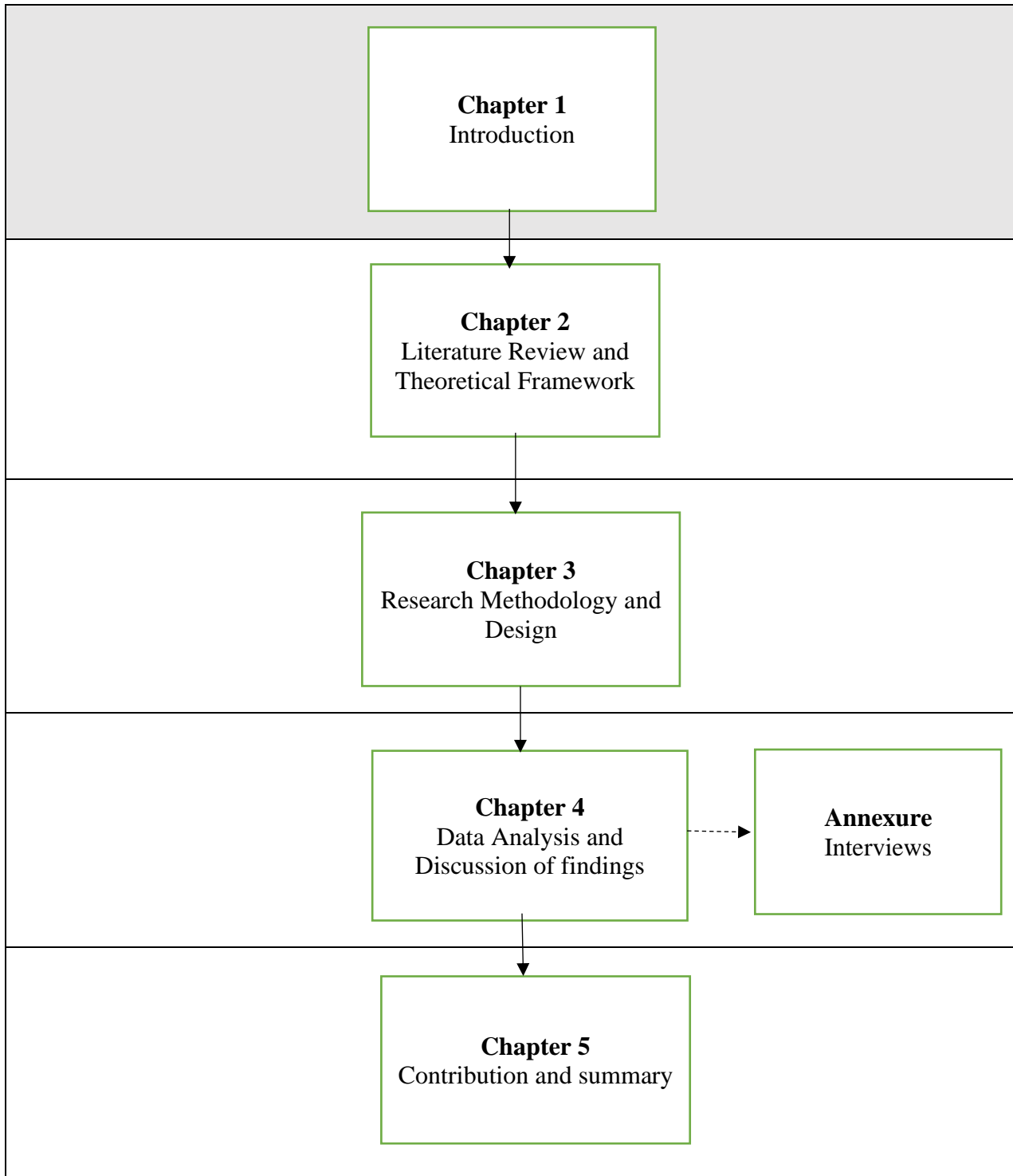
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ABSTRACT

The constant change in technology is reshaping the workplace environment, forcing employers to upskill and reskill employees to meet business needs. Technology such as micro-credentials are viewed as catalysts for skills development. Therefore, this study aimed to assist employers in integrating micro-credentials when reskilling or upskilling their workforce. Two theories were adopted: the Andragogy in practice model that assisted in understanding adult learning and UTAUT2 for understanding technology adoption. Thereafter, ten participants were interviewed who had acquired skills through micro-credentials. The finding highlighted that micro-credentials could offer employees opportunities for flexible learning and learning from experts since experts in their field teach most digital credentials. The benefits of adopting micro-credentials discussed in the findings included career growth, gaining recognition across sectors, and learning work-related skills. However, the challenge of funding, quality of credentials and work-learn balance were also discussed. Thus, this study proposed a framework that will be integrated into the workplace to provide upskilling and reskilling in this digital age.

Keywords: micro-credentials, digital badges, MOOCs, upskilling, reskilling, skills development, UTAUT2, Andragogy of Practice Model



1. INTRODUCTION

1.1. BACKGROUND INFORMATION

Reskilling and upskilling employees has been a problem for decades. However, the earlier workforce transformation was not as rapid as what is currently experienced (Illanes, Lund, Mourshed, Rutherford & Tryeman, 2018). The previous workforce had the opportunity to allow older employees to retire while allowing new employees to grow in the industry and acquire relevant skills (Illanes et al., 2018;). Currently, the digital revolution is transforming the work environment and its business processes at an accelerating rate, triggering the implications for reskilling, and upskilling the workforce (Shirani, 2019). These technological changes can result in organisations upgrading their infrastructure and hiring experienced workers with the appropriate skill set (Reilly, 2018). Forcing current employees to register for additional degrees or certifications to learn these new technologies (Chakma & Chaijinda, 2020).

The shift in skills sets for future work is also a driver in the change of many job roles (Fung, 2020). For example, businesses cannot disregard the use of technology such as Artificial Intelligence, which has recently gone mainstream (Hutchinson, 2023; Sebastian,2023). Literature predicts various applications of these technological tools in the business. For instance, e-commerce companies that rely on customer service for success can use generative AI to respond to customer enquiries quickly without having to hire additional personnel (George & George, 2023). Other businesses may integrate the use of these generative AI technologies to generate reports, conduct market analysis, code product offerings, or simply create a company website (Hutchinson, 2023; Haleem, Javaid, & Singh,2023). Therefore, it can be said that adopting these disruptive technologies will bring about transformation and expansion of the range of tasks that involve repetition, problem-solving, and collaboration (Seet et al., 2018).

Then again, employers have different opinions when it comes to training employees. Some employers agree that training and reskilling are required for these new technologies; some employers do not consider upskilling and reskilling their workforce a priority (Shirani, 2019). While other employers, when reflecting on some technologies, are still uncertain about which skills are needed and how training should be conducted (Seet et al., 2018). Therefore, re-skilling or upskilling solutions are still required for future work. Apart from this, the adoption of technologies such as Artificial Intelligence (AI) will also impact the way work is done, products are developed and the way businesses interact with customers (Fung, 2020; Illanes et al., 2018; Shirani, 2019).

Therefore, solutions such as micro-credentials can assist employers in reskilling or upskilling their workforce. Moreover, the implementation and use of micro-credentials or digital badges have evolved in the past few years. According to Wu et al. (2015), micro-credentials originated from online forums and social media platforms to differentiate advanced users from average users. During their conception, many referred to them as digital badges. The digital badge origin can be traced to the Scout organisation that used images to represent skills embedded in their Scout uniform (Trepulè, Volungevičienė, Teresevičienė, Greenspon, & Costa, 2021; Wu, Whiteley, & Sass, 2015). However, badges have evolved from images embedded in clothes to games where a player can get a digital badge for achieving a particular stage in the game (Wolz, Gottlieb, & Pongratz, 2021).

To date, digital badges are more complex as they contain metadata to validate the skills acquired. For example, information about the issuers, knowledge earned, and activities undertaken for achieving the badge, to name a few (Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015; Rimland & Raish, 2019; Trepulè, Volungevičienė, Teresevičienė, Greenspon, & Costa, 2021; Wolz, Gottlieb, & Pongratz, 2021). This evolution encourages the development of new digital badges and endless opportunities for their application in various sectors (Rimland & Raish, 2019; Rottmann & Duggan, 2021).

However, distinguishing digital badges from micro-credentials is still a grey area. Some studies use these words interchangeably (Eaton, 2019; Gibson, 2015; Jirgensons, 2018; Newby, 2019). Other studies describe micro-credentials as online learning instruction, focussing on skills development that enables self-paced learning, job-embedded, and competency-based learning (Acree, 2016; Rimland & Raish, 2019; Rottmann & Duggan, 2021; Wolz et al., 2021). Other studies define micro-credentials as symbolised by icons or images that serve as a digital badge to validate the skills acquired by learners from an accredited institution (Rimland & Raish, 2019; Rottmann & Duggan, 2021).

However, it is essential to note that micro-credentials are widely used for acquiring knowledge and skill sets for personal development (Crow, 2017; Wolz et al., 2021). This study seeks to investigate guidelines on how employers can adopt micro-credentials in upskilling or reskilling their employees. Therefore, a literature review will be conducted to understand the application of micro-credentials in the workplace, followed by the methodology, which thoroughly explains how the study will be conducted. The data will be collected through interviews, and guidelines will be formulated based on the literature and data analysis results.

1.2. PROBLEM STATEMENT

Lessons learned from the past industrial revolutions demonstrate that new technology encourages changes in skill acquisition. Looking at the employer's standpoint, this study seeks to formulate guidelines on how employers can integrate micro-credentials for reskilling and upskilling the workforce.

The emergence of new technologies is no longer a far-fetched idea. Especially as the COVID-19 pandemic confirmed the importance of companies adopting flexible business strategies for survival. Modern employers are faced with the challenge of having to hire unskilled workers. Unskilled workers comprise the combination of a new workforce and an experienced workforce with outdated qualifications that do not possess the skill set required to keep up with the rapid industrial changes (Gauthier, 2020; Calonge et al., 2019; Wolz et al., 2021). Calonge et al. (2019) pointed out that it is essential for workers to upskill and adapt to the changing job market. However, skill acquisition is not only a concern for employers, but bridging the skills gap is also a concern for many employees. Thus, both upskilling and reskilling solutions are required.

Some studies support the view of micro-credentials as a tool for skills development (Copenhaver & Pritchard, 2017; Gauthier, 2020; Lim et al., 2018; Calonge et al., 2019). However, there is little evidence to confirm the increase of micro-credentials for skill development in the work environment (Gibson et al., 2015; Calonge et al., 2019). Gauthier (2020) described that some modern employers preferred to hire capable and experienced employees rather than inexperienced graduates with university degrees. Therefore, this may raise the question of what will happen to higher-education students graduating each year. It is then worth exploring to what extent these micro-credentials can assist in tackling skills shortage and upskilling the current workforce, ultimately creating lifelong learning opportunities for earners (AACSB, 2018).

The other discussion worth noting is the inconsistency in digital credentialing (Selvaratnam & Sankey, 2021). Some studies suggest that it is essential to formulate a clear policy for issuing credentials that will hold value to the industry (Acree, 2016; Gauthier, 2020; Lim et al., 2018). When considering that employers' interest may lean toward understanding the value and the significance of micro-credentials for skills development (Lim et al., 2018). Therefore, examining how these micro-credentials can be verified is crucial, especially if they are to be transferrable from sector to sector (Selvaratnam & Sankey, 2021). However, many suggest blockchain as the preferred technology

because of its distributed digital ledger characteristics (Jirgensons & Kapenieks, 2018; Rossiter & Tynan, 2019; Selvaratnam & Sankey, 2021). In South Africa, including micro-credentials in the National Qualification Framework is challenging since this topic is still in its infancy (Crafford & Mathee, 2016). However, the National Curriculum Statement includes ‘technology changes’ as one of its development areas (Motshekga, 2009).

1.3. RESEARCH QUESTIONS

The purpose of this study will be to provide guidelines on how micro-credentials can assist employers in reskilling or upskilling their workforce. The Andragogy in practice model and UTAUT2 model will assist in understanding adult learning and technology adoption. The main question that will drive this study is to determine:

- **What guidelines can organisations use to adopt micro-credentials for reskilling employees?**

To assist in answering the above question, we will look at these sub-questions:

1. What opportunities can micro-credentials have in reskilling employees?
2. How can employers and employees benefit from adopting micro-credentials?
3. What are the challenges of adopting micro-credentials for reskilling employees?
4. What are the existing micro-credential frameworks?

1.4. RESEARCH OBJECTIVES

The main objective of this study will be to formulate guidelines for organisations to use when adopting micro-credentials when reskilling or upskilling the workforce.

To achieve the main objective, the study specifically focuses on:

1. To determine the opportunities micro-credentials can have in reskilling employees.
2. To examine the benefit of adopting micro-credentials.
3. To evaluate the challenges of adopting micro-credential when reskilling the workforce.
4. To review different micro-credential frameworks.

1.5. SIGNIFICANCE OF THE STUDY

This study will assist education providers (higher education institutions) and equip them with the development strategies they can use to adopt micro-credentials. Policymakers can also use this study when constructing the micro-credentialing policy for the work environment. Employers can gain

perspective on adopting micro-credential to upskill or reskill the workforce. Employees can use this study to develop personal or professional skills as part of their lifelong plans. Finally, researchers interested in this field can also benefit from this study.

1.6. ASSUMPTIONS

The underlining assumptions that can be noted when conducting this study are as follows but are not limited to:

- Acquiring a skill set through micro-credentials will not provide employees with a promising career or job security.
- Future employers will not opt to employ candidates that have micro-credentials rather than those with traditional degrees or certifications.
- Micro-credentials are not designed to get rid of the traditional degrees.
- Current employers possess some skills, and the new technology introduced in the workplace is not entirely foreign.

Therefore, the above assumptions will be considered when conducting this study.

1.7. LIMITATIONS

This study aims to investigate the adoption of micro-credentials in the work environment. However, it will only focus on the case study of adopting micro-credentials in a single industry. Therefore, the data collected for this study will apply to that industry and will only generally be used as valid in some sectors. This study will seek to understand the employer's perspective in adopting micro-credentials. Thus, skill acquisition through micro-credentials will be applicable to both experienced and new workers. It will be noted that some participants may not have been exposed to micro-credentials before and may not understand how they work or how they may benefit from them.

1.8. BRIEF CHAPTER OVERVIEW

1.8.1. Chapter 1- Background and Introduction

Chapter one contains the introduction and the background of the study. This chapter will help to determine why this study is being carried out. Therefore, this chapter briefly discusses the problem statement, research questions, and objectives. It further highlights the audience that will benefit from this study, the assumptions that can be observed when conducting this study, and the scope of the study.

1.8.2. Chapter 2- Literature Review

Chapter two will explore the current literature on micro-credentials in reskilling employees in an organisation. This chapter will also provide an analysis of the theoretical framework that will assist in examining the research questions. During this chapter, guidelines will also emerge to address the main question.

1.8.3. Chapter 3- Research Methodology

Chapter 3 will help determine how this study will be executed. This includes discussing the research philosophy, choosing the best research strategy for the study, and how data will be collected and analysed.

1.8.4. Chapter 4- Data Analysis and Research Results

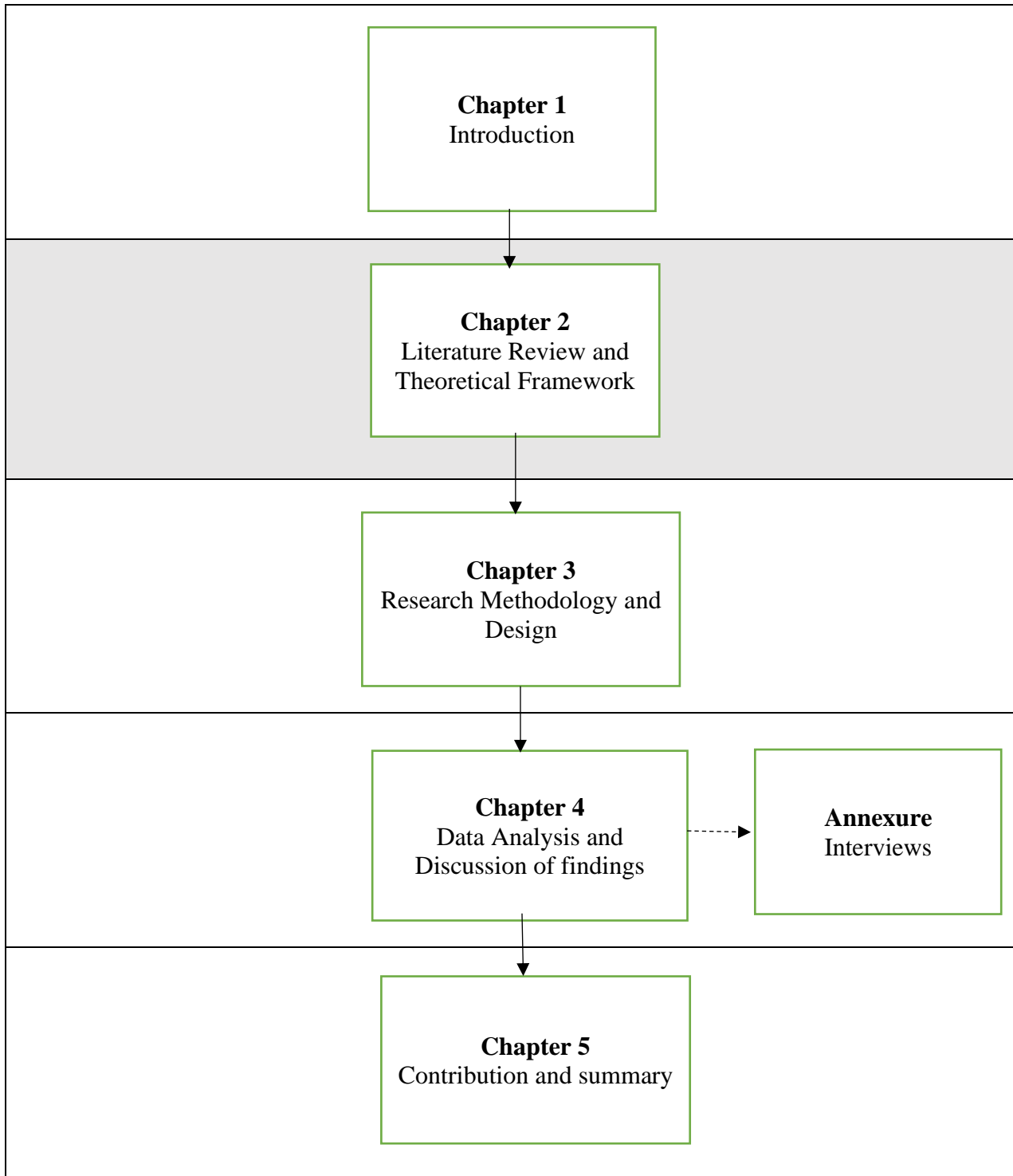
Chapter four includes a discussion on data collection and analysis. This chapter will analyse and discuss the gathered data from the interviews. It is also in this chapter that the findings and the literature will be compared to formulate the guidelines.

1.8.5. Chapter 5- Summary and Conclusion

This will be the contribution chapter, summarising the findings, responding to the research questions, and guiding future research. This chapter will also discuss the research limitations and the study summary.

1.9. CONCLUSION

The main object of this study is to understand how micro-credentials can assist employers in reskilling or upskilling their workforce. The problem highlighted in this study was that the work environment faces the challenge of continuously upskilling and reskilling the workforce due to technological changes. Therefore, this study will investigate the guidelines organisations can use to adopt micro-credentials in reskilling the workforce.



2. LITERATURE REVIEW

2.1. INTRODUCTION

The introduction of the Fourth Industrial Revolution 4IR changed the workplace's technology and brought innovation to organisations and the government. This challenged strategic advisors and business owners to review their business processes (Marr, 2020). The drivers of this tech revolution include technologies such as Artificial Intelligence (AI) and Machine Learning (ML), the Internet of Things (IoT), Big Data, and Blockchain. Furthermore, these technologies seem to be evolving quickly, triggering a paradigm shift that the current business owners cannot ignore.

For example, businesses mainly use AI and machine learning for analysis, automation, and decision-making, thus constructing new business models (Davenport et al., 2019; Donepudi, 2017). Current AI and machine learning systems trends include fraud detection, automated services such as self-help solutions (virtual assistance), innovative services like tracing transactions, generative AI tools that assist with daily tasks, and many other services (Donepudi, 2017). Therefore, upskilling workforce will be required when adopting AI and machine learning in the work environment (Donepudi, 2017).

The Internet of Things is another emerging technology that turns everyday objects into connected devices (Sisinni et al., 2018). Integrate sensors, smart nodes, and objects to communicate with each other without human interference (Ambrosin et al., 2016). The application of IoT in the workplace offers connectivity, both for human-to-device and device-to-device interactions, particularly as 5G networks are expanding exponentially (Cheng et al., 2018; Li et al., 2018; Pham et al., 2020). The adoption of technologies such as IoT is revolutionary for businesses, but the issue of privacy and security remains a problem (Ambrosin et al., 2016; Atzori et al., 2010; Cheng et al., 2018; Jirgensons & Kapenieks, 2018; Kotro & Sternås, 2019; Li et al., 2018; Marr, 2020; Masoodi & Pandow, 2021; Mayer, 2015; Seet et al., 2018). Thus, IoT devices can be exploited by hackers (Masoodi & Pandow, 2021). Therefore, companies must hire cybersecurity employees or equip the current workforce with cybersecurity skills to mitigate cyberattacks and prevent device vulnerabilities. These skill sets can be achieved through micro-credential learning.

Big data is another technology that is changing business operations in the 21st century. Big data generates data in real-time (velocity), with the uncertainty of the data (veracity), on a large scale (volume) and in different formats (variety) (Lee, 2017; Oussous et al., 2018; Sun et al., 2019). Big data allows companies to improve operations and develop new products and services (Lee, 2017; Sun

et al., 2019). Lee (2017) states a need for more qualified data scientists. This implies that more employees or future workforce must acquire data science skills.

Blockchain technology is another disruptive innovation in the world of work. Blockchain is a 'distributed ledger maintained by network nodes, recording transactions executed between nodes' (Gatteschi et al., 2018, p.1). Data inserted in the ledger cannot be modified or erased and is public (Swan, 2015). Nowadays, blockchain applications are seen in various sectors. For example, the education sector can use blockchain to store information on student qualifications and certifications (Gatteschi et al., 2018). However, this groundbreaking technology requires technical skills like installing wallets (Gatteschi et al., 2018). Therefore, employees who need to work with this technology must have the technical skills to support the blockchain infrastructure (Lamb, 2018).

Therefore, skills development is inevitable in this digital age, and employees need upskilling to cope with technological changes. For companies to deal with technological changes, it is inevitable for employers to retrain their workforce. Therefore, this study will explore the use of micro-credentials for upskilling and reskilling the workforce. Firstly, by defining micro-credentials, understand why employers should adopt them to reskill their workforce, examine how they can benefit both employers and employees, look at the challenges of adopting them in the workplace, and review different micro-credentials frameworks. After that, two theories will be reviewed to guide this study: the Unified Theory of Acceptance and Use of Technology (UTAUT2) and Andragogy in Practice, adopted from learning science. The conclusion will be drawn on why employers should use micro-credentials in reskilling and upskilling their employees.

2.2. UPSKILLING AND RESKILLING REVOLUTION

Companies have been providing training to their workforce for various reasons, either as part of a business process or to introduce a new skill set. However, due to the transition in the global market, the work environment is going through some changes (Illanes et al., 2018; Sivalingam, 2020). The volatility of the work environment can imply that the current skills may be regarded as irrelevant tomorrow. Therefore, employees need upskilling or reskilling to be employable and relevant in this digital age (Sivalingam, 2020). According to Sofia, Fraboni, De Angelis, Puzzo, Giusino, and Pietrantonio (2023), upskilling is improving existing skills or acquiring new skills relevant to the employee's current industry. It caters to the personal development of an employee who requires additional skills (Jaiswal et al., 2021). While reskilling is defined as the process of learning new skills

outside the employees' current skills, and reskilling is done to change industries (Sawant, Thomas, & Kadlag, 2022).

Jansen et al. (2019) pointed out that it cannot be precisely identified which jobs or skills will become absolute, but technological changes may trigger the need for reskilling. This means even job titles will become less indicative of the skill set required due to technological changes (Anani, 2018). For instance, modern software developers are expected to acquire skills such as cryptography, trading technology, cybersecurity and other skills in addition to writing and reading code (Alameda, 2017; Anani, 2018).

The introduction of disruptive technologies means that computers will perform tasks that are more complex and less routine-based (Jansen et al., 2019). Interestingly, introducing these technologies also changes the structure and processes of the work environment (Anani, 2018). As was observed during the COVID-19 pandemic, the eruption of the new gig economy where remote work emerged, and tasks were completed on a project basis, changing the normative work practices (Anani, 2018; Kniffin et al., 2021). Therefore, future work will have to focus on identifying which tasks can be automated and which tasks will require workers to be equipped with digital and technical skills (Jansen et al., 2019; Walker et al., 2018). Additionally, there will be a need for increased collaboration between the industry and academia to bridge the skills gap (Anani, 2018). Retraining will remain an ongoing process as technology evolves at an accelerated rate (Jansen et al., 2019).

2.3. WHAT IS MICRO-CREDENTIALING?

It is essential to understand what the term micro-credentialing means. To break this down, Ehlers (2018) states that the word *credential* comes from the Latin word *credence*, which implies credibility. Credibility based on learning outcomes is usually supported by evidence that an individual is competent and has been assessed in a field of study (Ehlers, 2018; Gibson et al., 2015). The literature has various concepts and definitions when defining micro-credentials, and they are often used interchangeably with words such as digital badges and Massive Online Open Courses (MOOCs), just to name a few. Table 1 shows the different concepts of micro-credentials in the literature.

Table 1 Different terms and concepts of micro-credentials

| Term | Definition | Concepts | Authors |
|---------------------|---|--|--|
| Micro-credentials | Define micro-credentials as virtual, portable learning and skills that are acquired granularly. | A virtual representation of skills or knowledge | (Rimland & Raish, 2019) |
| | Credentialing that adopted competency-based professional learning to recognise learner skills and achievements. | Proof of skills, achievement, and competence | (Kilsby & Fountain, 2019) |
| | Mini certifications in specific study or professional development areas will help recognise the student's skills. | Demonstrates knowledge and skills earned through assessment-based activities. | (Lim et al., 2018) |
| | The certification of the assessed learning is less than the formal qualification. | Assessed learning less than formal qualification | (Oliver, 2019) |
| Digital badge | A representation of an accomplishment that is visual, available online, and contains metadata, including links that help explain the context and result of an activity. | Supports skill acquisition through performance. | (Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015) |
| | A digital identity certificate that can be transferred electronically and can be verified with 100% accuracy by computers. | Equivalent to a tangible certificate issued by a trusted institution | (Brands, 2002) |
| | A clickable graphic that contains an online record of achievement and information about the organisation or entity that issued the badge. | A solution modified to the needs of digital competence training offered in higher education. | (Borrás-Gené, 2018) |
| Massive Open Online | Free online courses, which started collaboratively as tech-minded learning events. | MOOCs offer access to education. | (Lambert, 2020) |

| Term | Definition | Concepts | Authors |
|------|--|----------|---------------------------|
| | They are designed to be free and openly accessible without grading or formal assessment. | | (Zhu, Bonk, & Sari, 2018) |
| | Modern Internet-based teaching support with unrestricted access. | | (Alalwan et al., 2019) |

Table 1 shows the different terminologies and understanding of micro-credentials. However, the concept of skills and knowledge earned as a form of recognition from an institution emerges (Kilsby & Fountain, 2019; Lim et al., 2018; Rimland & Raish, 2019). Other studies interchange micro-credentials and digital badges (Jirgensons & Kapenieks, 2018; Newby & Cheng, 2020). On the other hand, a digital badge is identified as an online image containing metadata equivalent to an actual certificate (Borrás-Gené, 2018; Brands, 2002; Gibson et al., 2015). When it comes to the concept of Massive Open Online Courses (MOOCs), there was mutual understanding, as they were identified as free online courses that anyone can access without prerequisites (Alalwan et al., 2019; Lambert, 2020; Zhu et al., 2018).

The literature identifies that the lack of micro-credential definition is the underlying cause of the challenges of their adoption in the workplace. Rimland and Raish (2019) shared the concept of micro-credential as virtual, portable learning and skills acquired granularly. This concept of micro-credentials as the virtual representation of skills was also applicable to the definition of digital badges by Borrás-Gené (2018), who identified digital badges as a clickable graphic that contains an online record of achievement and information about the organisation or entity that issued the badge. Therefore, the concept of micro-credential as a virtual representation of skills influenced various studies to adopt the terms 'micro-credential' and 'digital badge' to be used interchangeably.

The other narrative was defined by Kilsby and Fountain (2019) as the concept of micro-credentials as competency-based professional learning to recognise a learner's skills and achievements. The competency-based concept was supported by other studies that demarcated micro-credentials as meta-skills, competencies, or accomplishments achieved by learners from micro-credential providers (Ghasia et al., 2019). This concept highlights competency-based learning to acquire skills as the focal point of the micro-credential definition.

The other concept explored in this study was that Lim et al. (2018) expressed micro-credentials as mini-certifications in specific areas of study or professional development that will help recognise the student's skills. This concept of micro-credentials as mini certificates encompasses various forms of certification, including micro-masters, nano degrees, and licences, for as long as the certification focuses on a small volume of learning and allows the learner to complete the certificate over a short period (Ahmat et al., 2021).

All three concepts linked that micro-credential definitions when compared to the traditional HEI system can be represented in the following concepts:

- *Micro-credential as a virtual clickable graphic*

This definition, when compared to the traditional university setting, can be represented by a tangible certificate earned by a learner after completing the course.

- *Micro-credential as competency-based learning*

This definition in the traditional university setting can be represented by *credits* offered to the course to measure learning outcomes.

- *Micro-credential as a mini certificate*

This definition in the traditional university setting can be represented by a short course to achieve a particular set of skills. Therefore, a clear definition is required to unify the abovementioned concepts and other concepts identified when defining micro-credentials. Galindo (2023) proposed micro-credentials (*credits*) + digital badges (*certificates*) = open badges (*digital credentials*) (Galindo, 2023). However, this is beyond the scope of this study. Therefore, in this study, the adopted terminology of micro-credential is a virtual representation of skills or knowledge earned.

When distinguishing between micro-credentials and MOOCs, micro-credentials are competency-based professional learning to recognise learner skills and achievements (Kilsby & Fountain, 2019). On the other hand, MOOCs provide education to many participants and are designed to be free and openly accessible without grading or formal assessment (Zhu et al., 2018). The structure of micro-credentials is also different from that of MOOCs. For example, micro-credentials are built by a series of modules, assessments, and projects centred around specific skill competencies (Gleason et al., 2021). Furthermore, micro-credentials are often recognised by employers and other professionals within the same industry (Desmarchelier & Cary, 2022).

MOOCs are certificates of completion that can be shared on online platforms such as LinkedIn or the individual Curriculum Vitae CV (Du, 2020). The other difference between micro-credentials and MOOCs is the setting; micro-credentials are often offered by HEIs, accredited professional platforms and Industry professional associations (Oliver, 2022). In contrast, HEIs or online platforms provide MOOCs (van de Laar, West, Cosma, Katwal, & Mancigotti, 2022). Finally, the other significant difference is that the scope of micro-credentials enhances professional development and skills (Lim et al., 2018). MOOCs are designed to cater to a more comprehensive, in-depth understanding of the topic in online courses (Fabus et al., 2023). Table 2 shows the difference between micro-credentials and MOOCs.

Table 2 The Difference between Micro-credentials and MOOCs

| | Micro-credentials | MOOCs |
|-------------|---|--|
| Definition | Competency-based professional learning to recognise learner skills and achievements. | They are designed to be free and openly accessible without grading or formal assessment. |
| Structure | Series of modules, assessments, and projects centred around specific skill competency. | Mimic the traditional structure with curriculum, delivered by a lecturer with quizzes, assignments, and forum discussions. |
| Recognition | Recognised often by employers and other professionals within your industry | Certificate of completion that can be shared on online platforms such as LinkedIn or the individual CV. |
| Setting | Offered by HEIs, accredited professional platforms and Industry professional associations | HEIs or online platforms |
| Scope | Professional development and skills enhancement | Comprehensive, more in-depth understanding of the topic online course |

After exploring the difference between micro-credentials and MOOCs, it was worth looking at the difference between micro-credentials and digital badges using the abovementioned metrics. Micro-credentials are competency-based professional learning to recognise learner skills and achievements (Kilsby & Fountain, 2019). In structure micro-credentials are a series of modules, assessments, and projects centred around specific skill competency (Gleason et al., 2021). In contrast, a digital badge

is not a course but a virtual representation of a completed course (Gibson et al., 2015). Micro-credentials are often recognised by employers and other professionals within your industry (Desmarchelier & Cary, 2022). For digital badges, recognition of achievement depends on the reputation of the digital badge provider (Perkins & Pryor, 2021). For setting micro-credentials are offered by HEIs, accredited professional platforms and Industry professional associations (Oliver, 2019). In contrast, digital badges are provided by either HEIs or any online platform or professional associations (Perkins & Pryor, 2021). Then, finally, when it comes to scope, micro-credentials enhance professional development and skills enhancement (Lim et al., 2018). Digital badges covers any formal or informal learning setting that can offer digital badges. The differences between micro-credential and digital badges are tabulated in Table 3 below.

Table 3 The Difference between Micro-credentials and Digital Badges

| | Micro-credentials | Digital badges |
|-------------|---|---|
| Definition | Competency-based professional learning to recognise learner skills and achievements. | Virtual representation of achievement or skills earned by an individual |
| Structure | Series of modules, assessments, and projects centred around specific skill competency. | It is not a course but a virtual representation of a completed course. |
| Recognition | Recognised often by employers and other professionals within your industry | Recognition of achievement depends on the reputation of the digital badge provider. |
| Setting | Offered by HEIs, accredited professional platforms and Industry professional associations | Offered by HEIs, any online platform and professional associations |
| Scope | Professional development and skills enhancement | Any formal or informal learning setting can offer digital badges |

The final terms distinguished were between digital badges and MOOCs. As mentioned above, digital badges were defined as a virtual representation of achievement or skills earned by an individual (Gibson et al., 2015). However, MOOCs are designed to be free and openly accessible without grading or formal assessment (Zhu et al., 2018). Regarding structural design, digital badges are not courses but a virtual representation of a completed course (Gibson et al., 2015). However, MOOCs

imitate the traditional structure with a curriculum delivered by a lecturer with quizzes, assignments, and forum discussions (Gibson et al., 2015). Digital badge recognition depends on the reputation of the digital badge provider. MOOCs are recognised as certificates of completion that can be shared online (Gibson et al., 2015).

Regarding the setting, digital badges are offered by, HEIs, online platform, and professional associations (Perkins & Pryor, 2021). MOOCs are also offered by HEIs or online platforms (van de Laar, West, Cosma, Katwal, & Mancigotti, 2022). Lastly, digital badges cover any formal or informal learning setting. MOOC's scope focuses on a comprehensive, more in-depth understanding of the online course topic (Fabus et al., 2023). Table 4 tabulates the differences between digital badges and MOOCs.

Table 4 The Difference between Digital Badges and MOOCs

| | Digital badges | MOOCs |
|-------------|---|--|
| Definition | Virtual representation of achievement or skills earned by an individual | They are designed to be free and openly accessible without grading or formal assessment |
| Structure | It is not a course but a virtual representation of a completed course. | Mimic the traditional structure with curriculum, delivered by a lecturer with quizzes, assignments, and forum discussions. |
| Recognition | Recognition of achievement depends on the reputation of the digital badge provider. | Certificate of completion that can be shared on online platforms such as LinkedIn or the individual CV. |
| Setting | Offered by HEIs, any online platform and professional associations | HEIs or online platforms |
| Scope | Any formal or informal learning setting can offer digital badges | Comprehensive, more in-depth understanding of the topic online course |

Therefore, micro-credentials, digital badges and MOOCs can be distinguished based on their definitions, their structural design and how they can be recognised by employees, employees, and

other professional bodies. The other differences include their scope and their setting based on the online platform that offers them.

2.4. MISCONCEPTIONS ABOUT MICRO-CREDENTIALING

Various misconceptions about micro-credentials may need to be clarified in their adoption. It is then significant to discuss some of the micro-credential misconceptions.

2.4.1. Micro-credentials are just a Passing Trend

One of the misconceptions is that micro-credentials are just a passing educational trend. After the adoption of MOOCs provided by private providers, there was a trend where most people registered for courses and did not complete them (Belhassen,2019). The high drop-up rate in online courses undermined their credibility (Bezerra & Silva, 2017). Furthermore, MOOCs made the mistake of equating course completion to measure success rather than measuring the actual impact of training (Belhassen,2019). Therefore, as MOOCs are frequently confused with micro-credentials, the misconception that they are merely a passing trend cannot be endorsed. Micro-credentials, unlike MOOCs, propose competency-based learning to acquire new skills for future work (McGreal et al., 2022).

2.4.2. Micro-credentials Guarantee Employment

Micro-credentials, although they are skill-based learning, do not guarantee employability or career success (Fitzgerald & Huijser, 2021). It is important to note that micro-credentials are not a one-size-fits-all solution (Acree, 2016), just like how traditional degrees are criticised for being unreliable indications of employability, as they cannot demonstrate work readiness or guarantee anyone employability (Boud & Jorre de St Jorre, 2021). Micro-credentials offer learners competency-based learning and job-embedded learning to help learners achieve their educational goals and learn new skill sets. However, they do not promise guaranteed employment.

2.4.3. Micro-credentials are Less Valuable than Traditional Degrees

HEIs have a history of collaborating with professional bodies to certify their students beyond degree completion (Olcott Jr, 2022). For example, in South Africa, the South African Institution of Chartered Accountants (SAICA) validates Chartered Accountant qualifications beyond the accounting degree. Professional bodies certify qualifications such as engineering, pharmacy, law, and other professional qualifications. Therefore, professional bodies will not only certify traditional degrees but can also

certify stackable credentials that offer skills in a short period and can be appealing to private providers (Fitzgerald & Huijser, 2021).

2.4.4. Micro-credentials are Only Offered by Universities

There is a growing interest in integrating micro-credentials into the HEI ecosystem since most HEIs are considering agile ways of learning (Fitzgerald & Huijser, 2021). However, not only are micro-credentials offered by HEIs but there is a significant growth of private providers that offer micro-credentials in various sectors (Wheelahan & Moodie, 2021). Therefore, the notion that micro-credentials can only be provided by HEIs is a misconception. Instead, micro-credentials allow HEIs to partner with private providers and industrial partners to bridge the skills gap (Oliver, 2019).

2.4.5. Micro-credentials are Only for Technical Skills

Micro-credentials offer a variety of skill sets, but technical skills are more popular. Some universities incorporate micro-credentials for their teachers' professional development (Wheelahan & Moodie, 2021). Gallagher (2018) also shared that there is an increase in the acceptance of micro-credentials among human resource managers. Micro-credentials also apply to soft skills development (Desmarchelier & Cary, 2022). Therefore, it is only a misconception that micro-credentials are only for technical skills.

2.4.6. Micro-credentials are Participation Certificates

Selvaratman and Sankey (2021) stated that micro-credentials have the potential solution for skills development. Micro-credentials, by design, contain meta-data and competencies that enable the learners to be assessed for the learning outcome of each credential (Pirkkalainen et al., 2023). Therefore, the credibility of micro-credentials goes beyond the participation certificate (Pirkkalainen et al., 2023).

2.4.7. Micro-credentials are Quick and Easy to Complete

Micro-credentials offer flexible learning and can be completed quickly compared to the full degree (Resei et al., 2019). However, gaining new skills takes longer and requires learners to achieve competency-based learning (Ifenthaler et al., 2016). Some micro-credentials may need previous qualifications to register and complete them (Kishore et al., 2021). Therefore, it is a misconception that micro-credentials are quick and easy to complete.

2.5. OPPORTUNITIES FOR THE ADOPTION OF MICRO-CREDENTIALS IN THE WORKPLACE FOR EMPLOYERS

2.5.1. Targeted Skills Development

Varadarajan, Koh and Daniel (2023) stated that employers seek quick ways to enhance productivity. Adopting micro-credentials in the workplace can allow employers to target the skills required to achieve the organisation's business goals (Woods & Woods, 2023). Furthermore, they are equipping employees with relevant skills to improve the organisation's efficiency (Rossiter & Tynan, 2019). Gauthier (2020) shared that micro-credentials should demonstrate project-based education to prove competency. Therefore, high-quality micro-credentials ought to verify a distinct skill learners learn when they submit evidence of application in practice (Tooley & Hood, 2021). Moreover, micro-credentials allow employees to develop professionally and continuously learn (Hunt et al., 2020).

When employers proactively ensure employees acquire the relevant skill set (Alam et al., 2022). The organisation builds a culture of participating in lifelong learning (Babalola, 2023). Studies show that organisations that adopt professional development are more likely to remain relevant and progressive than their competitors (Resei et al., 2019). They are more eager to invest in human capital (Tamoliune et al., 2023). Therefore, micro-credentials enable employers to develop an addictive learning environment (Varadarajan et al., 2023).

2.5.2. Responsive to Industry Trends

Micro-credentials are not limited to meeting business needs but can also assist organisations in being more innovative and responsive to technological trends. Ali and Khan (2023) stated that the growing popularity of micro-credential innovation in the education sector meets the ever-increasing need for flexible learning and career orientation education. The ever-increasing need is motivated by the labour market that constantly demands employees to evolve with the job market due to automation processes (Tamoliune et al., 2023). What worsens the situation is the widening gap between traditional education and the skills required for technological changes (Qadir, 2023). Hunt (2020) emphasises that although micro-credentials are relatively new in the education sector, they can provide alignment to address current industry and business trends.

The lesson organisations can learn post-COVID-19 pandemic is that organisations should prepare for the unpredictable (Prataviera et al., 2022). The pandemic forced businesses to adapt, survive, resist change, and close (Mishi et al., 2023). Therefore, in this new reality, employers are more likely to

value sustainability and maximise their employees' potential (Tien-Dung, Majerova, & Das, 2022). Thus, skill acquisition remained critical for any business to succeed in this new reality.

2.5.3. Cost-Effective Training

Orman, Simsek, et al. (2023) pointed out that as university fees increase yearly in many countries, people seek alternative, cost-effective ways to update their targeted skill sets. Micro-credentials have been perceived to be cheaper and more flexible options for learners to earn both micro-credentials that can be stacked into macro-credentials in the future (Boud & Jorre de St Jorre, 2021). Macro-credentials include degrees, diplomas, and certificates awarded by accredited or regulated educational organisations (Thi Ngoc Ha, Spittle, Watt, & Van Dyke, 2023). Nevertheless, besides stacking credentials, adopting micro-credentials can also be an economical direction for organisations to train employees for the relevant skill set needed for that position rather than invest in the long-term, expensive university qualification (Olcott Jr, 2022; Ralston, 2021).

However, in the same breath, other micro-credentials can be very expensive, challenging the organisations to have sufficient budget to address the employees' needs (Desmarchelier & Cary, 2022; McGreal et al., 2022). Most studies proposed that organisations should embrace the challenge of becoming “training organisations” and consider long-life learning an integral part of skills development (Desmarchelier & Cary, 2022; Lang, 2023).

2.5.4. Data-driven Insights

The fourth opportunity for employers to adopt micro-credentials in the workplace is their offering of data-driven insights for employees' skills development journey (Miller & Jorre De St Jorre, 2022). Adopting micro-credentials in the work environment can assist employers in identifying and analysing skills gaps within the organisation by providing insights and feedback on skills gained by employees, completion rates, and identifying improvements where skills are still needed (Desmarchelier & Cary, 2022; Mapitsa et al., 2019; Varadarajan et al., 2023). This can assist employers in allocating resources effectively by presenting a real-time analysis of which micro-credentials are in high demand within the organisation and predicting future skill sets that will be required (Cosby et al., 2023).

Therefore, data-driven insights can encourage adaptive learning (China National Academy of Educational Sciences, 2023). According to Srivastava (2023), adaptive learning intelligently caters

to a learner's unique preferences and needs. Thus, employers can use the data available through micro-credentials to support the employees' iterative learning experience when obtaining the relevant skill set (Cosby et al., 2023).

2.5.5. Recruitment Advantage

The fifth opportunity of adopting micro-credentials in the workplace is the recruitment advantage. Employers can quickly identify candidates with relevant skills through micro-credentials (Felton et al., 2023). They make the candidate screening processes more efficient (Tamoliune et al., 2023). Candidates with relevant micro-credentials possess tangible evidence of skills earned, which may also benefit them during recruitment (Yueh et al., 2023). Moreover, Yueh et al. (2023) stated that employees who are micro-credential holders tend to be more resilient to change as they are more likely to learn and acquire new skills (Desmarchelier & Cary, 2022; Goger et al., 2022). Furthermore, employees with micro-credentials may refer like-minded candidates for open positions, which may result in the organisation hiring highly skilled candidates.

2.6. BENEFITS OF ADOPTION OF MICRO-CREDENTIALS IN THE WORKPLACE FOR EMPLOYERS

Micro-credentials could offer an opportunity for integration between providers of Higher Education Institutions (HEI) and employers. Currently, the HEIs are the sole actors that offer accreditation since they are the only ones that endorse students with the entire degree (Ehlers, 2018). However, there is a call for engaging employers to collaborate with educational institutions in providing students with real-world practical projects (Oliver, 2019). This means industries should be participants in validating the curriculum; likewise, quality assurance and accreditation should be taken seriously (Gallagher, 2018; Oliver, 2019). Therefore, the adoption of micro-credentials in the workplace will provide companies with the benefit to upskill and reskill their workforce in the following ways:

2.6.1. Bridging Skills Gap

Bridging the skills gap and employability remains a critical challenge in the workplace (Pauillet et al., 2020). Caratozzolo et al. (2020) mention that skills obsolescence is expected as technology progresses and jobs become more complex and demanding. However, that is not the only case; another problem is the increased demand for heterogeneous jobs (Bate, 2018). Heterogeneous jobs are interdisciplinary, meaning they are applicable across multiple fields (Pauillet et al., 2020). For instance, a cybersecurity specialist can work across various fields, such as accounting, law,

government, and the private sector (Bate, 2018; Poullet et al., 2020). Therefore, technological improvements will not fix skills gaps but will change requirements as technology advances (Poullet et al., 2020). Thus, bridging the skills gap should be collaborative between employers, employees (learners), providers, and policymakers (Oliver, 2019; Zain, 2023).

○ ***Employers***

Gauthier (2020) mentioned that modern employers were questioning the validity of university degrees. However, Caratozzolo et al. (2020) suggested that the validity of educational products should not be determined only by HEIs but also by employers and accrediting agencies. Since even highly skilled workers face decreased productivity due to technological changes in the workplace (Caratozzolo et al., 2020; Poullet et al., 2020). Therefore, employers are seeking for rapid ways to upskill and reskill their workforce, and the agreed premise is micro-credentials for skills development (Acree, 2016; Berry & Byrd, 2019; Gauthier, 2020; Selvaratnam & Sankey, 2021). Micro-credentials offer trustworthy qualifications in the domain of technical skills, business skills, and power skills (Poullet et al., 2020).

○ ***Employees***

While employers are seeking for skilled workers, employees are looking for ways to learn these skills to meet the demand (Gauthier, 2020). Poullet et al. (2020) state that businesses should instead focus on reskilling current employees to increase productivity and gain a competitive advantage. Furthermore, micro-credentials can differentiate the skills earned by an employee and can be customised to meet their learning outcomes (Lim et al., 2018). Therefore, micro-credentials can be used for personal and professional development to remain relevant in the workplace (Lim et al., 2018; Oliver, 2019; Poullet et al., 2020).

○ ***Providers***

Providers are significant stakeholders in providing quality resources that will assist employers in reskilling or upskilling their employees (Oliver, 2019). Providers may include traditional universities, private providers, and employers offering retraining (Oliver, 2019). Therefore, HEIs must collaborate with companies to provide learning to help close the skills shortage (Gauthier, 2020; Poullet et al., 2020).

- ***Policymakers***

In South Africa, the government is the driver when setting the HEI standards. The National Qualifications Framework (NQF) is a body responsible for providing quality learning and training systems in South Africa. Therefore, the NQF provides guidelines for records in which learner achievements are registered to facilitate national recognition, attained skills, and knowledge (Bolton et al., 2020). Therefore, as these micro-credentials emerge, the government should provide direction on how these credentials can be standardised by ensuring that the recognition, quality and funds are available (Kato et al., 2020).

2.6.2. Encouraging Employee Growth

The concept of upskilling and reskilling to measure up to technological capabilities sets a new set of educational goals (Pullet et al., 2020). Thus, acquiring micro-credentials could motivate employees to continuously engage with online learning designed to assist them in achieving their educational objectives (Oliver, 2019). Furthermore, Copenhaver and Pritchard (2017) mentioned that integrating micro-credentials into a company's training programme could offer an innovative and customised way to certify and recognise learning. Lim et al. (2018) stated that employees who acquired new skill sets through micro-credentials would stand out compared to their peers.

Additionally, earning micro-credentials can be seen as a signpost since, after receiving a digital badge, an employee will be provided with information about further learning opportunities (Gauthier, 2020; Calonge et al., 2019). Since each digital badge contains metadata, it can assist in guiding the user to the next set of skills to achieve their educational goals (Copenhaver & Pritchard, 2017). Moreover, because micro-credentials are sharable, employees can share them on other online platforms to showcase their new skills (Lim et al., 2018).

2.6.3. Recognition Across Sectors

Acquiring a digital badge provides the earner with the opportunity for personal and skill development (Lim et al., 2018). For skills development, an employee will be offered a chance to respond to the needs of an organisation (Baiocco et al., 2020). Furthermore, when micro-credentials are viewed as a form of accreditation and validation of skills, employees will be recognised across different sectors for acquired skill sets (Kato et al., 2020). Therefore, earning a digital badge can be a virtual representation, allowing employees to formalise their reputation within and across industries

(Copenhaver & Pritchard, 2017; Poullet et al., 2020). Accreditation reflects work of accomplishment, not just passing a test (Wilson et al., 2016).

Thus, micro-credentials can present employees' achievements in a user-centric, transparent and effective way to showcase skills attained (Baiocco et al., 2020; Brown et al., 2021; Kato et al., 2020). Therefore, the endorsement of the digital badge by the external organisation to publicly license the value of the badge is essential (Everhart et al., 2016). Hence, for micro-credentials to be considered valuable, they need to be assessed and verified (Resei et al., 2019). However, some computer systems come with predefined badges that allow organisations to personalise their badges to be aligned with the organisational culture (Lim et al., 2018)—for example, the learning management system (LMS) such as Moodle or Blackboard.

The following stakeholders can gain from the endorsement:

- ***Badge earners***

This includes employees who are in the process of upskilling or reskilling, and accreditation of badges can assist them in understanding how they can leverage the value of the badges they have attained (Everhart et al., 2016).

- ***Badge issuers***

Issuers or providers can be private providers or universities. Since they are the ones that create, define and determine the competency of their badges, they can benefit from external endorsement for their badge programs (Everhart et al., 2016; Oliver, 2019).

- ***Badge viewers***

This can include employers within and across industries, the earner's peers, and other customers who use digital badges to evaluate and understand the earner's achievements (Everhart et al., 2016; Oliver, 2019). This can also assist in determining which badges are most suitable in their field of interest (Everhart et al., 2016).

- ***Badge endorsers***

This can include policymakers, which can ensure appropriate behaviour by all parties (Oliver, 2019). This can also be an independent organisation that acknowledges and accredits the value of digital badges through an endorsement to indicate their competency in alignment with external organisations (Everhart et al., 2016).

2.6.4. Foster Collaboration Between Employees

Adopting micro-credentials in the workplace can foster collaboration between employees. Metadata embedded in a digital badge does not only show badge competency (Copenhaver & Pritchard, 2017). However, it can also enable company or human resources administrators to include badges in their ranking and the promotion process (Hamson-Utley & Heyman, 2016). Acree (2016) mentions four elements when developing micro-credentials which include:

- **Self-directed-** Employees should be able to complete micro-credentials at their own pace (Acree,2016).
- **Job-embedded-** implies that each credential should be directly aligned or to enhance the skills required for the employee's job (Acree,2016).
- **Competency-Based-** This means the micro-credentials earned by an employee should demonstrate their ability for a particular skill at work (Hunt et al., 2020).
- **Research-Based-** This means that micro-credentials should be designed around skills that have been researched and that show impact on the work practice (Acree, 2016).

Other studies shared more elements to be considered for micro-credential development.

- **Sharable-** Employees should be able to share it across many platforms (Msweli et al.,2022).
- **Accredited and recognised-** This refers to micro-credentials being formally recognised in the education sector like a formal degree or by practice like a Microsoft certification (Msweli et al., 2022).
- **Modular and stackable-** this implies that micro-credentials should be stacked or grouped into a larger unit or qualification (Ahmat et al., 2021; Rossiter & Tynan, 2019)
- **Short and focused learning-** This implies that micro-credentials can be completed in a short period (Msweli et al., 2022).

Oliver (2019) further suggests that the endorsement of micro-credentials by employers is essential, for it can encourage employees to include micro-credentials in their work experience as a tool for promotion or a chance to network with other employees (Oliver, 2019). Therefore, the micro-credential design should allow users to engage to exchange ideas and experiences (Berry & Byrd, 2019; Oliver, 2019).

2.6.5. Continuous Learning

Micro-credentials offer an agile approach to learning. To earn a micro-credential, employees must register for micro-credentials by selecting the relevant credential, which can be from a university (as a provider) or a private external provider (Lim et al., 2018). After that, take the course, write an assessment, and receive the digital badge as proof of credential earned (Rossiter & Tynan, 2019). The digital badge received after completing the credential should be shareable to other online platforms (Brown et al., 2021). Moreover, the delivery of these credentials varies from hours to weeks or even months (Msweli et al., 2022). Therefore, employees will be able to engage in continuous lifelong learning experiences.

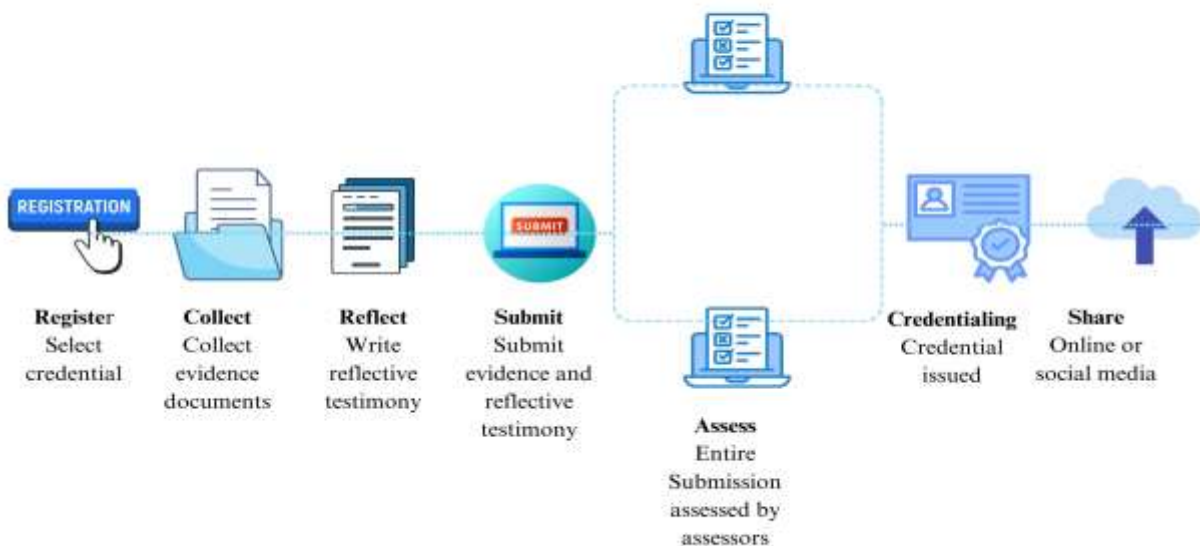


Figure 1 Micro-credentials ecosystem adopted from (Source: Lim et al., 2018).

The process of micro-credential ecosystem

- **Register:** Employees can register for micro-credentials by selecting the relevant credential, which can be from a university (as a provider), a private external provider or an internal portal (Lim et al., 2018).
- **Collect:** This includes understanding the micro-credentials requirements and collecting evidence for the deliverables through writing, videos, interacting with other employees and many more (Lim et al., 2018).

- **Reflect:** Assessments form part of reflection. In this phase, instructors can give the user questions as guidance to reflect on what they have learned. This can also be captured through writing, video, or audio (Lim et al., 2018).
- **Submit:** This is the submission of evidence once completed in the submission link. The instructor can then check to ensure the requirements are met. If requirements are not met, the user can require supporting information (Lim et al., 2018).
- **Access:** This is when the submitted evidence is assessed if it meets the requirements. The instructor will review the evidence using the rubric and provide feedback (Lim et al., 2018).
- **Credential:** In this phase, the user receives their digital badge if they successfully meet the requirements. The awarded badge can be visible online (Lim et al., 2018).
- **Share:** After being issued a digital badge, the badge can be shared on other online platforms, such as social media (Lim et al., 2018).

However, some employers still perceive micro-credentials as interest-driven informal certifications (Fishman et al., 2018). The organisation's perception of micro-credentials is essential to address the lack of awareness and understanding of their value in skills development (Resei et al., 2019; Brown et al., 2021). Therefore, organisations may consider the following:

- **Awareness campaigns:** Organisations can launch online education as a form of awareness for employees as micro-credentials provide *continuous learning*, contrary to a full degree (Oliver, 2019; Rossiter & Tynan, 2019). This can encourage employees to register for courses they are interested to develop job-embedded skill sets (Acree, 2016).
- **Draft a clear accreditation policy:** The organisation can formulate and list the skill set that can be achieved through micro-credentials and include the skill set that requires formal traditional education. This can assist employees in registering for competency-based learning to be recognisable in their industry (Resei et al.; Acree, 2016).

Employers need to understand the different types of credentialing and decide which will suit their organisation's needs when reskilling; for example, Table 5 below differentiates four types of credentialing. Formal courses include formal learning, for example, the university degree. Non-formal credentialing includes online courses such as MOOCs (Lambert, 2020). Recognition of skills is another way of credentialing; this happens when individuals are given certificates for achieving a specific skill after taking an assessment, for example, micro-credentials (Oliver, 2022). Finally, the

record of experience can be another form of credentialing, including a certificate for long-term service (Wei, 2022).

Table 5 Different Types of Credentialing

| Credential | Definition | Example |
|------------------------------|--|--|
| Formal | Formal learning course | -Professional certificates -Degrees -Micro-credentials |
| Non-Formal | Non-formal learning courses can be an addition or alternative to a formal course | -MOOC certificates |
| Recognition of skills | Certificate of recognition for achieving a specific skill after an assessment | -Certificate of technical expertise -Certificate of Skills update -Micro-credentials (Digital badges) |
| Record of experience | Certificates for completion of the experience | -Certificate of Participation -Certificate of long-term service |

Therefore, knowing different types of credentialing can assist employers in making informed decisions about which credential route suits their business needs. Table 6 below compares the differences between traditional learning and micro-credential learning. Firstly, when it comes to validation, traditional learning focuses on attendance as proof that learners came to class. In comparison, micro-credentials focus on competencies the learner achieves through task completion (McGreal et al., 2022). In the traditional setting, the syllabus is the approved standardisation of learning, while for micro-credentials, reviewers are the ones who determine which skill sets are required next (Felton et al., 2023).

In traditional learning, content is more fixed, while in the micro-credential setting, content is more personalised depending on the learner's needs (Mashford-Pringle et al., 2023). Learners are rewarded for seat time in the traditional setting, while evidence of learning is rewarded for micro-credentials (Miller & Jorre De St Jorre, 2022). Traditionally, learners are admitted based on the admission

requirements if they qualify for the course, while for micro-credentials, learners can be accepted without any admission requirements (Halas, 2022). Traditional courses take months to years, while micro-credential hours are often applied to the completion period (Varadarajan et al., 2023).

Traditional learning is more rigid and structured, while micro-credentials are more flexible, and micro-modules can be stacked into a larger micro-credential (Desmarchelier & Cary, 2022; Miller & Jorre De St Jorre, 2022; Resei et al., 2019). The traditional institution offers certification and transcripts for recognition, while micro-credentials and shareable digital badges or certificates are provided (Acree, 2016). Regarding skills, traditional learning focuses on theory, while micro-credentials respond intensely to industrial demands (Felton et al., 2023). Then, finally, traditional learning is schedule-driven, while micro-credentials are driven by scarce skill (Olcott Jr, 2022). Table 6 summarises the differences between conventional education and micro-credential learning.

Table 6 The Comparison between Traditional Learning and Micro-credential Learning

| | Traditional learning | Micro-credential learning |
|----------------------|-------------------------------|---|
| Validation | Attendance | Competency |
| Learning approved by | Syllabus | Reviewers |
| Content | Fixed | Personalised |
| Reward for | Seat time | Evidence of Learning |
| Admission | Admission requirements | No admission requirements |
| Duration | Months to years | No of hours |
| Flexibility | Rigid and structured | Modules can be combined into a larger credential |
| Recognition | Certificate and transcription | Digital badges that are transferable and can be shared online |
| Skill focus | Theoretical based | Responsive to industrial demands |
| Demand | Schedule driven | On-demand with growing platforms |

2.7. BENEFITS OF ADOPTION OF MICRO-CREDENTIALS FOR EMPLOYEES

Employees can take advantage of and use micro-credentials to upskill or reskill their capabilities in several ways. Especially as new technology developments require an improved career perspective

(Resei et al., 2019). This section discusses some of the benefits employees can have when adopting micro-credentials, such as:

2.7.1. Access to Learning Demands

Micro-credentials can allow employees to access (just-in-time) new content in response to technological demands. As Crow (2016) stated, micro-credentials will offer access to learning options because of the expansion of opportunities available. The variety of options available can also lead to multiple opportunities to overcome the challenges provided by previous training programmes (Copenhaver & Pritchard, 2017). Moreover, there has been an exponential increase in the continuous intake of micro-credentials in different fields of work, as shown in Table 7 such as:

Table 7 Application of Micro-credentials in Different Work Fields

| Field of work | Authors |
|---------------------|--|
| 1. Higher Education | Rottmann & Duggan, 2021; Trepulè et al., 2021; Wilson et al., 2016; Wolz, 2021 |
| 2. Cybersecurity | Baiocco et al., 2020; Pike et al., 2020; Toolin et al., 2021 |
| 3. Engineering | Cook, 2021; Mischewski & Christie, 2018 |
| 4. Health | Kilsby & Fountain, 2019; Wahler, 2018 |

Besides the increase in micro-credential courses, their design systems are said to be robust (Oliver, 2019). Furthermore, emerging technologies such as blockchain can provide security and reliability (Gatteschi et al., 2018; Lamb, 2018). Additionally, the other attractive aspect of micro-credentials is that many of them require no prerequisite skill set or education to enrol, allowing anyone who wants to learn a new skill (Acree, 2016; Calonge et al., 2019; Wolz et al., 2021). Lastly, exploring micro-credentials as a tool for reskilling can also save organisations money since they offer short courses, unlike a full degree, which can take years to complete.

2.7.2. Skills Recognition

For employees, the drive to learn can be intrinsically or extrinsically motivated, but frequently, it is intentional to achieve a particular goal (Conrad & Openo, 2018). Understanding competency, which can be observed as the employee's ability to apply learnt (knowledge) in their field of work (Kostin & Weafer, 2017), can assist in acknowledging that registering for a micro-credential is a strategic move to expand learning options and gain recognition in the work field (Baz, 2018). Most researchers agree that micro-credentials offer competency-based learning (Acree, 2016; Baiocco et al., 2020; Crow, 2016; Everhart et al., 2016; Gauthier, 2020; Gunn, 2017; Msweli et al., 2022). Therefore,

adopting micro-credentials for reskilling or upskilling creates the opportunity for growth and recognition of skills achieved for professional development (Trepulé et al., 2021). Employers should also acknowledge the skill set achieved by each employee through micro-credentials.

2.7.3. Personalised Learning

It is essential also to note that micro-credentials are not a one-size-fits-all solution (Trepule et al., 2021). However, instead, they are designed to foster personalised learning (Acree, 2016). Digital credentialing providers and endorsers should consider record standards and learning outcomes that communicate to recipients what is required and how it can be achieved (Lim et al., 2018). The focus goal in micro-credential courses should be to give individuals an improved learning experience and provide consistent feedback (Resei et al., 2019). Thus, for more personalised learning, employees can:

- Complete micro-credentials at their own pace and time (Acree, 2016).
- Set their goals to attain job-embedded competency-based learning (Acree, 2016; Msweli et al., 2022).
- Select the preferred reputable provider for each module learning outcome (Lim et al., 2018).

Moreover, employees will benefit from registering micro-credentials since they are frequently delivered online (Msweli et al., 2022). Therefore, geographic location should not be a problem, which can foster lifelong learning (Hunt et al., 2020).

2.8. CHALLENGES OF ADOPTING MICRO-CREDENTIALS IN THE WORKPLACE

2.8.1. Lack of Recognition

Lack of recognition is one of the challenges of adopting micro-credentials in the workplace. The discrepancy in the definition of micro-credentials highlighted by different studies may potentially set a negative assumption to employers (Berry & Byrd, 2019; Poullet et al., 2020; Resei et al., 2019; Rimland & Raish, 2019; Rottmann & Duggan, 2021). Therefore, implementing standards for micro-credentials offering is vital (Resei et al., 2019). Furthermore, stakeholders seem to have no mutual understanding regarding micro-credential offerings (Ahmat et al., 2021).

For instance, HEIs perceive micro-credentials as informal and formal short courses to recognise credentials. In contrast, learners perceive micro-credentials as the alternative way to acquire competency-based learning, but employers perceive micro-credentials as certificates of attending professional development (Ahmat et al., 2021). Fishman, Teasley, and Cederquist (2018) also stated

that knowledge acquired through micro-credentials is obtained through informal means. This could also be why most employers are still uncertain about which micro-credentials can be trusted (Oliver, 2019). In South Africa, most HEIs offer micro-credential courses in the form of postgraduate diplomas or advanced postgraduate certificates. However, although HEI's providers offer micro-credential programmes, it is unknown whether employers accept national or international digital credentialing (Ahmat et al., 2021). Therefore, it is essential to involve employers in micro-credential development to mitigate the inconsistent value and for providers to fully understand what is required in the marketplace (Copenhaver & Pritchard, 2017; Gauthier, 2020).

Orman, Şimşek, and Çakır (2023) suggested that research on employers' appreciation and recognition of micro-credentials needs to be studied. Therefore, stakeholders in the micro-credential ecosystem must create a recognised framework to set a standard to enhance these credentials' credibility. The framework could assist in encouraging broader acceptance by HEIs and employers (Nordin et al., 2022).

2.8.2. Quality Assurance

Quality assurance is another challenge when it comes to micro-credential adoption. Studies show a significant increase in micro-credential providers equally in variety and size (van der Hijden, 2019). Therefore, the reputation of those who offer these micro-credentials is important (Resei et al., 2019). Van der Hijden (2019) stated that the downfall of most new providers is that they over-emphasise their reputation. Therefore, quality assurance when developing digital credentialing remains the question that needs to be addressed (Fishman et al., 2018; Resei et al., 2019). This can be achieved by considering an entity that can validate the evidence presented in a digital credential, whether credible or not (Fishman et al., 2018). Additionally, guidance about credit allocation within the digital credential should be clearly stated, not just the qualification (Oliver, 2019).

Furthermore, Oliver (2022) stated that quality assurance is needed for micro-credential offerings. However, there seem to be mixed emotions about how quality assurance can be implemented. The lack of transparency on standards remains a problem (Halas, 2022; Romero-Llop et al.; Valero-García & Martín-Aragón, 2022). Another concern is that micro-credentials can both be formal and non-formal. Therefore, how quality assurance can be established for non-formal credentials remains unknown (Cirlan & Loukkola, 2020).

However, since accredited HEIs already occupy a mature quality assurance process, maybe they should offer an endorsement of credentials to private providers. However, this could come across as imposing regulation on private providers (Oliver, 2022). Therefore, experts should be involved in designing and validating micro-credential offerings. This will ensure that providers are offering programs that are aligned with the needs of the industries. Furthermore, it ensures that continuous improvements are maintained.

2.8.3. Limitation of Transferability and Stacking

Initially, micro-credentials were designed to be stand-alone learning for meeting scarce skill requirements (Fisher & Leder, 2022). They were designed to be stackable and transferable (Gibson et al., 2015; Liyanagunawardena et al., 2017; Oliver, 2019; Rossiter & Tynan, 2019). This means that micro-credentials completed by one provider should be recognised by another provider (Resei et al., 2019). However, some micro-credentials cannot be combined and stacked to a complete degree (Resei et al., 2019). Thus, even though stacking credentials can be an alternative way for a user to earn a degree gradually, some cannot be transferrable (Oliver, 2019; Resei et al., 2019).

Gallagher (2019) emphasises the importance of education and solving a specific problem in evaluating human capital. Therefore, Desmarchelier and Cary (2022) suggested that stacked micro-credentials should be recognised as credit. Meaning “learners must meet equivalent learning outcomes as they would if they had completed the full units in the degree program” (Desmarchelier & Cary, 2022). Therefore, HEIs should consider collaborating with employers to establish the mechanism for transferring earned credentials as (*credit*) towards a formal degree, allowing learners to stack micro-credentials towards a formal degree and acquire a complete qualification over time.

2.9. REVIEW OF EXISTING MICRO-CREDENTIALS FRAMEWORKS

2.9.1. The European Approach

The European Union (2021) acknowledges a growing need for people to improve and update their competencies and skills to fill the gap created by the rapid changes in the labour market. The COVID-19 pandemic accelerated this, as many people’s careers were affected. This left the EU labour market with insufficient relevant skills (European Union, 2021). Thus, people need to acquire relevant skill sets. The European Union (2021) recommended that continuous upskilling and reskilling were essential, and different ways of learning were needed for flexible professional learning and skills development. Therefore, micro-credentials were recommended to certify short learning experiences

(European Union, 2021). Thus, as shown in Table 8, the EU established the ten principles for adopting and issuing micro-credentials.

Table 8 European Approach of Micro-credential Framework (Source: Council of European Union, May 2021, p. 29-34).

| Feature | Meaning |
|-------------------|---|
| Quality | Micro-credentials should be subject to internal and external quality assurance by the issuers. Quality assurance processes should also be documented, fit for purpose, and accessible to meet the needs and expectations of learners and stakeholders. |
| Transparency | Micro-credentials are measurable, comparable, and understandable, with clear information on learning outcomes, workload, content, level, and the learning offer, as relevant. |
| Relevance | Micro-credentials should be designed and issued as distinct, targeted learning achievements and learning opportunities leading to them, which are to be updated as necessary to meet identified learning needs. Collaboration between education and training organisations, employers, social partners, other providers, and users of micro-credentials is encouraged to increase micro-credentials relevance for the labour market. |
| Valid assessment | Micro-credential learning outcomes are assessed against transparent criteria. |
| Learning pathways | Micro-credentials are designed and issued to support flexible learning pathways. Stackability- Micro-credentials are designed to be modular so that other micro-credentials may be added to create more considerable credentials. Decisions to ‘stack’ or combine credentials lie with the receiving Validation of non-formal and informal learning . Micro-credentials are possible following assessing learning outcomes from non-formal and informal education. |
| Recognition | Micro-credentials have a clear signalling value of learning outcomes for smaller learning modules. Recognition paves the way for a more |

| Feature | Meaning |
|--------------------------|---|
| | comprehensive and comparable offer of such learning experiences across the EU. |
| Portable | Micro-credentials are owned by the credential-holder (the learner). The credential holder may store and share them easily through secure digital wallets. |
| Learning centred | Micro-credentials are designed to meet the needs of the target group of learners. Learners are involved in the internal and external quality assurance processes, and their feedback is considered part of the micro-credential's continuous improvement. |
| Authentic | Micro-credentials should contain sufficient information to check the identity of the learner (credit holder), the legal identity of the issuer, and the date and place of issuance of the micro-credential. |
| Information and guidance | Lifelong learning guidance services should be incorporated into micro-credentials, and the micro-credential courses should be inclusive, accommodating the broadest possible learning groups to support education, training, and career development. |

2.9.2. The Australian Approach

The Australian Government Department of Education (2021) shared similar sentiments with the European Union (2021) that COVID-19 has transformed organisations to upskill and reskill the workforce. Furthermore, a growing demand for short courses encouraged employees to embark on long-life learning (Australian Government Department of Education, 2021). Therefore, formulating a framework of micro-credentials adoption was essential to assist learners who were considering acquiring skills through micro-credentials. Employers who wanted to understand and enrol employees on a micro-credential course. Then finally, micro-credential providers who wanted to understand micro-credential crediting (Australian Government Department of Education, 2021). Therefore, a framework that addresses the unifying principles was formulated in Table 9.

Table 9 Australian Approach of Micro-credentials Framework (Source: Australian Government, Department of Skills and Employment, November 2021, p.11)

| Feature | Meaning |
|------------------------------------|---|
| Outcome-Based | Micro-credentials highlight the learning outcomes a learner is expected to achieve upon completion. Learners will demonstrate that they have achieved these outcomes through assessment. Assessment completed to a sufficient level identified by the provider results in the awarding of the micro-credential. |
| Driven by Industry Need | Micro-credentials are designed and implemented with the intent of both being learner-centric and meeting industry standards/ needs. The skills obtained by learners upon completing a micro-credential build on a learner's knowledge, skills or competencies and target industry needs/ gaps. Micro-credentials can also address a more general industry need or skill, e.g. communication and leadership. |
| Tailored/Support Lifelong Learning | Micro-credentials are created to allow learners to choose courses targeted to their needs and future ambitions. Lifelong learning is increasingly important given the growing reskilling and upskilling need caused by industry disruption and the dislocation and mental health challenges that such disruption may cause. |
| Transparent and Accessible | Providers supply a set amount of information when publishing micro-credentials. Aspects such as learning outcomes, mode of delivery, expected effort, content, and assessment methods will be accessible/ viewable by learners before course initiation. |

The Australian framework focuses on four principles for micro-credential adoption. The first principle was outcome-based learning, which emphasises that a learner's achievement through micro-credential should be demonstrated by outcome through assessment completion. This was not new, as several studies conquered this notion that achieving micro-credentials should be demonstrated by the proof of competency gained (Hunt et al., 2020; Msweli et al., 2022; Oliver, 2019).

The second principle discussed for micro-credential adoption was that they need to be driven by industry needs. The need to be guided by the industry principle consolidated two thoughts in

literature. The first school of thought was that micro-credentials need to offer competency-based learning. Hunt et al. (2020) described competency-based learning as demonstrating a particular skill at work. The second school of thought was job-embedded learning because for micro-credentials to be industry-driven implies that each credential should be directly aligned or enhance the skills required for the employee's job (Acree, 2016).

The third principle was to support long-life learning. The Australian Government Department of Education (2021) further emphasised that lifelong learning was imperative to promote growth that can combat the challenges of upskilling and reskilling needed for disruptive industries. This lifelong concept in micro-credentials was prevalent in the literature to encourage continuous learning and employability (Brown et al., 2021; Resei et al., 2019).

The fourth principle was that micro-credentials need to be transparent and accessible. Transparency relates to the providers' learning outcomes, content details, and accessibility of the offered micro-credentials (Australian Government Department of Education, 2021). Transparency needs to be accessible to both learners and providers. Therefore, earning digital credentials allowed earners a transparent and effective way to showcase skills attained (Baiocco et al., 2020; Brown et al., 2021; Kato et al., 2020). Therefore, unifying these four principles formulated a framework and understanding of what organisations needed to consider when adopting micro-credentials for skills development.

2.9.3. Digital Promise Approach

Digital Promise created an initiative to build an ecosystem for micro-credential adoption as technology transforms the workplace, and in Table 10, the following principles were highlighted (Digital Promise, 2023).

Table 10 Digital Promise Approach of Micro-credential Framework

| Feature | Meaning |
|------------------|--|
| Competency-based | Distinct skills to support professional training and the specific proof an individual must submit to demonstrate their competence in that skill. |
| Research-based | Micro-credentials should be supported by research that demonstrates how that competency supports professional impact. |
| Personalised | Micro-credentials professional needs and support personal goals |
| On-demand | Agile to start and continue learning in their ways and time |

| Feature | Meaning |
|--------------|---|
| Shareable | Shared on online platforms and with current and future employers |
| Verifiable | They should be verified for authenticity by earners and by issuers. |
| Portable | Credentials should be transferred between compliant systems without losing any achievement data. |
| Controllable | Earners should have control over whom they share their credentials with and the systems they live in. |

Digital Promise is an organisation that has spent years researching both single and stackable micro-credentials. After years of research, eight critical principles for micro-credential adoption were formulated. The first principle included competency-based learning, which states that micro-credentials should offer distinct skills to support professional training and the specific proof an individual must submit to demonstrate competence (Digital Promise, 2023). Competency-based learning was the focal point for all micro-credential offerings, for either industry-driven or targeted skills learning (e-Campus Ontario, 2023; Acree, 2016; Msweli et al., 2022).

The other principle was research-based learning; this principle was anchored in offering research to demonstrate the impact of how competency supports professional development (Digital Promise, 2023). Acree (2016) agrees that micro-credentials should be designed around skills that have been researched and show effect on the work practice. Personalised learning was another principle extensively discussed in the literature (Oliver, 2019; Resei et al., 2019; Rossiter & Tynan, 2019). Personalised learning supports employees' personal goals (Digital Promise, 2023). The other principle was on-demand learning, which promoted flexible and agile learning (Oliver, 2019). This enabled learners to complete micro-credentials in their own time and pace.

Micro-credentials were also stated to be shareable with other online platforms with current and future employers (Digital Promise, 2023). The other principle that needed to be considered by micro-credential platforms was the ability for verifiability, which ensures that micro-credentials should be verified for authenticity by earners and issuers (Digital Promise, 2023). Portability should also be considered from digital credentialing platforms to ensure that credentials are transferred between compliant systems without losing any achievement data (Digital Promise, 2023). Then, finally, micro-credentials should be controllable; this authorises earners to have control over whom they share their credentials with and the systems they live in (Digital Promise, 2023).

2.9.4. e-Campus Ontario Approach

The e-Campus Ontario formulated a micro-credential framework and principles for their skills recognition system that could also assist other organisations (e-Campus Ontario, 2020). The framework in Table 11 is supported by four principles, which include:

- **Relevance**

The principle of relevance depicts that micro-credentials should only be issued for competencies relevant to the labour market. Therefore, there needs to be constant partnership and communication between HEIs, credential providers and employers (e-Campus Ontario, 2020).

- **Verifiability**

This principle ensures that micro-credentials should be verifiable, and their integrity should be maintained (e-Campus Ontario, 2020).

- **Ownership**

The principle of ownership describes that once credentials have been awarded, the data associated with it will be the property of the earner (e-Campus Ontario, 2020).

- **Extensibility**

Extensibility emphasises that micro-credentials should be designed for continuous pathways to encourage long-life learning (e-Campus Ontario, 2020).

Therefore, after considering the four principles, e-Campus Ontario formulated a micro-credential framework that is shown in the table below:

Table 11 e-Campus Ontario Micro-credential Framework

| Feature | Meaning |
|-----------------------------|---|
| Issuing Body | An established institution, organisation, agency, or employer should issue micro-credentials. |
| Competency/ Skills targeted | They should adhere to competency language harmonised skills and must be aligned with a common competency framework. |
| Outcomes | The performance competencies should be aligned with underlying knowledge, skills, and attitudes. |
| Summative assessment | The evidence of achievement of outcome for micro-credential is required, and it should be embedded and made visible to employers. |
| Transcriptive | A micro-credential transcript should be compatible with the traditional one, if possible. |

| Feature | Meaning |
|---------------------|--|
| Partner endorsement | Industry partners and other external bodies should validate micro-credentials. This could assist to validate two things: <ul style="list-style-type: none"> ○ The competencies that are in demand in the industry. ○ The assessments that are reflective of the industrial job performance |

The e-Campus Ontario micro-credential framework mentioned six components for micro-credential adoption. The first component was selecting the issuing body: HEIs, professional development providers, employers, or any other institution that offers micro-credentials (e-Campus Ontario, 2020). The second component was targeted skills or competency-based learning; e-campus Ontario (2020) explained that micro-credentials should adhere to competency language harmonised skills and must be aligned with a common competency framework. Therefore, micro-credential providers and employers must set a standard that will be recognisable across the industry (Nordin et al., 2022).

The third component was outcome-based learning, which implies that performance competencies should be aligned with underlying knowledge, skills, and attitudes regarding micro-credential adoption (e-Campus Ontario, 2020). After that, summative assessments that demonstrate evidence of achievement of outcome for micro-credential are required, and they should be embedded and made visible to earners (e-Campus Ontario, 2020). Transcript components also needed to be compatible with the traditional transcript (e-Campus Ontario, 2020). Then, the final component was the importance of endorsement partnership for micro-credentials to be validated by industry partners to meet industry skills competency demands and to demonstrate that assessments to reflect job performance (e-Campus Ontario, 2020).

Summary from the micro-credential frameworks as shown in Table 12.

Table 12 Micro-credential framework summary

| European approach | Australian Approach | Digital Promise | e-Campus Ontario |
|---|--|--|--|
| Quality Transparency Relevance Valid assessment Learning pathways Recognition Portable Learning centred Authentic Information and guidance | Outcome-Based Driven by Industry Need Tailored/Support Lifelong Learning Transparent and Accessible | Competency-based Research-based Personalised On-demand Shareable Verifiable Portable Controllable | Relevance Verifiability Ownership Extensibility Issuing Body Competency/ Skills targeted. Outcomes Summative assessment Transcriptive Partner endorsement |

After the review summary, the table below shows the comparison review of the three frameworks.

Table 13 Micro-credential framework summary comparison

| European approach | Australian Approach | Digital Promise | e-Campus Ontario |
|------------------------------|------------------------------------|------------------------|-----------------------------|
| Transparency | Transparent | x | x |
| Relevance | x | x | Relevance |
| Authentic/ Learning pathways | x | Verifiable | Verifiability |
| Valid assessment | Outcome-Based | x | Outcomes |
| Information and guidance | Tailored/Support Lifelong Learning | On-demand | Extensibility |
| Portable | x | Portable | x |
| x | Driven by Industry | Competency-based | Competency/ Skills targeted |
| Learning pathways | x | Shareable | x |
| Quality | x | Research-based | x |
| Learning centred | x | Personalised | x |
| x | x | Controllable | Ownership |
| Recognition | x | x | Summative assessment |
| x | x | x | Issuing Body |
| x | x | x | Transcriptive |
| Relevance | x | x | Partner endorsement |

Four micro-credential frameworks were reviewed: the European approach, the Australian approach, the Digital Promise, and the e-Campus Ontario micro-credentials frameworks. Table 13 indicates the elements of micro-credentials discussed in each framework and shows the limitations of each framework. The European framework focused on the design of micro-credentials, for example, whether they are learner-centred, authentic, follow learning pathways, provide valid assessments, are

relevant and many others. However, it did not cover the ownership after the credentials are offered to the learners and the targeted skills the micro-credentials need to possess, for example, competency-based learning.

The Australian framework discussed the outcomes micro-credentials need to achieve, for example, transparency, support of long-life learning, industry-driven, and outcome-based. However, it did not touch on the design for micro-credentials or how they need to be verified. The Digital Promise framework looked at both the design for example, micro-credentials need to be verifiable, portable, shareable, and controllable, and it also looked at the outcomes that they need to offer: competency-based learning, research-based learning, personalised, and on-demand learning. This was also the case with the e-Campus Ontario framework. It covered both the design and outcomes of micro-credential elements and even suggested partner endorsements and issuing bodies. Therefore, after reviewing the four micro-credential frameworks. Most elements were common in all four frameworks, but they were named differently in each framework. Thus, the elements that were provided in each framework can be the building blocks to construct the universal micro-credential framework for skills development.

2.10. THEORETICAL FRAMEWORK

This study seeks to understand how employers can use micro-credentials in reskilling or upskilling their workforce. Therefore, two theories will guide in determining how micro-credentials can be the technology employers can use to achieve a competent workforce. The first model, the Unified Theory of Acceptance and Use of Technology (UTAUT2), will assist in analysing the user's objectives for using technology (Venkatesh et al., 2011). The second model will assist us in predicting and explaining adult learning and how effective micro-credentials are in reskilling or upskilling the workforce. This model is called the Andragogy in practice.

The UTAUT2 model integrates eight various models of acceptance and technology, presented by Venkatesh et al. (2011). The eight theories that were integrated include: “technology acceptance model, motivational model, theory of reasoned action, theory of planned behaviour, models for PC utilisation, innovation diffusion theory, social cognitive theory and a combined theory of planned behaviour and technology acceptance model” (Venkatesh et al., 2011). The UTAUT2 was selected as it was the extended version of UTAUT incorporating performance expectancy, effort expectancy, social influence, and facilitating conditions as additional constructs, and UTAUT2 considered age

and gender as moderators. The additional constraints offered a comprehensive understanding of factors influencing technology usage and acceptance (Venkatesh et al., 2011).

2.11. UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY MODEL 2

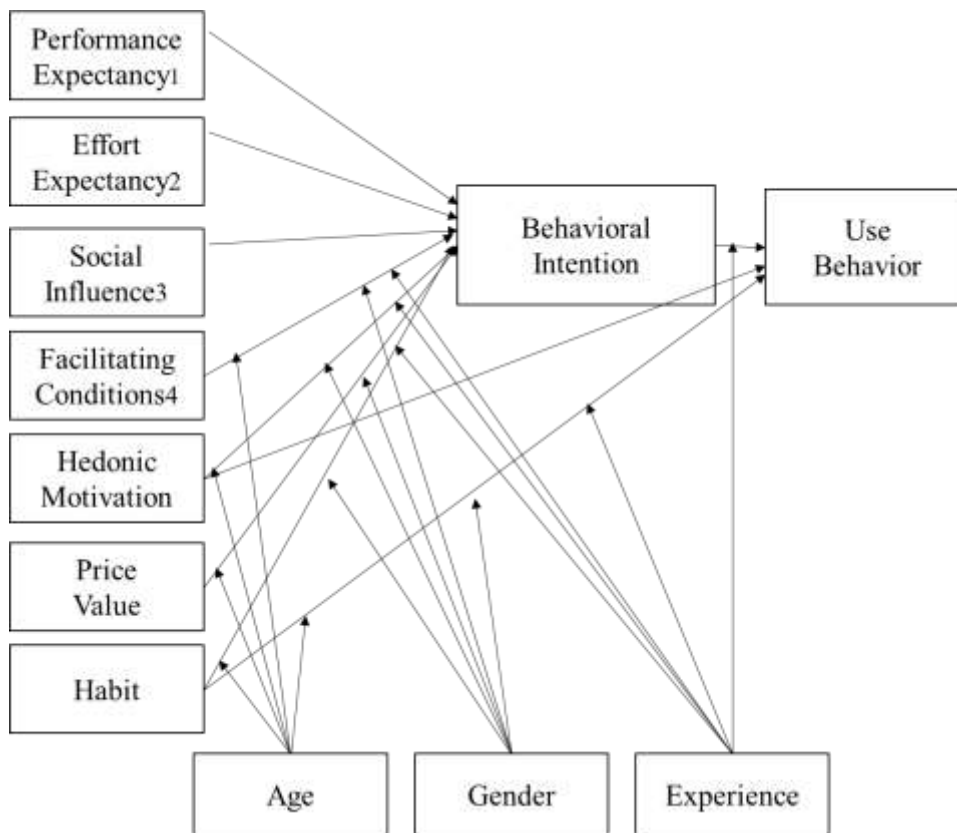


Figure 2 The Unified Theory of Acceptance and Use of Technology (UTAUT2) (Source: Venkatesh et al., 2011)

This model has four key constructs, namely:

2.11.1. Performance Expectancy

This measures how technology use can benefit users when performing certain activities (Venkatesh et al., 2003). In the work environment, employees may perceive the adoption of micro-credentials as valuable when earning the credentials to enhance their work performance. Thus, employees may view micro-credentials as a way to achieve new skills directly applicable to their work (Oliver, 2019).

2.11.2. Effort Expectancy

This measures the ease of use associated with users when using new technology (Venkatesh et al., 2003). Therefore, employees will be more likely to adopt micro-credentials if they seamlessly integrate them into their work routines (Hussey & Das, 2021). Thus, since micro-credentials are short and enable flexible learning, employees are likelier to adopt them without significantly changing their daily routines (Hussey & Das, 2021).

2.11.3. Social Influence

What users perceive as essential to others and believe they should use that particular technology (Venkatesh et al., 2003). When employers promote the value of micro-credentials for lifelong learning, employees will be encouraged to consider micro-credentials when they want to gain a new skill set (Oliver, 2022; Perkins & Pryor, 2021). Furthermore, since micro-credentials are sharable, employees may be motivated to gain recognition from their peers and future employers (Ahmat et al., 2021).

2.11.4. Facilitating Conditions

Users view the resources and support offered to use the technology effectively (Venkatesh et al., 2003). Therefore, employers should provide employees with a supportive environment with the tools and technologies required to complete micro-credential courses (Bigelow et al., 2022; Miao et al., 2023). However, the four key constructs were amended by three more constructs to construct the UTAUT2 model, and the three constructs were:

2.11.5. Hedonic Motivation

This includes the pleasure derivative from using technology, which has been shown to play a significant role in technology acceptance (Venkatesh et al., 2011). Thus, employees may be motivated to enrol for micro-credential courses when they gain a sense of achievement after achieving a digital badge (Miao et al., 2023).

2.11.6. Price Value

Cost and pricing are essential in the user's decision to use technology (Venkatesh et al., 2011). For micro-credential adoption, the price value may include cost, time and effort to achieve the credential (Ahmat et al., 2021; McGreal et al., 2022). Therefore, employees should perceive the value of earning micro-credentials as investing time and energy to improve their careers (Desmarchelier & Cary, 2022). On the other hand, employers should see the cost of training their employees as an investment for bridging the skills gap to achieve a competitive advantage (Siam et al., 2022). *Experience and Habit*: Venkatesh et al. (2003) explain experience in three levels.

1. Post-training when the new technology was offered.
2. A month later
3. Three months later

2.11.7. Habit

On the other hand, habit is defined as an automatic behaviour when an individual performs an activity or uses technology (Chang, 2012). Habitual learning can foster long-life learning for continuous

professional development for employees through micro-credentials (Conrad, 2022). Therefore, for long-life learning to become a habit, all stakeholders will require consistency, including micro-credential providers, employees, and employers (Conrad, 2022).

The above vital concepts explain the behavioural intention of users when using technology, and the other four concepts are individual variables which have a moderate impact on technology use in the UTAUT2 model (Alwahaishi & Snásel, 2013; Venkatesh et al., 2003; Venkatesh et al., 2011).

2.11.8. Behavioural Intention

This is the individual's willingness or intention to use the technology in the future (Venkatesh et al., 2011). High behavioural intention indicates strong adoption. Therefore, when employees are willing to enrol, proactively achieving micro-credentials for professional growth may indicate behavioural intention (Miao et al., 2023).

The UTAUT2 model also includes demographic concepts that could significantly influence micro-credential adoption in the workplace. The demographic variables included:

2.11.9. Gender

Regarding performance expectancy, investigations on how different genders perceive micro-credentials can be investigated (Venkatesh et al., 2011). This can be useful to examine if any credentials are preferred by a specific gender (Chang, 2012). To address effort expectancy, gender demographics can be applied to investigate whether males or females encounter usability issues when using micro-credential platforms (Venkatesh et al., 2011). For social influence, analysis can be determined to investigate if gender influenced employees to adopt micro-credentials. Then, finally, for hedonic motivation, gender can be examined to explore different motivations or rewards for adopting micro-credentials (Venkatesh et al., 2011).

2.11.10. Age

Regarding performance expectancy, age can be investigated to determine whether different age groups have varying expectations regarding micro-credentials relevance to their career growth. For effort expectancy, age can be a measured demographic to analyse if there are any age-related challenges in navigating the micro-credential platforms (Chang, 2012). Then, age can be considered for facilitating conditions to examine if older employees require additional support to use micro-credentials efficiently (Venkatesh et al., 2011). Finally, age can be explored for the habit variable if it influences habit formation for micro-credential usage.

2.11.11. Experience

Experience in terms of performance expectancy can assess whether employees' experience influences their expectations regarding the benefits of micro-credential adoption (Venkatesh et al., 2011). In facilitating conditions, the experience can be used to examine whether employees with more experience require less support to adopt micro-credentials (Chang, 2012). After that, habit experience can be reviewed to see if it affects the development of habitual usage for micro-credentials.

Therefore, the UTAUT2 model synthesises the critical factors for predicting the intentional behavioural use of technology in an organisation (Venkatesh et al., 2011). In this study, the UTAUT2 will be applied to understand employees' behavioural intention when using micro-credentials for reskilling or upskilling their capabilities caused by technological changes.

For employers to understand how employees will approach learning and relearning, this study adopted a theory from the learning science discipline called the Andragogy in practice model. The Andragogy in practice model will predict and explain how adults learn (Taylor & Kroth, 2009). *Andragogy* is the Greek word which is a combination of two words: “*andra*”, which can be translated to the English phrase *adult* and “*agogus*”, which can be translated into *leading*, which implies that andragogy is the study of coaching or teaching adults (Knowles, 1980).

The theory of andragogy can assist employers to understand that adults need to be taught differently from children since their learning processes are different (Blondy, 2007; Holton et al., 2001; Tainsh, 2016; Taylor & Kroth, 2009). Therefore, Malcolm Knowles' theory of andragogy in practice will be used to understand how employees will adopt micro-credentials in reskilling or upskilling their capabilities as Holton et al. (2001) stated that this theory can be used even to assist professionals performance improvements.

2.12. THE ANDRAGOGY IN PRACTICE MODEL

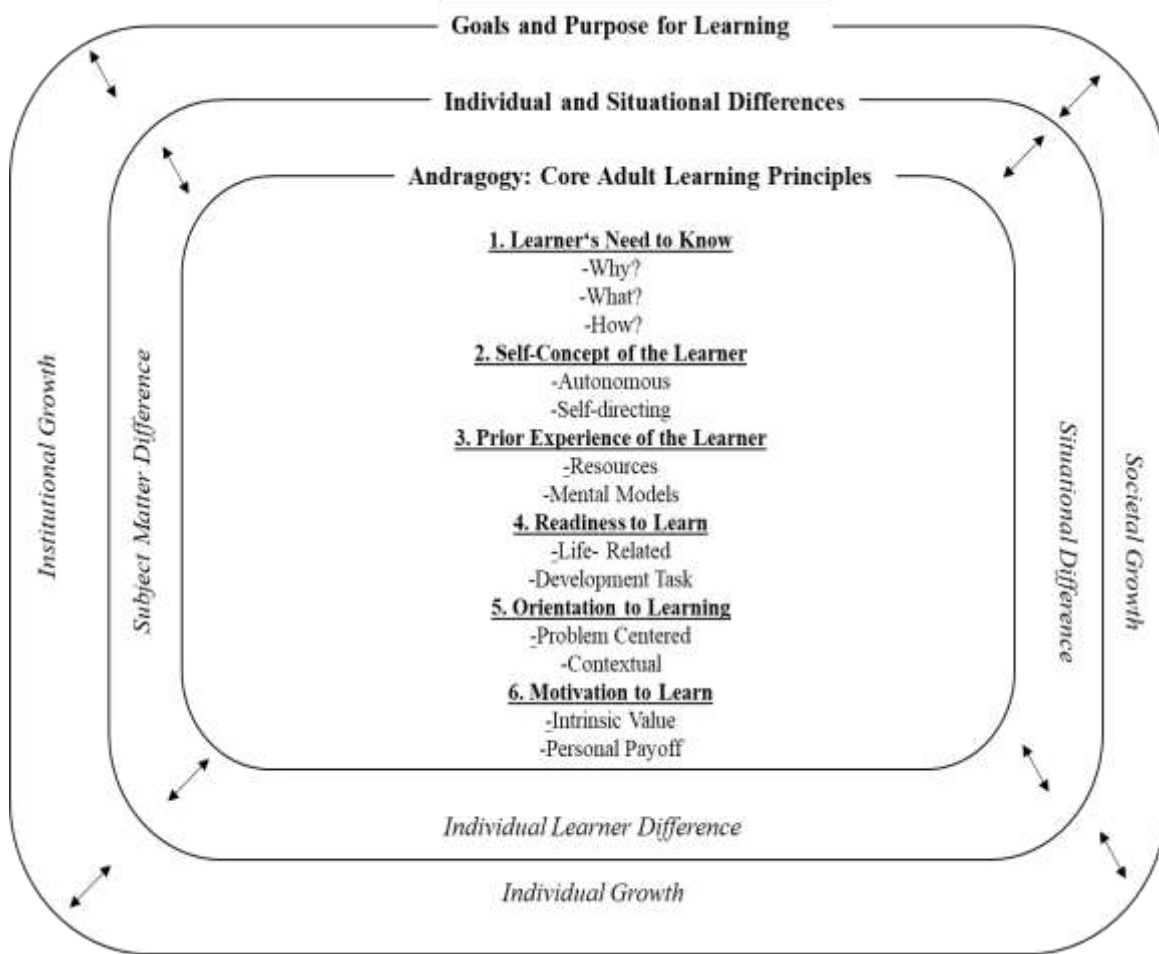


Figure 3 Andragogy in Practice Model (Source: Knowles, Holton & Swanson, 1998).

2.13. THE ANDRAGOGY IN PRACTICE MODEL CONSISTS OF THREE DIMENSIONS:

2.13.1. Goals and Purpose for Learning

This is an outer ring comprising the development outcome of learning. Three aspects inspire this outer ring:

- **Individual growth**- an employee's personal growth to achieve their goals and purpose (Knowles, 1980).
- **Institutional growth**- enhancing the organisations' productivity (Knowles, 1980).
- **Societal growth**- maintaining social order (Knowles, 1980).

Knowles (1980) used these three aspects to define the mission of why adults learn, but they were not linked directly to the model assumptions.

2.13.2. Individual and Situation Differences

The middle ring of the model contains differences that influence adult learning. Which can be identified as:

- **Subject matter difference:** Different learning strategies can be required for different subjects (Holton et al., 2001). For example, some technical subjects like programming may require a different learning style.
- **Individual learner difference:** Not all individuals will learn or behave similarly (Holton et al., 2001). Therefore, when studying micro-credential objectives, they are designed to offer personalised learning (Acree, 2016; Copenhaver & Pritchard, 2017; Gibson et al., 2015).
- **Situational difference:** The situation difference can be influenced by several things, such as the learner's experiences, cultural background and other factors (Holton et al., 2001). Thus, some situations may force learners to be collaborative, while others may force them to be self-directed (Blondy, 2007; Holton et al., 2001).

2.13.3. Core Adult Learning Principles

This is the inner ring of the model, and it consists of the six underlying assumptions that are discussed in this theory:

- **The Need to Know**

Employees need to know why they should learn something; clearly defining the learning outcomes will motivate their engagement in the activities (Cochran & Brown, 2016). For example, employees should understand why they need to acquire specific skills or credentials and how they align with their career development (Zou et al., 2023).

- **Self-Concept**

Taylor and Kroth (2009) explain that as people mature, they tend to act independently and resist situations in which they feel obligated. Therefore, employees should be responsible for their learning and selecting a micro-credential to enrol should be self-directed. Furthermore, employees must actively decide which micro-credentials are most relevant to their career development and job responsibilities (Zou et al., 2023).

- **Prior Experience**

Knowles et al. (2014) explain that adults have prior experience which can be applied to their learning process. Thus, employees can leverage their work experience to learn new skills to build upon their competencies. Therefore, micro-credential technologies are flexible and inspire collaboration between students and instructors (Cochran & Brown, 2016).

○ **Readiness to Learn**

Taylor and Kroth (2009) explain that readiness to learn is reliant on learners' interpretation of how relevant the topic is. Thus, adults align learning with concept development (Cochran & Brown, 2016). The immediate applicability can signify readiness to learn, especially when employees understand the added benefits of micro-credentials in their current and future career goals. Therefore, since micro-credentials can be stackable, the instructor can ask open questions even from previous credentials for discussion to determine a learner's readiness to learn (Hall-Ellis, 2016).

○ **Orientation to Learn**

Adults are motivated to learn when they observe that the knowledge they are acquiring is authentic and will help them solve problems they are experiencing in real life (Cochran & Brown, 2016; Taylor & Kroth, 2009). Therefore, employees may be interested in learning skills that will assist them to perform their daily tasks.

○ **Motivation to Learn**

Learning is intrinsically motivated for adults, mainly to increase their self-esteem or recognition (Blondy, 2007; Cochran & Brown, 2016). Therefore, for employees to receive micro-credentials as a form of recognition can enhance their self-esteem, job security, or even promotion.

Furthermore, the individual situational differences are analysed, illustrated in Table 12, with the goals and purpose for skill development.

Table 14 The Goals and Purpose of Learning

| Andragogy Assumptions | Goals and purpose for learning (<i>outer ring</i>) | | |
|------------------------------|---|--|-----------------|
| | Individual | Institutional | Societal |
| Need to know | Micro-credentials will provide the needed skill set | The micro-credentials will develop a competent skill set | |
| Self-concept | Personalised learning | Competency-based training | |

| Andragogy Assumptions | Goals and purpose for learning (<i>outer ring</i>) | | |
|--------------------------------|---|----------------------|-----------------|
| | Individual | Institutional | Societal |
| Prior Experience | They are upskilling to a new skill set. | | |
| Readiness to learn | Micro-credentials that apply to their everyday work | | |
| Orientation to learning | Ability to solve new problems. | | |
| Motivation to learn | Micro-credential will provide recognition. | Enhance productivity | Economic growth |

Table 14 demonstrates the out-ring of the andragogy of practice, naming the goals and purpose for learning. When aligned with the andragogy of practice six assumptions and placed in the outer layer of the models, it can be observed that adults learn for various reasons.

- **Individual Growth**

Various factors may impact the goals and purpose of individuals' growth. The first assumption, which explains the importance of discovering the need to learn, can impact employers to consider micro-credentials when reskilling upskilling (Lang, 2023). Since micro-credentials offer personalised and flexible learning, other employees may fulfil the assumption of self-concept (Resei et al., 2019). After that, because most individuals already have prior experiences and expertise when learning new skills, they may already know which credentials will assist them in achieving their goals—making it easier for them to apply micro-credential competencies to their everyday work and use them to solve new problems. Moreover, micro-credentials can also give individuals recognition across the industry (Oliver, 2019; Resei et al., 2019).

- **Institutional Growth**

Micro-credentials can assist organisations in developing the relevant skills and competencies for their employees to meet their industrial needs (Mishi et al., 2023). Furthermore, adopting micro-credentials in an organisation can also assist in offering competency-based training (Acree, 2016).

- **Societal Growth**

Overall, adopting micro-credentials in the workplace, in school, and in our societies, in general, can positively impact economic growth. Since society will have relevant skills, this can improve work

performance and productivity. Table 15 will assist in understanding the individual situational differences that may occur when organisations adopt micro-credentials as a form of upskilling or reskilling.

Table 15 The Individual Situational Differences

| Andragogy Assumptions | Individual situational differences (<i>middle ring</i>) | | |
|--------------------------------|--|--|---|
| | Subject matter | Individual learner | Situational |
| Need to know | | Some employees may need to learn which micro-credentials will assist them when reskilling or upskilling. | |
| Self-concept | | Personalised learning is essential for micro-credentials at the learner's pace. | |
| Prior Experience | Some courses need to be stackable, and they require a particular credential. | | Some micro-credentials are not transferrable from one institution to another. |
| Readiness to learn | Some micro-credentials may require Job-embedded learning. | | |
| Orientation to learning | Competency in the subject may be essential. | | |
| Motivation to learn | | Upskilling, reskilling | |

- **Subject Matter Difference**

Micro-credentialing varies; some courses may not be stackable, meaning they are single stand-alone credentials, and other micro-credentials may be stackable, meaning they can be stacked into a macro-credential qualification (Oliver, 2022). Therefore, depending on the credentials, some can offer job-embedded learning directly aligned with the skills needed to perform daily tasks. In contrast, others may only provide competency-based learning to be competent when performing new skills (Acree, 2016).

- **Individual Learner Difference**

It is important to note that organisations should expect that some employees may need to learn which credentials will assist them when reskilling or upskilling. Therefore, transparency and awareness may be imperative (Rossiter & Tynan, 2019). The other individual difference for an organisation is that learners may complete micro-credential courses at their own pace and time (Rimland & Raish, 2019). Then, finally, some employees may enrol for upskilling to be more knowledgeable in their field or reskilling to learn new skills or change fields (Sivalingam & Mansori, 2020).

- **Situational Difference**

The other situation regarding micro-credential adoption will be to consider that some micro-credentials may not be transferrable from one institution to another, making them hard to stack into a full qualification.

2.14. RESEARCH QUESTIONS ALIGNMENT WITH TWO THEORIES:

Formulation of research questions based on the UTAUT2 and Andragogy in practice model. The main question of this study will be to determine the following:

-What guidelines can organisations use to adopt micro-credentials for reskilling employees?

To assist in answering the main research question, these sub-questions were formulated:

- **What opportunities can micro-credentials have in reskilling employees?**

This research question seeks to investigate opportunities for micro-credential adoption in the workplace. The alignment of this research question to UTAUT2 addresses variables such as *performance expectancy* to examine whether there is a use in gaining micro-credentials for employees to perform their work or develop new skills, and the other variable measured was *social influence* to determine whether the employers recognise achievements gained from micro-credentials. After that, for the andragogy of practice, the first assumption (*the need to learn*) and the second assumption (*self-*

concept) were addressed by this research question. The alignment of this research question to UTAUT2 also examined the *effort expectancy* to check whether the effort employees need to contribute to enrolling micro-credentials and *price value* since other micro-credentials may be expensive and require an investment commitment from the employers. After that, for the andragogy of practice model, the third assumption of *prior experience* and the fifth assumption of *orientation to learn* were explored under this research question.

- **How can employers and employees benefit from adopting micro-credentials?**

This research question highlights the benefits of adopting micro-credentials in the workplace. This research question is aligned with UTAUT2's social influence, habit and hedonic motivation. Furthermore, for andragogy of practice, this research question will explore the sixth assumption of motivation to learn.

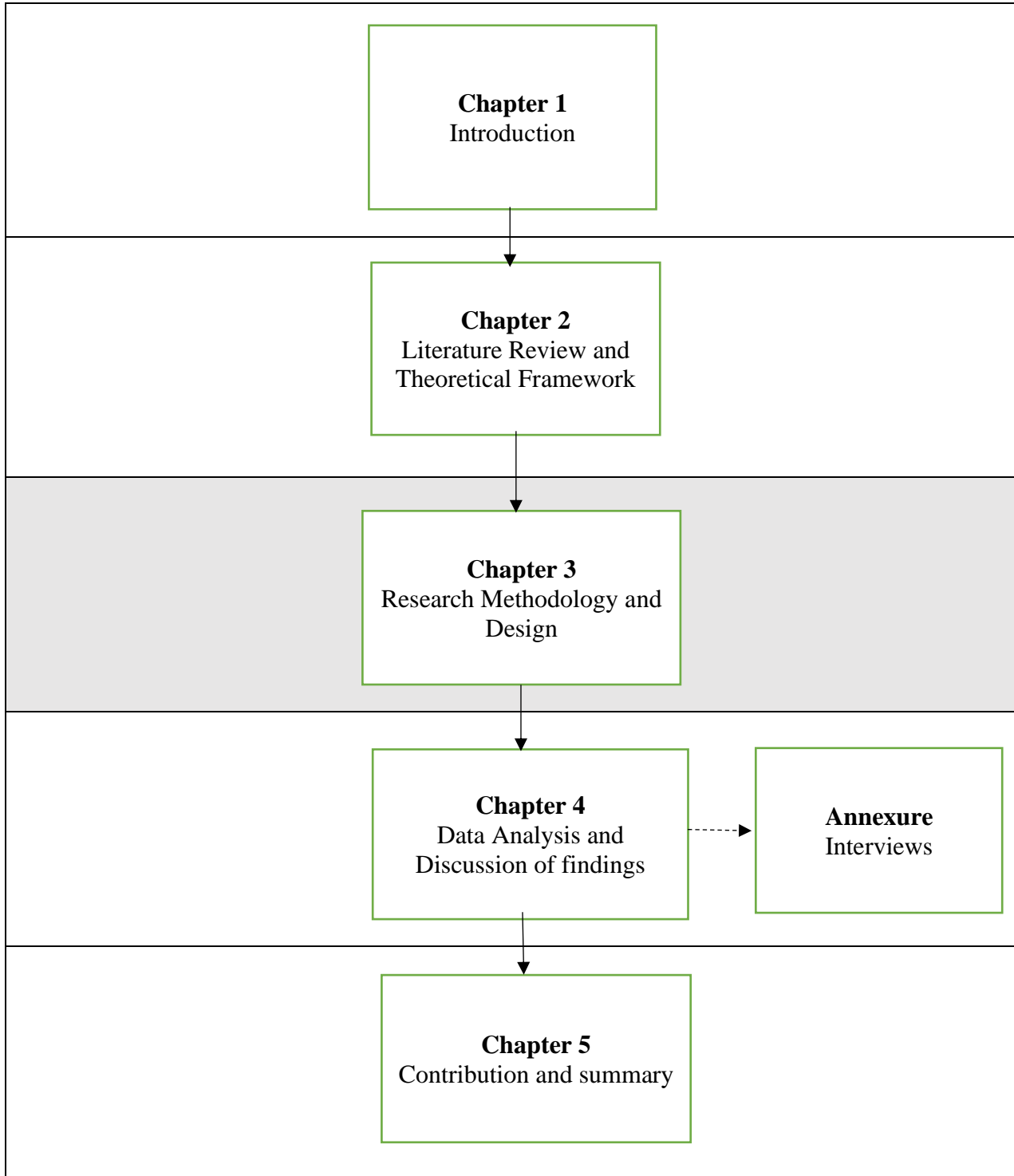
- **How can organisations deal with challenges when adopting micro-credentials?**

This research question examined the challenges of adopting micro-credentials in the workplace. They aligned with the UTAUT2 *facilitation condition* to determine if employers will provide sufficient support to assist employees when enrolling for micro-credential courses. Furthermore, the andragogy of practice will explore the fourth assumption of readiness to learn.

Moreover, this study will evaluate the application of the two theories to understand the implications of micro-credentials in the reskilling workforce. The table below illustrates the key components of both theories.

2.15. CONCLUSION

Micro-credentials could allow collaboration between providers, Higher Education Institutions, and employers. Employers are seeking rapid ways to upskill and reskill their workforce, and after exploring the literature, the agreed premise is micro-credentials. Since they provide continuous learning. However, some employers still perceive micro-credentials as informal certification. Therefore, the quality assurance question should be addressed, and clear guidelines should be provided for employers to understand how these micro-credentials can assist in developing their workforce. The Unified Theory of Acceptance and Use of Technology (UTAUT2) and Andragogy in Practice theories were applied in this study to link the empirical thoughts and to guide the researcher in organising ideas to answer the research questions of this study.



3. METHODOLOGY

3.1. INTRODUCTION

After reviewing the supporting literature on adopting micro-credentials in the workplace in Chapter Two, this Chapter will examine the research methodology applied in this study. However, for the research process to commence, it is important to state the research objectives (Güler, 2015). For this study, the research objectives were to (a) determine the opportunities micro-credentials can have in reskilling employees, (b) to examine the benefits of adopting micro-credentials for the reskilling workforce, (c) to evaluate the challenges of adopting micro-credentials in the reskilling workforce and (d) to review different micro-credentials frameworks for skills development.

Therefore, to achieve the research objectives, the methodology was selected. The methodological choice can be qualitative, quantitative or mixed research methods (Saunders et al., 2019). The quantitative research includes numbers and mathematical variables (Saunders et al., 2019; Yin, 2018). While the qualitative research method involves collecting descriptive data (Noble & Heale, 2019). Then, the mixed research method includes quantitative and qualitative methods (Saunders et al., 2019). This study adopted the qualitative method to understand the phenomena in-depth (Moon et al., 2016). Moreover, Saunders et al. (2019) research onion was discussed to gain insight into the research methodology applied in this study.

3.2. OVERVIEW OF RESEARCH METHODOLOGY

3.3. RESEARCH PHILOSOPHY

Adapting research philosophy was the starting point as it describes the important approach of the researcher for generating knowledge (Aczel, 2015). Saunders et al. (2019) describe research philosophy as the development and nature of knowledge the researcher chooses to view the world. Moreover, the research philosophy is influenced by ontology (nature of reality), epistemology (nature of knowledge) and axiology (nature of ethics) (Mayer, 2015; Saunders et al., 2019).

Therefore, in research, ontology studies the fundamental nature of our existence or reality (Killam, 2013). For example, in this study, the researcher perceives reality as something that cannot be measured. Furthermore, regarding epistemology, this study, conversely, examine the connection between knowledge and what the researcher discovered during the research (Killam, 2013).

While axiology speaks to the ethical aspect of research, including roles and values (Killam, 2013). Therefore, the Saunders et al. (2019) research onion will be adopted to explain the study's philosophy, strategy, and data collection and analysis. As illustrated in Figure 4

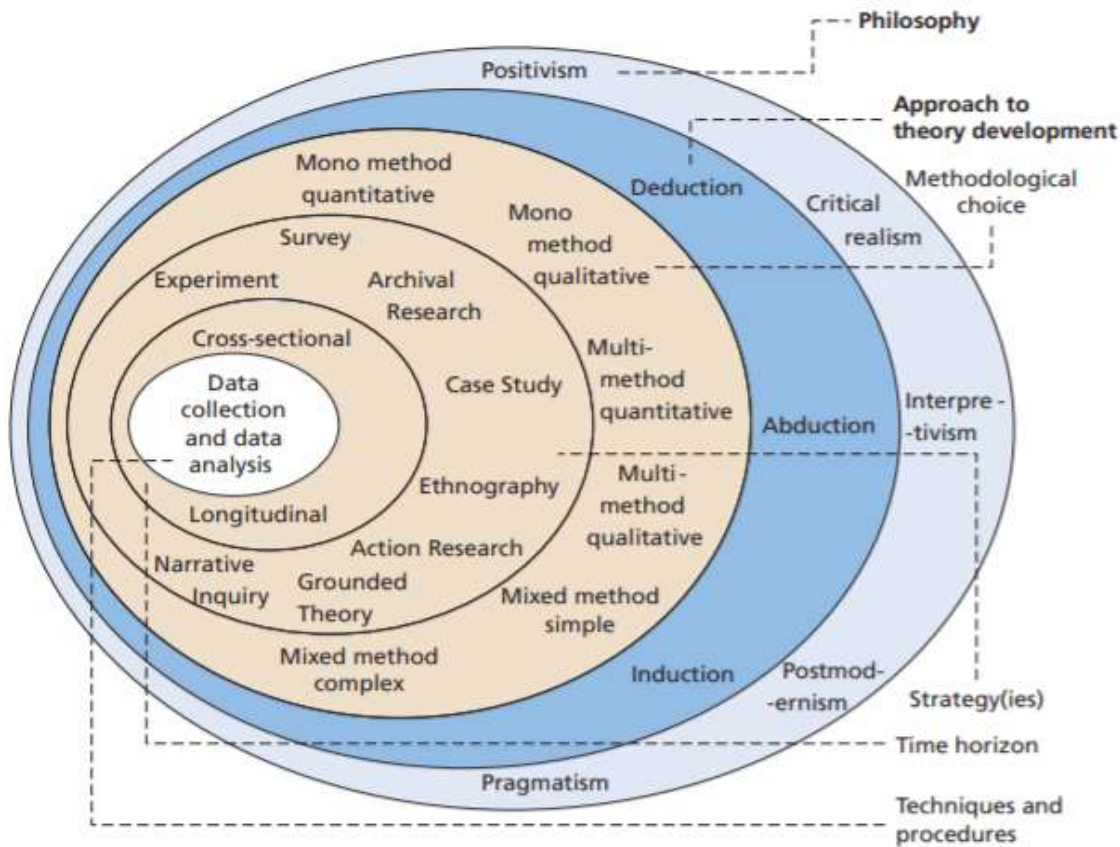


Figure 4 The Research Onion (Source: Saunders et al., 2019).

Saunders et al. (2019) highlighted four research philosophies in the research onion: positivism, realism, interpretivism and pragmatism.

- **Positivism:** Positivist research believes that facts can be proven, and only scientifically confirmed knowledge is genuine. Moreover, positivism separates the research from the existing world (Ryan, 2018).
- **Realism:** This paradigm is also called critical realism, and researchers believe that a single reality can have multiple interpretations (Fleetwood, 2014).
- **Interpretivism:** This paradigm is unlike positivism; it is subjective. This means interpretivist researchers believe that humans cannot be separated from their knowledge and that there is a direct link between research and research subjects (Alharahsheh & Pius, 2020).
- **Pragmatism:** This problem-centred paradigm focuses on real-world practical orientation and action (Mackenzie & Knipe, 2006).

From Saunders et al. (2019) research onion, it can be observed that there are four philosophical paradigms, and the comparison of these philosophical positions is tabulated in Table 16.

Table 16 Comparing the Four Philosophical Paradigms

| | Ontology | Epistemology | Axiology |
|-----------------------|---|--|---|
| Positivism | The real world exists, but the researcher interprets the nature of reality in an objective, external view independent of the social actors. | More objective and only phenomena with credible data are observed. | The researcher is detached and independent of the study. Moreover, the research is value-free. |
| Realism | The real world exists but is independent of human beliefs and thoughts. However, it accepts that knowledge and meaning are human constructed. | More data equals more accuracy in phenomena. It aims to challenge social structure. Thus, “facts” that are socially constructed are central. | The researcher attempts to reduce errors and biases but remains objective. The research is value-laden |
| Interpretivism | The real world is socially constructed, and the researcher is subjectively viewing the world. | Focus on understanding, interpretation, and perceptions and is influenced by the construction of shared reality. | The researcher participates in the study (subjective role). Plus, the research contribution is influenced by the researcher's interpretation. The research is value-bound |
| Pragmatism | The real world is externally independent of human beliefs. The reality is of practical significance. | Focus on practical, relevant problems. Therefore, artefacts that provide successful action are considered to have a practical meaning. | The researcher emphasises practical outcomes and solutions. The research is value-driven |

The research philosophy can also be influenced by the research questions and objectives of the study (Ryan, 2018; Santandreu David et al., 2019). In this study, the objective was to examine the possible guidelines employers can use when reskilling their workforce using micro-credentials. Therefore, this study aimed to understand how adopting micro-credentials assisted employers in reskilling or

upskilling their workforce. Thus, the philosophical approach of this study gravitated towards an interpretivism paradigm. Interpretivist researchers tend to integrate human interest into a study and assume that access to reality is through social construction (Myers, 2019).

Therefore, an interpretive researcher desires information that will consider what people do or think, the problems they encounter in their lives, and how they deal with them (Myers, 2019). Moreover, an interpretivist researcher usually focuses on the meaning and becomes the social actor to reflect on different parts of an issue (Saunders et al., 2019). To achieve this, this study focused on the most naturalistic method of data collection and considered conversation (interviews) with the people as valid knowledge.

3.4. RESEARCH APPROACH

Saunders et al. (2019) research onion defines the three research approaches: deductive, abductive, and inductive approach (2019) research onion defines the three research approaches: deductive, abductive, and inductive approaches. The research approach directs the study to theory development, but the theory may or may not be made plain in the research design (Saunders et al., 2019). Therefore, if a researcher chooses an approach to determine how to apply the theory already available when conducting the study (Aczel, 2015). A deductive approach can be selected to verify or test the available theories in the study (Göttfert, 2015). Thus, selecting a deductive approach means the researcher needs to start with a theory, usually developed from literature reading and from literature, a strategy is designed to test the theory (Saunders et al., 2019).

On the other hand, the inductive approach enables the researcher to collect and analyse data to explore a phenomenon and to build a theory for the study (Saunders et al., 2019). The objective of this approach will be to understand the problem better and contribute a new theory (Aczel, 2015). The other approach included by Saunders et al. (2019) research onion was an abductive approach. This approach comprises existing theories intending to modify or build a new one (Myers, 2019; Saunders et al., 2019). It was also important to note that the deductive approach was conducted from general to specific. The inductive approach was conducted from specific to general, and the abductive approach can exchange between general and specific (Aczel, 2015). Table 17 below illustrates the differences between the three research approaches.

Table 17 Examine the Three Research Approaches

| | Deductive | Inductive | Abductive |
|----------------|--|---|---|
| Aim | To test theories and eradicate false ones | To build new theories | To modify existing theories or to create new ones |
| Logic | If the premises are true, then the conclusion is also true | Known premises are used to produce untested conclusions | Known premises are used to produce testable conclusions |
| Generalisation | General to specific | Specific to general | Exchanges between the general and the specific |
| Conclusion | Validation or falsification | Transferability of results | Suggestions of a new theory or future direction |

Therefore, in this study, an inductive approach was selected. The aim was to formulate guidelines for micro-credential adoption for upskilling and reskilling workforce. The literature review with the guidance of the Andragogy in Practice model together with UTAUT2 theories was considered as the logic to test known premises in producing the micro-credentials guidelines. Thereafter, the contribution achieved in this study can be transferrable into another research context, for example, HEIs.

3.5. RESEARCH STRATEGY

A research strategy is a blueprint for answering research questions (Bhattacharjee, 2012). After selecting the research topic of the study and identifying the research philosophy and approach, it is essential to choose the research strategy. A research strategy enables the researcher to collect relevant data for the study (Myers, 2019). Thus, each strategy should respond to the research questions and objectives. Thus, it was essential to understand the research type and what the study aims to achieve. Therefore, there are different types of research, such as explanatory, descriptive, confirmatory, predictive, or exploratory research, as shown in Table 18. This study adhered to exploratory research to understand the research objectives (Henseler, 2018). Exploratory studies usually formulate and test the premise (Henseler, 2018). Therefore, the guidelines will be formulated with the assistance of the two theories and literature review, together with the findings from data collection and analysis. Table 18 further discusses different types of research studies.

Table 18 Examine the Different Types of Research

| | |
|--------------|--|
| Confirmatory | Its objective is to understand the underlying relationship between variables, and its purpose is to achieve consistent estimates among theories. |
| Explanatory | Explain why a case occurs and its occurrence in the future. |
| Exploratory | Usually, construct a premise and then test it. |
| Descriptive | Intent to provide more guidelines of the phenomena. |
| Predictive | Its objective is to predict individual cases. |

Therefore, even though a research strategy was mainly influenced by the research questions, objectives and the supporting philosophy of the study (Saunders et al., 2019). It was also important to note that the research strategies are not mutually exclusive; for example, a case study may include a survey research strategy (Saunders et al., 2019). Table 19 briefly shows the eight research strategies from Saunders et al. (2019) research onion.

Table 19 Eight Research Strategies

| Strategy | Objective | Data collection Examples |
|-------------------|--|--|
| Experiment | The aim is to examine causal relationships and whether a change in an independent variable will generate a difference in another independent variable. | -Laboratory experiments -Field experiments |
| Survey | Enables collection of extensive data | -Questionnaires -Interview survey |
| Archival research | Allows concentration upon the past and the changes over time | -Documents -Administrative records |
| Case study | Thoroughly study a phenomenon over a period within one or few sites. | -Interviews -Observations -Secondary documents |
| Ethnography | Gaining insight into a specific context and exploring different interpretations from various perspectives or cultures. | -observations - Field notes |
| Action research | Offer interactive design that accepts that complex phenomena are best understood by presenting | -Surveys -Focus groups -Documents |

| Strategy | Objective | Data collection Examples |
|-------------------|---|--|
| | changes or actions and observing the outcome of such actions on the phenomena. | -Artefacts |
| Grounded theory | It is often called “theory building” and emphasises developing and constructing theory. | -Interviews -Observations -Secondary documents |
| Narrative inquiry | Engage with participants using stories to establish social patterns | -Interviews -Archive data -Observations |

3.5.1. Selecting a Case Study as a Research Strategy

Therefore, this study adopted a case study research strategy. This research strategy was used to understand complex social phenomena and allows the researcher to capture a real-life event's holistic and significant qualities (Yin, 2018). Yin (2018) further explains that a case study can be considered when the researcher wants to (1) answer the “why” and “how” research questions and (2) cover contextual situations because of their relevance to the phenomenon underpinning the study; (3) when there are unclear boundaries between the context and the phenomenon of the study. For example, a case study strategy in this study was ideal for understanding micro-credential application in an organisational setting. This assisted in determining how can employers and employees benefit from the adoption of micro-credentials for skills development, also looking at the opportunities micro-credentials can offer to develop the employees’ skill sets, the challenges they may encounter and then review existing frameworks for micro-credential adoption.

3.5.2. Determining the Case

The case of the study is a unit of analysis and cannot be taken out of context (Baxter & Jack, 2008). Therefore, the analysis was based on a single organisation. It is important to examine different case study designs and select the suitable one for this study, as shown in Table 20.

Table 20 Three Case Study Designs

| | Description | Suitable |
|---------------------------------|--|---|
| Single Case | Holistic single case study | For critical testing of existing theory |
| Single Case with Embedded units | Holistic single case with embedded units. Therefore, it consists of multiple levels of analysis. | |
| Multiple- Case studies | More than one case to be studied. | For theory testing or extension |

This study employed a single case with embedded units. This allowed the researcher to explore different subunits within a more significant case (Baxter & Jack, 2008). The embedded design also enabled the comparison of various strategic decisions within the organisation and examined how different teams respond to the strategic decisions and the organisation's overall performance (Bhattacharjee, 2012). Hence, three teams were studied to determine their response to the executive strategic decision when implementing micro-credentials for skills development.

3.5.3. Conducting Case Research

Eisenhardt (1989) proposed a blueprint process for constructing and extending theories from case research. Table 19 explained the process of building theory from Case Study research (Eisenhardt, 1989). Therefore, the case study process adopted, was tabulated in Table 19.

Table 21 Process of Building Theory from Case Study Research

| Steps | Activity |
|------------------------------------|--|
| Get Started | Formulate research questions |
| Selecting Cases | Select a theory that is aligned with the study. |
| Crafting Instruments and Protocols | Data collection and method -Qualitative -Interviews |
| Entering the Field | Data collection includes field notes. |
| Analysing Data | Within case analysis (Gain familiarity with data and preliminary theory generation) |

| Steps | Activity |
|----------------------|--|
| Shaping Hypotheses | Iterative tabulation of evidence for each variable. Construct relationships between variables. |
| Enfolding Literature | Compare similarities and conflicts with the literature. |
| Reaching Closure | Theoretical saturation when possible |

3.6. DATA COLLECTION

The case study research strategy permits multiple methods for data collection (Saunders et al., 2019; Yin, 2018). This can include combining quantitative and qualitative data techniques (Yin, 2018). Saunders et al. (2019) stated that data can be divided into two types, namely primary and secondary data. Primary data includes techniques such as surveys, observation, and interviews (Saunders et al., 2019). In comparison, secondary data can consist of techniques such as documents and archive records (Saunders et al., 2019; Yin, 2018). For this study, semi-structured interviews was utilised as the primary data, and documents which included publications such as research articles, e-books, and books were regarded as the secondary data.

3.6.1. Interviews

The interview data collection technique assists researchers in collecting valid and reliable data relevant to the research objectives and questions (Saunders et al., 2019). Different types of interviews can be employed, depending on the type of response the researcher needs to achieve from the research questions (Myers, 2019; Saunders et al., 2019). For example, for formal and structured interviews, standardised questions are applied to each participant (Saunders et al., 2019). Interviews can also be unstructured and informal conversations (Saunders et al., 2019). Therefore, between the structured and unstructured extremes, there is an intermediate position often called a semi-structured interview (Saunders et al., 2019). Semi-structured interviews are mostly for qualitative research (Myers, 2019; Saunders et al., 2019; Yin, 2018). They are semi-structured and non-standardised (Saunders et al., 2019). This study employed semi-structured interviews because they enabled the researcher to create a list of questions covered in an interview. Moreover, additional questions were examined, and note-taking was recorded for data collection.

3.7. SELECTING PARTICIPANTS

All the participants interviewed in this study are employed by company A. Thus, company A employees working on three projects were interviewed. The employees participating in this study range from operational workers to management positions.

Project A

Project B

Project C

The participants for this study were selected through convenient sampling. Convenience sampling is a non-probability technique where respondents are selected non-randomly but based on their accessibility (Bhattacharjee, 2012). This study interviewed people to understand how rapid technological change demands employee skills development.

3.8. TRIANGULATION

Triangulation is using multiple data sources or methods in qualitative research to construct an understanding of a phenomenon (Hartley & Sturm, 1997). Moreover, triangulation is sometimes called the mixed method since it combines quantitative and qualitative data to validate research findings (Shaikh, 2020). Patton (1999) mentions the four types of triangulations, which include (1) theory triangulation, (2) data source triangulation, (3) method triangulation and (4) investigator triangulation. However, this study employed only two types of triangulations. The first was the method of triangulation, which included multiple methods applied for data collection; this comprised of interviews and publication documents (Noble & Heale, 2019). The second type of triangulation was data source triangulation (Dzwigol, 2020). This involved interviewing different types of individuals for data validation and achieving multiple perspectives (Dzwigol, 2020; Flick, 2018). For example, the researcher interviewed the management, the developers, the researchers, and the employees who worked as operators.

3.9. DATA ANALYSIS

3.9.1. Content Analysis

Content analysis is a research tool for qualitative analysis method used to determine the occurrence of certain concepts or words within a set of text. Recorded human artefacts such as journals, voice recordings, manuscripts, and social media posts are used to investigate visual, written or spoken

artefacts. The research process is called unobtrusive, which simply means extracting data without necessarily interacting with participants (Crosley, 2021). The researcher can analyse data already available for public use from interviews, social media posts, speeches, literature reviews, books, etc. Qualitative content analysis (QCA) is suitable for describing and interpreting data using systematic coding (Assarroudi et al., 2018).

When conducting a content analysis, the text is extracted from the original text and broken down or condensed into meaningful units (Lindgren et al., 2020). Condensing text is simply shortening the original text by removing words the researcher may consider insignificant, such as repetitions while maintaining the content of the meaning unit intact (Lindgren et al., 2020). However, it is essential to highlight that not all texts need to be condensed; some texts (especially short texts) may lose meaning if they are further condensed. After the text is condensed, it is coded; coding is simply labelling or putting a description code of the condensed text, which is done with the research study objectives in mind. Coding further assists in reducing the risks of missing essential context from the original text (Lindgren et al., 2020). After that, codes are sorted into manageable categories, such as a word, phrase, or sentence, by sorting codes that are interrelated from other codes. Then, categories are grouped into themes and examined using conceptual or relational content analysis.

3.9.2. Types of Content Analysis

Content analysis is driven by explicit and implicit content (Neuendorf, 2017). Explicit content can be easily identified in the original text and requires no explanation (Crosley, 2021). Implicit content requires more interpretation, which can introduce subjectivity in the study as the researcher's interpretation of data can influence the conclusions. Also, two methods of analysis are used for content analysis: conceptual and relational (Crosley, 2021).

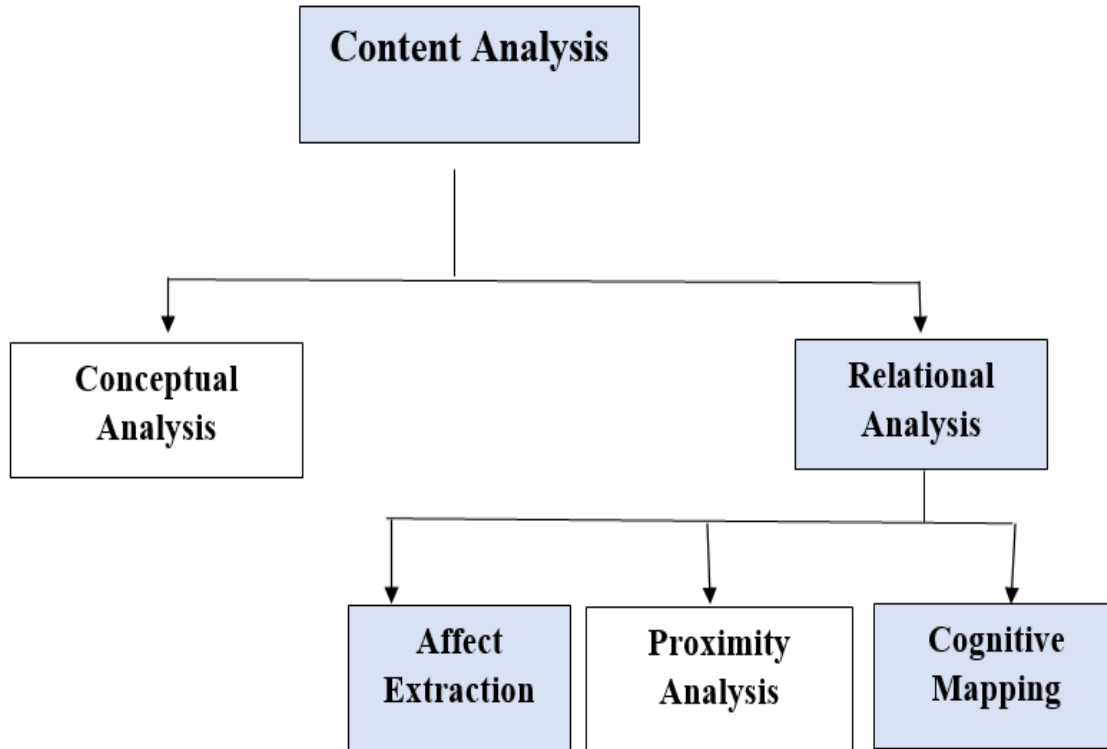


Figure 5 Different Types of Content Analysis

3.9.3. Conceptual Analysis

Conceptual analysis focuses on the occurrences of concepts in a data set (Neuendorf, 2017). This includes the existence and frequency of concepts represented mainly by words or phrases in the text. Moreover, in the conceptual analysis, concepts are selected for examination, and its analysis includes quantifying the tallied results (Lindgren et al., 2020). The conceptual analysis begins by identifying the study’s research questions and selecting text coded into manageable categories indicative of the research questions (Crosley, 2021). Therefore, when conducting the conceptual analysis, the following steps are taken:

- **Determine the level of analysis:** This could either be a word, phrase, sentence, theme, etc.
- **Decide the number of concepts to code:** This could be a pre-defined or interactive set of concepts or categories. After that, choose if the researcher will allow flexibility when adding categories through the coding process or stick with the predefined set of concepts or categories.

- **Determine whether to code for the existence or frequency of the concept.** When the researcher decides to code for the existence of an idea, a concept will be counted once if it appears in the text, and it does not matter how many times it can occur. However, when the researcher decides to code the frequency of a concept, it will be counted each time the concept appears in the text.
- **Determine how concepts will be distinguished:** The researcher will have to decide if (a) text will be coded as it appears in the original text and (b) determine the level of implicit (interpretation) will be allowed.
- **Develop the rules for coding text;** this will assist the researcher in the process of translating the text into codes in a consistent and organised manner.
- **Code the text,** organise and clean the data and correct the errors.
- **Analysis of results:** This includes interpreting the results, formulating conclusions, and determining which data was irrelevant.

3.9.4. Relational Analysis

Relational analysis identifies concepts from the original text, like conceptual analysis (Crosley, 2021). However, the relational analysis aims to determine the relationship between the identified concepts further. Relational analysis aims to identify meaningful or semantic relationships (Crosley, 2021). Therefore, the researcher can identify the research question and select the analysis samples in the relational analysis. After that, select text for analysis and ensure enough information is collected to analyse results. The relational analysis further has three subcategories shown in Table 22:

Table 22 Three Subcategories of Relational Analysis

| Category | Analysis |
|-----------------------|---|
| 1. Affect extraction | This approach is an emotional review of concepts explicit in a text. A challenge in this approach is that emotions can differ across population, space, and time. However, it could be a suitable approach to capturing the psychological and emotional state of the writer of the text or speaker. |
| 2. Proximity analysis | This approach reviews the co-occurrence of explicit concepts in the text. A string of words is then defined in the text called a window. The window is then scanned across the text to check the co-occurrence of concepts. The results |

| Category | Analysis |
|----------------------|--|
| | are a concept matrix formulation, a group of interrelated co-occurring concepts determining the overall meaning. |
| 3. Cognitive mapping | This approach is more of a visualisation technique for proximity or effects analysis. It attempts to create a model of the text's overall meaning—for example, a graphic relationship between concepts. Cognitive mapping also offers the opportunity to compare semantic connections across text. |

This study employed both affect extraction and cognitive mapping. The affect extraction assisted in reviewing the micro-credentials platform by analysing the comments from interviewees with prior experience in taking micro-credential courses. After that, the cognitive mapping helped in mapping the analysis graphically and aligned the results with the theory components. This study adhered to the relational analysis steps, and the following process was applied in the research analysis:

1. **Determine the type of analysis:** This study interviewed ten people who had previously enrolled on micro-credential courses. Interview questions taken from the literature were the unit of analysis to determine the essential themes and to respond to the research questions.
2. **Reduce the original text into codes of words and categories:** The respondents' original text was condensed into short, meaningful sentences, then coded for meaning or words' existence.

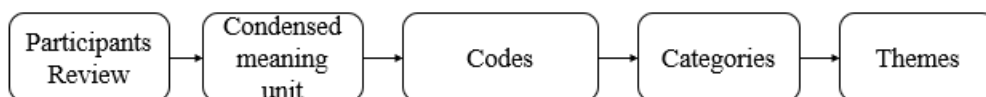


Figure 6 Coding Scheme Process

3. **Explore the relationship between concepts:** After the text was coded, it was then ready for analysis, and it was analysed in the following ways:
 - a) *Strength of relationship:* This is when the degree of relations between two or more concepts will be analysed.

- b) *Sign of relationship*: This will check if any concepts positively relate.
 - c) *Direction of relationship*: This concept will assist in determining the type of relationship that categories exhibit. For example, Competency-based categories may be related to the Performance expectancy element of ATUAT theory and further imply the “*Need to Know*” element in the Andragogy theory.
4. **Code the relationships**: The relationship between the concepts will then be coded.
 5. **Perform statistical analyses**: The researcher will check for relationships among the identical variables during coding.
 6. **Mapping out representations**: The decision mapping model will be illustrated to outline the performed analysis.

3.9.5. Software Tools

The interviews were conducted online through Microsoft Teams, and the Microsoft Teams transcripts were set to expire within three days after completing the analysis. This was to protect the interviewee's personal information. After that, Atlas.ti analysis software was used to conduct the content analysis. The illustrations were constructed using Canva as the illustration tool.

3.10. VALIDATION CONCERN

3.10.1. Credibility

In interpretive research, credibility is demonstrated by documenting findings and conclusions (Dodge et al., 2005). Therefore, it tests the acceptability of the research argument (Meyer & Dykes, 2019). The credibility of the interpretive study can be improved by offering evidence of data collection (Bhattacharjee, 2012). This study demonstrated credibility through data collation by accurately recording interviews and clear notes of the findings and analysis. Moreover, the data collected and analysed in this study will be available for independent audit if needed (Bhattacharjee, 2012).

3.10.2. Confirmability

Confirmability refers to the extent to which the research findings could be verified by others (Bhattacharjee, 2012). Additionally, a systematic process should be replicated to achieve confirmability, demonstrating the links of results to the conclusion (Moon et al., 2016). Therefore, this research discussed the philosophical position to ensure that the results discussed in this study were based on the participants' preferences and experiences, not that of a researcher (Meyer & Dykes, 2019; Moon et al., 2016). Moreover, from the detailed methodology, the reader can determine

confirmability by studying how data was presented and how theories merge (Moon et al., 2016). Giving them the option to accept or reject the conclusion drawn in this study.

3.10.3. Dependability

Dependability defines the research's consistency and reliability (Moon et al., 2016). To determine the study's dependability, the research procedures should be documented so that someone else can audit, critique and follow the research process (Bhattacharjee, 2012; Moon et al., 2016). In this study, the researcher provided a transparent research process that is stable and reliable to provide consistent and repeatable results.

3.10.4. Transferability

Transferability refers to the extent to which the finding of this study can be transferred or applied to other contexts or subjects (Moon et al., 2016). In this study, the researcher precisely described the research context, highlighted the research assumptions, and explain how this study can be practically applied to other research settings. However, transferability can be a challenge in interpretive research because the findings often relate to a particular environment influenced by the limited number of participants (Bhattacharjee, 2012; Meyer & Dykes, 2019; Moon et al., 2016).

3.11. ETHICS

3.11.1. Informed Consent and Voluntary Participation

In a qualitative study, ethical consideration was vital due to the in-depth nature of the research process (Arifin, 2018). Conducting interviews can involve intermingling, unstructured conversations between the researcher and the participants (Klopper, 2008). Therefore, it was the responsibility of a researcher to ensure that ethical standards were established (Arifin, 2018). Thus, participants were informed that participation in this research was voluntary, meaning they can freely withdraw from this study if conditions were unfavourable (Bhattacharjee, 2012). Moreover, every participant received an informed consent form that was signed before participating in the study (Arifin, 2018; Bhattacharjee, 2012). Hence, the researcher had to confirm permission with the following stakeholders:

- **The University of Pretoria**

The researcher applied for ethical clearance from this institution to gain approval to conduct the study. This included submitting all required documents for an ethical clearance certificate/letter. That was submitted to the targeted organisation of interest.

- **The organisation of interest**

After obtaining the ethical clearance, a letter was submitted to the organisation requesting permission to collect data. The letter ensured the organisation that confidentiality will be preserved. Plus, any data collected, analysed, and reported in this study will be treated with privacy and confidentiality.

- **Participants**

The participants were informed about the purpose of the study. Therefore, they were allowed to either accept or decline to participate. If they choose to participate, it was mandatory to sign the informed consent form to protect their rights and privacy.

3.11.2. Data Analysis and Reporting

It was the researcher's responsibility to be transparent to the participants about the purpose of the study before they agreed to participate and data was collected (Bhattacharjee, 2012). Moreover, it was the researcher's ethical duty to analyse and report data correctly. Even when the findings were negative or unexpected (Bhattacharjee, 2012), in this study, precautions were taken to minimise errors during data collection or analysis to avoid unintentional misrepresentation (Rosenthal, 1994). Therefore, it was essential to ensure that the data collected was not fabricated but complete and valid for data analysis (Arifin, 2018; Bhattacharjee, 2012). The researcher also practised an honest and open approach to disclose setbacks and problems encountered during the study.

3.12. CONCLUSION

The purpose of Chapter 3 was to discuss the research methodology of this study. The research onion was adopted as a guide in understanding the nature of the reality of this study. The research philosophy adopted was the interpretivism paradigm. The approach to theory development was the inductive reasoning research approach. The research strategy preferred was a case study. Then, different data collection techniques were reviewed, including interviews and document analysis. The validation concerns and ethics of the interpretive research were also discussed to assess the validation of results.

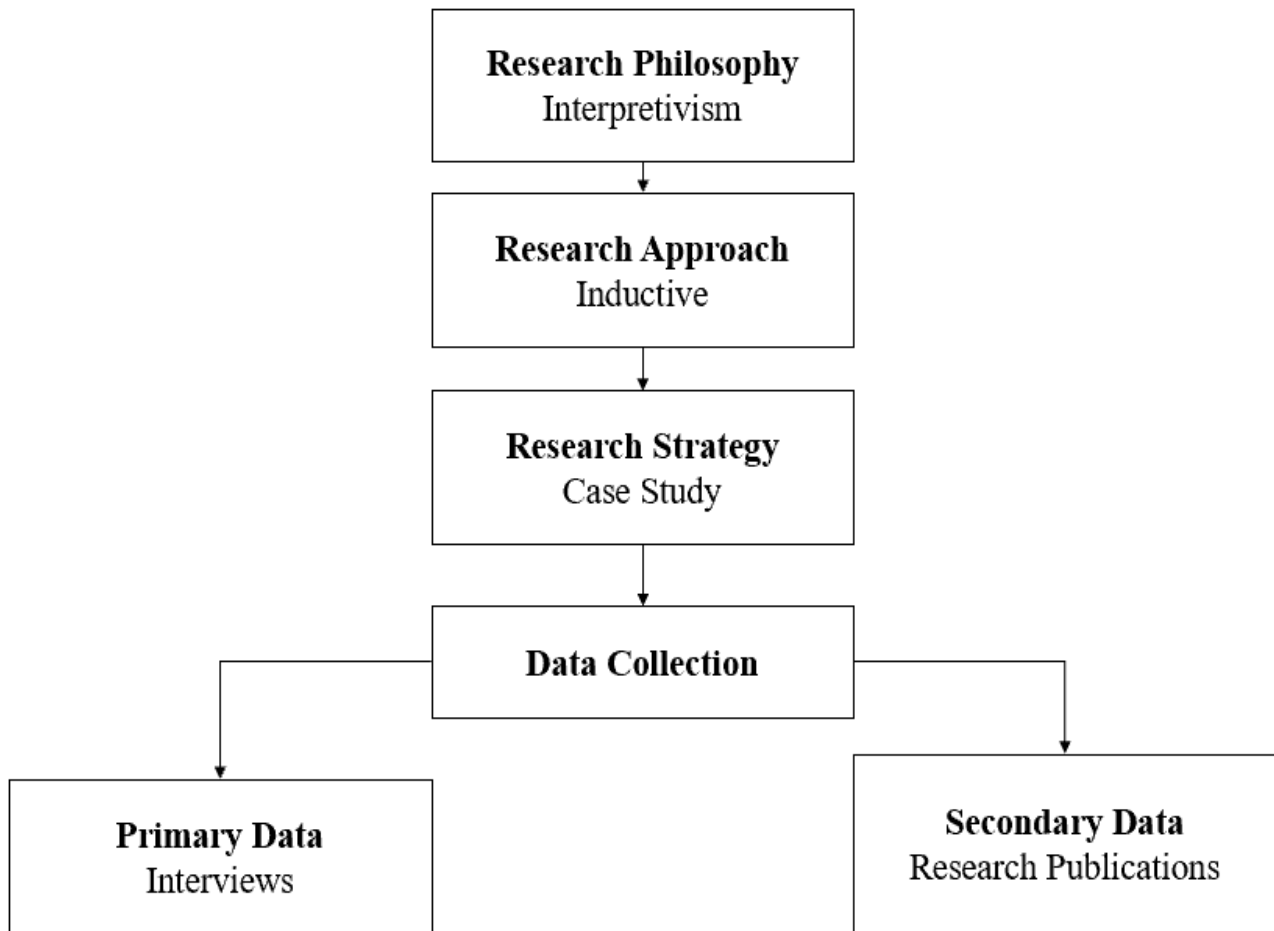
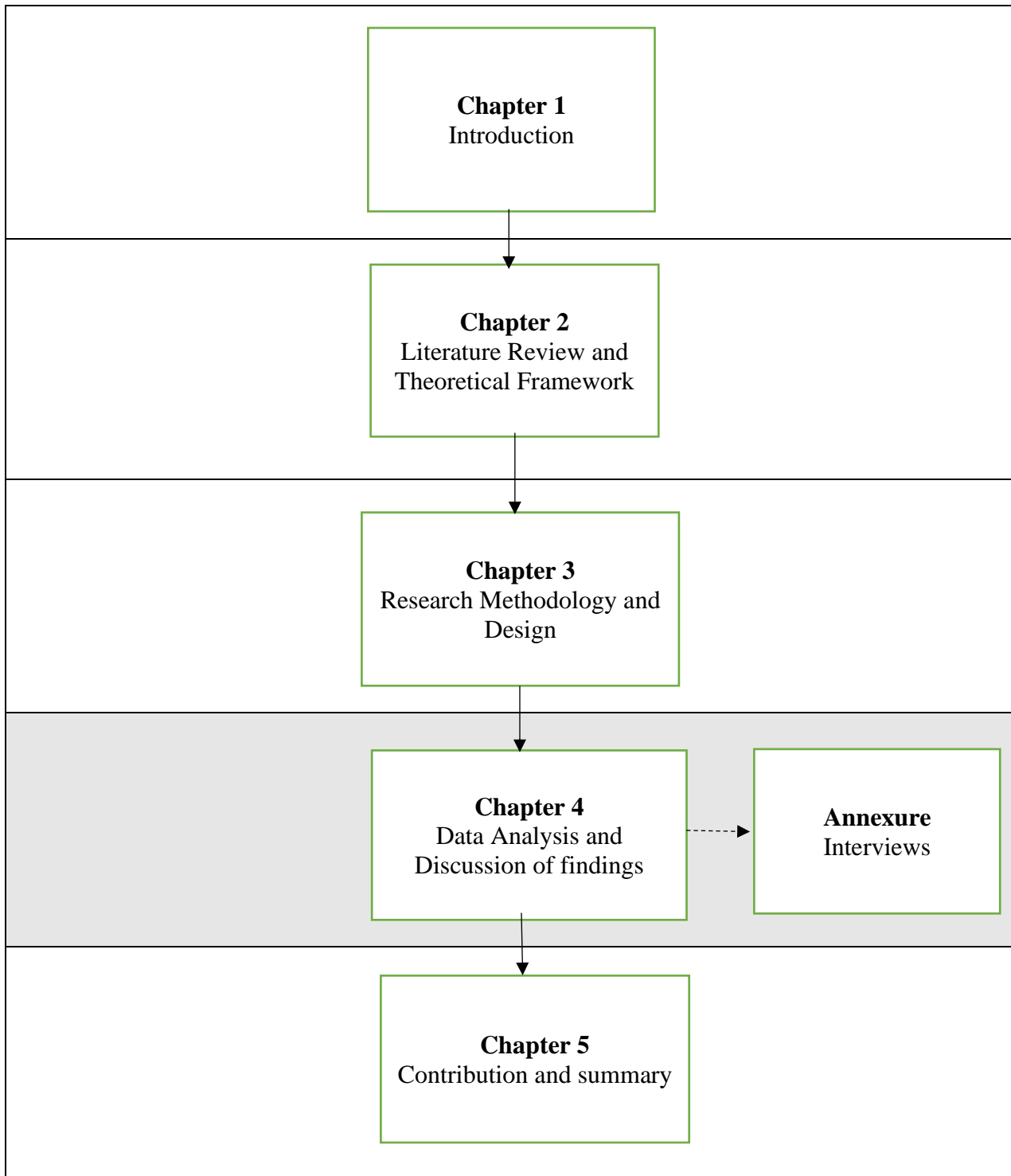


Figure 7 Research methodology summary



4. ANALYSIS OF FINDINGS

4.1. INTRODUCTION

As discussed in Chapter 3, this study adopted the interpretivism research philosophy; the research strategy was an inductive research approach using a case study as the research strategy and data was collected through interviews. The aim was to formulate guidelines for employers to integrate micro-credentials when reskilling and upskilling the workforce. Four research questions were formulated.

RQ1 What opportunities can micro-credentials have in reskilling employees?

QQ 2 How can employers and employees benefit from adopting micro-credentials?

RQ 3 How can organisations deal with challenges when adopting micro-credentials?

RQ 4 What are the existing micro-credential frameworks?

Therefore, sixteen interview questions were drafted, which can be viewed in Table 24 **Appendix A**. Ten people were interviewed. In this chapter, the findings and analysis of the interviews will be discussed, and then the conclusion will be drawn from the findings.

4.2. FINDINGS AND ANALYSIS

This section will discuss sixteen interview questions by stating the question backed by the literature. Then, the findings and discussion will follow.

4.2.1. What do you understand about micro-credentials?

It seems there was a misunderstanding of the micro-credential definition discussed in Chapter 2. The literature has various concepts and definitions when defining micro-credentials, and they are often used interchangeably with words such as digital badges or Massive Online Open Courses (MOOCs) (Gibson et al., 2015; Lambert, 2020; Rimland & Raish, 2019). Therefore, the ten interviewed participants were asked, “What do you understand about micro-credentials?”. The following definition themes were identified.

- **Micro-credentials are online certificates.**

Most participants understood micro-credentials as online certificates and further eluded that these online certificates were provided by the widely known Massive Online Open Courses, as one of the participants explained:

“Micro-credentials are like those online certificates, digital certificates you acquire online. So, you learn something on LinkedIn and Coursera and get those certificates.” –Participant A.

- **Micro-credentials are used as credentials after the exam.**

The other theme that emerged from the participants' understanding of micro-credentials was the credits received after the exam. One participant expressed that what they understood about micro-credentials was that:

“Once you have learned a particular course, written an exam, and passed it, I believe those are the credits you get after” -Participant C.

- **Micro-credentials as short courses**

There was also a common understanding of micro-credentials as the short courses that online platforms or companies offer. One participant explained that:

“I would say that micro-credential is a short course, and I think platforms or companies like LinkedIn and Coursera commonly offer it,” Participant G said.

Most of the participants needed help understanding the term micro-credential, as shown in Figure 8

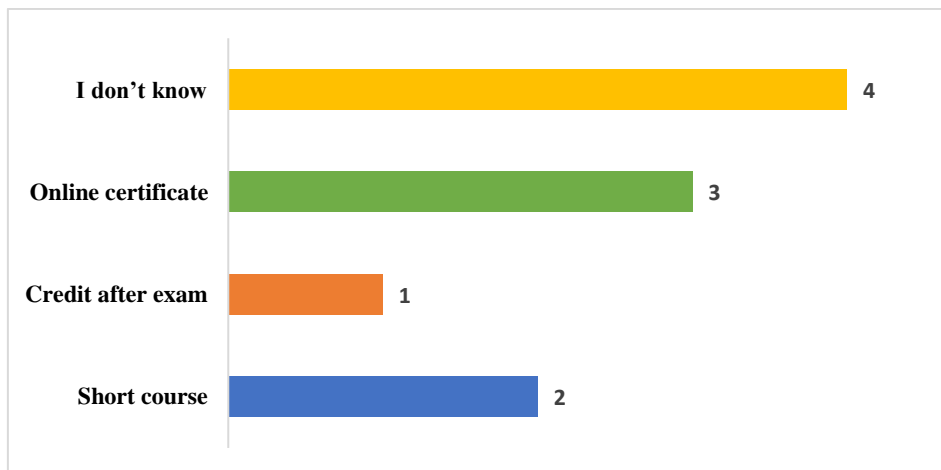


Figure 8 Micro-credential definition themes from participants

What can be drawn from the abovementioned findings is that the micro-credential definition remains unclear, as observed in the formulation of three emerging common themes. However, it was not a surprise that most participants identified micro-credentials as online certifications, as there still needs to be a better understanding of distinguishing between micro-credentials and MOOCs. Almost all the participants who identified micro-credentials as online certificates linked them to those received in MOOC platforms. Du (2020) also stated that MOOC platforms offer certificates of completion that can be shared on online platforms such as LinkedIn or the individual Curriculum Vitae. Therefore, it is evident that free certificates received online can be easily misunderstood as micro-credentials.

The other theme identified from the findings was that of micro-credentials as the credit received after writing an exam. This definition was close to what Rimland and Raish (2019) shared of micro-credential as virtual, portable learning and skills acquired granularly. This concept of micro-credentials as the virtual representation of skills was also applicable to the definition of digital badges by Borrás-Gené (2018), who identified digital badges as a clickable graphic that contains an online record of achievement and information about the organisation or entity that issued the badge. Therefore, the credit that learners gain after completing a micro-credential, mainly in the form of a badge, was another definition of micro-credential in literature.

The other theme observed in the findings was micro-credentials as the short course. This observation was accurate. Most micro-credentials take a short period to complete; as stated by Msweli et al. (2022), micro-credentials are short and focused learning. However, not all short courses are micro-credentials, as most free MOOCs are short. Therefore, as stated in Chapter 2, Table 1 Different terms and concepts of micro-credentials are essential to distinguish between MOOCs, micro-credentials, and digital badges.

The findings showed that most participants were puzzled when asked what they understood by the term micro-credentials. However, they all agreed that they had taken online courses for professional learning to upskill or skill themselves. Thus, the findings concur with what was discussed in the literature. A universal micro-credential definition is necessary for their adoption in the workplace for upskilling and reskilling employees.

4.2.2. Have you taken any online courses?

Upskilling and reskilling the workforce is not something new. According to Illanes et al. (2018), companies have been providing training to their workforce for various reasons, either as part of the business process or for the introduction of a new skill set. Therefore, skill acquisition is inevitable in a volatile work environment. Thus, participants were asked if they had taken any online courses in the form of upskilling or reskilling in this digital world.

The two themes were observed in the findings, the first being work-related courses and the second being on-demand courses.

- **Work-Related Credentials**

Most participants highlighted that they enrolled for micro-credentials to improve their productivity at work. This was either for upskilling or reskilling to remain relevant in their career field. Therefore, when asked if they had taken any online courses, one participant responded:

“Yes, I have done online courses around cybersecurity, like the basics of cybersecurity. So, it was offered by the Cybersecurity Institution Institute” -Participant B.

The other participants also agreed that:

“Yeah, I have taken several online courses.

Firstly, it was work-related, and it was also to build my profile and the skills I acquired. Some things were related to my work at the time” -Participant C.

The other theme that emerged from most participants when asked if they had taken any online courses was:

- **On-Demand Courses**

Some participants believed they needed to acquire courses highly recommended in their industry to keep up with the competition. Therefore, some participants enrolled on multiple courses to get digital badges; one participant expanded:

“I am enrolled on two of them, but one took precedence over the other, so I am currently busy with one that is a program and project management, and it is roughly 8 to 9 months long” -Participant G.

Figure 9 illustrates the two main themes identified when participants responded to this question and some of the courses they have previously completed through micro-credentials.

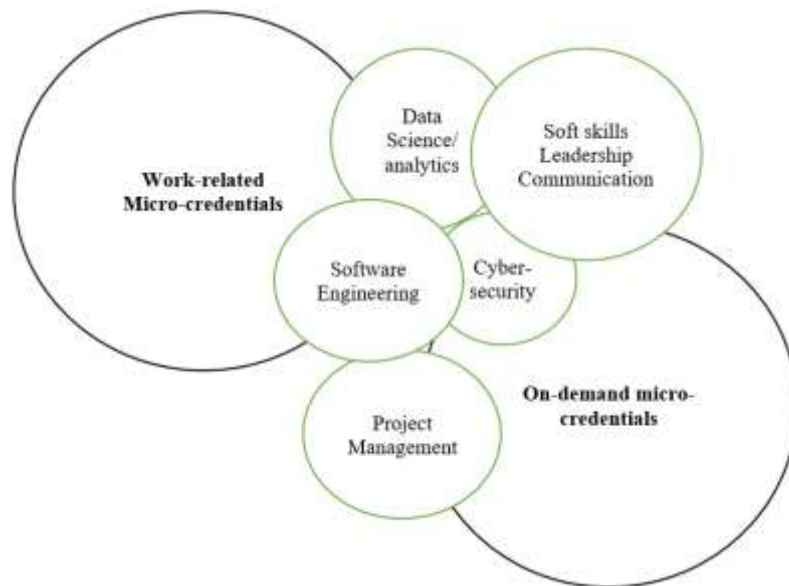


Figure 9 Work-related and on-demand courses taken by participants.

Few participants could not specify why they took online courses. However, most participants expressed that they took online credentials for work-related skill sets or just took micro-credentials that were perceived as on-demand in their field. Several participants who enrolled for work-related credentials shared that they enrolled to improve their technical skills, such as software engineering, cybersecurity, and many more; some of the skills are shown in Figure 9 above. However, there was also a trend of participants who enrolled for on-demand micro-credentials that were recognisable in their field of work.

After analysing the responses, it was evident that micro-credentials courses offer work-related learning opportunities, which was not something new in literature, as most studies emphasise that the micro-credentials earned by an employee should demonstrate their ability for a particular skill at work (Hunt et al., 2020). Therefore, the participants confirmed a known premise from the literature that micro-credentials are designed to fill the skills gap in the labour market.

The element of micro-credentials being taken for on-demand courses in the industry was also widely spoken about in literature. Most micro-credentials were offered not just to meet business needs in organisations but also to respond to technological changes. Therefore, it was unsurprising that some participants took these courses to pursue new trends.

4.2.3. What was your experience with online training?

The literature discusses that adopting micro-credentials in the workplace has brought an agile approach to learning. Most employees opt to register for micro-credentials by selecting the relevant credential, which can be from a HEI or online professional development provider (Lim et al., 2018). After that, learners would take the course, write an assessment, and receive the digital badge as proof of credential earned. The participants were asked about their experiences with micro-credential courses, and the following themes were observed.

○ **Time Management**

Some participants expressed that their experience with micro-credentials required time management as they can quickly become overwhelmed with keeping the work-life balance. One participant explained that:

“It requires much discipline, and if you have been stagnant regarding your studying for a couple of years now, it takes some time for you to adjust to juggling both work and studying and having a life outside of work” -Participant G.

○ **Self-Paced**

The other theme observed among the participants when enrolled for these micro-credentials was the ability to do them at their own pace. Most participants explained how they prefer online courses because they could do them at their own pace. One participant explained that:

“It allowed me to be flexible because I did not have much time, but I wanted the certificate, so I just did it whenever I was ready and took my time with it,” Participant H said.

○ **Accessibility**

The other theme observed from the participants was the accessibility or convenience of these online courses. The ability to access the information and review the material whenever needed was also a highlight for some participants. One participant elaborated that:

- “Convenient because the content is there, and you can access it at whatever time you can, and it is entirely up to you how long you want to focus on a particular course” Participant C.

Therefore, Figure 10 shows the participants' experience with micro-credentials and the three identified themes.

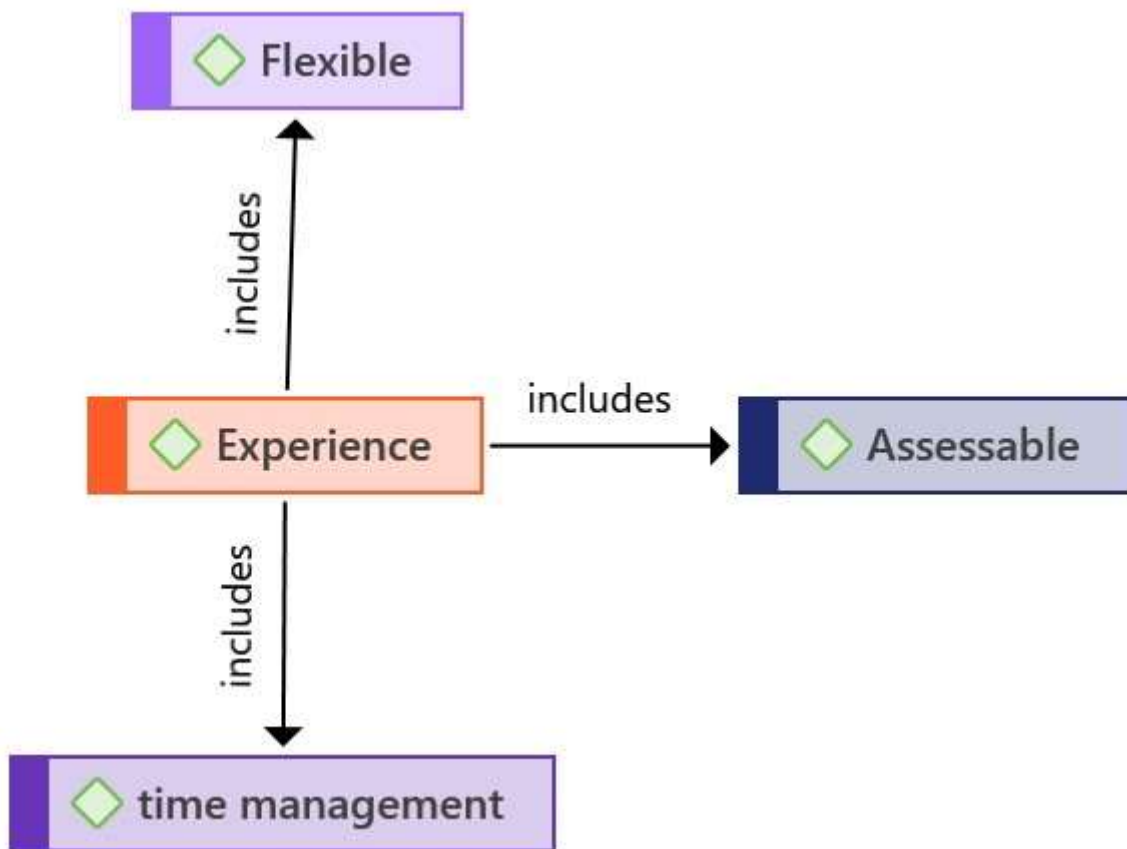


Figure 10 Themes of micro-credential experience from participants

Therefore, participants' experience with online credentials was embodied within the three themes: time management, self-paced experience, and accessibility. These findings were surprising as, in the literature, self-paced learning was the theme most studies discussed regarding micro-credential adoption. Oliver (2019) stated that micro-credentials, unlike traditional learning systems, are more of a flexible way of learning. They are often professed as an ideal way of attaining a certificate of competency for employees. Acree (2016) also mentioned that micro-credentials can be completed at your own pace and time. However, the element of time management regarding micro-credential adoption was least unlikely to be mentioned. Some studies mainly focused on micro-credentials for personalised learning. For example, Resei et al. (2019) expressed that the focused goal of micro-credentials should be to give individuals a learning experience and provide consistent feedback. This idea leans towards accessibility rather than time management.

Therefore, it can be said that time management was overlooked when it comes to micro-credential adoption in the work environment. This can be unfavourable to their adoption since most employees may experience burnout if they cannot balance their work and studies. Thus, employers need to

leverage strategies to ensure their employees are given time to optimise their studies and work. On the other hand, accessibility was also a popular theme among participants. Crow (2016) stated that micro-credentials offer access to learning options and just-in-time access to new content in response to technological changes. However, regarding accessibility and self-paced themes agreed with the literature, but the element of time management was a surprise.

4.2.4. Which skills have you learned online?

Varadarajan, Koh and Daniel (2023) stated that employers seek quick ways to enhance productivity. Therefore, adopting micro-credentials in the workplace allowed employers to target the skills required to achieve the organisation's business goals (Woods & Woods, 2023). Participants were asked which skills they learned online through micro-credentials, and the findings were summed up into predominately technical skills; only a few participants shared that they had taken credentials that offered soft skills.

- **Technical Skills**

One participant shared that:

“The skills I have learned from the course were around the type of security—you know, focusing on cybersecurity governance, the dark web and digital forensics”-Participant B.

The other participant eluded that the technical skills they have learned were:

“Data engineering certificates are the skills I have gained for the technical side. Soft skills: I took a course on constructing a good dissertation” -Participant E.

This participant also shared the soft skills they have taken to assist them in enhancing their writing skills. The other participant shared that even though they have taken courses to enhance their soft and technical skills mostly, they have taken courses to improve their technical capabilities:

“I have learned soft and technical skills, primarily like data analysis and project management. I am supposed to get my certification in cybersecurity, but I do not see it happening this year,” said Participant G.

Therefore, when participants were asked which skills they learned from micro-credential courses, it was evident that they had taken courses that would improve their technical skills, and this was a response from almost all participants. Even though Desmarchelier and Cary (2022) shared that micro-credentials also apply to soft skills. The literature also stated that micro-credentials offer a variety of

skill sets, but technical skills were more popular. The findings confirmed what was discussed in the literature that it is first a misconception that micro-credentials are only for technical skills. Then again, it was confirmed that most participants enrolled on these micro-credentials to gain technical skills. The word cloud below Figure 11 shows some of the skills the participants gained online.



Figure 11 Word cloud of participants' skill sets earned through micro-credentials.

4.2.5. Were the skill set that you learned online aligned with the work that you do?

A misconception was discussed in the literature that other people just perceive micro-credentials as participating certificates. Selvaratman and Sankey (2021) pointed out that micro-credentials could be the potential solution for skills development. This was backed by the evidence that, by design, micro-credentials contained meta-data and competencies that enable the learners to be assessed for the learning outcome of each credential (Pirkkalainen et al., 2023). Pirkkalainen et al. (2023) further explained that micro-credentials credibility goes beyond the participation certificate. An emphasis was observed in the literature that modern employers were more data-driven and seemed to be more interested in identifying and analysing skill gaps within organisations. Identifying the skills gap enabled employers to allocate resources effectively by presenting a real-time analysis of which micro-credentials are in high demand within the organisation and predicting future skill sets that will be required (Cosby et al., 2023). Therefore, participants were asked if the skills they learned online were related to their work. The findings show that all participants expressed that the micro-credentials they received aligned with their work. One participant shared that:

“The skills I was learning aligned with the portion of the work I am currently doing in cybersecurity because the online courses I took were cybersecurity related. However, now I am in a hybrid because I do security and software development,” said Participant I.

The other participant also shared that the micro-credentials they received aligned with their work and played a pivotal role in being promoted at work, allowing them to receive a job offer from another company.

“Yes, and 100%. So, I will take you back to before I joined this organisation. I joined a leadership female leadership program as a junior because I did not understand what happens in a management position. So, enrolling on that course gave me a view, and it also gave me the experience and exposure to how to behave. When I got a higher position, it also led me to get this current job because I now had a broader understanding of what is expected of me; another one, security plus, was related to information security in my past job, and it still related to pen-testing in my current job. So, the content there is still up to date, and I am using it to date. What else? These certificates are skilled-based” -Participant C.

One of the participants further elaborated that if the micro-credentials they enrolled for were not aligned with their work, they enrolled for credentials they were interested in venturing into.

“Yeah, if it is not aligned, it is something that I want to venture into.

You see, I am a software developer, but I have attended a data engineering course since it is not far off from software development, but it is not what I do at work. I took courses to learn a new skill from another field or just to improve the existing skills that I have in this field. So, sometimes, they are aligned, and sometimes, they are just for advancement.

If I may say, because I believe we should be multi-skilled” -Participant E.

Therefore, all participants agreed that the micro-credentials they took online aligned with their work. However, some assisted them in either upskilling or expanding their knowledge in their field of work, others got recognised and promoted from their positions, and some participants took these credentials to reskill and explore other technical fields. These findings are in favour of what was discussed in the literature. Micro-credentials offer that opportunity for both upskilling and reskilling the workforce. Kisby and Fountain (2019) stated that micro-credentials are competency-based professional learning to recognise a learner’s skills and achievements.

4.2.6. Did the course you enrolled in online correspond to the organisation's need?

Changes in technology require workers to acquire new skill sets continuously. Lim et al. (2018) stated that acquiring a digital badge provides the earner with the opportunity for personal and skill development. Baiocco et al. (2020) also shared that through micro-credentials, employees could be offered a chance to respond to the needs of an organisation. Therefore, the participants were asked if the micro-credential they received responded to the organisations' needs. The findings were as follows:

- **Industry-Needs**

Some participants shared that the credentials they received met the demands of their work. They had observed that after receiving the micro-credentials, they could assist in other tasks. One participant shared that:

“Yeah, for example, at work, there is a scarcity of pen testers. So, I took one of these courses for pen-testing to be ready to join the team,” said Participant F.

One of the participants further explained that they customise their learning based on the organisation's needs:

“Yeah. So, when I join an organisation or a company, I am there to learn. I am willing to be open to anything. When you go to a particular company, they have tools related to their processes. Once I go there, I ensure I do not just memorise or get information from old senior staff on how they do what they do. I want to understand why they are doing it and how they are doing it. That is why I enrol in courses on applications that companies work with. I customised my learning according to the organisation I am with, and that is helpful as it simplifies my job because I understand the tools. There is no need for me to be running around trying to find what I need to get”- Participant C.

- **Job-Embedded**

Some participants shared that the credentials they received enabled them to do their everyday tasks. One participant responded to this question by saying:

“Yes, I am in the Project Management Office, right? I am also a project manager for specific projects, so all courses contribute to something that I do to make high use of the projects that I am working on and the work I carry out daily”- Participant G.

Therefore, Industry needs, and job-embedded themes were analysed from the participants' responses to this question. The responses also supported the concept of job-embedded by Acree (2016), who stated that each credential should be directly aligned with or enhance the skills required for the

employee's job. The findings also supported the point discussed in the literature that when employers proactively ensure employees acquire the relevant skill set, the organisation builds a culture of lifelong learning.

The other point tied to these findings was discussed in the literature: organisations that adopt professional development will be more likely to remain relevant and progressive when compared to their competitors (Resei et al., 2019). Therefore, meeting the industry needs and taking credentials that offer job-embedded are essential for micro-credential adoption in the work environment. Furthermore, just like what Baiocco et al. (2020) also shared, through micro-credentials, employees could be offered a chance to respond to the needs of an organisation. The findings supported Baiocco et al. (2020) statement as it was evident that employees were keen to take credentials that responded to the organisation's needs.

4.2.7. Were the courses you enrolled in online relevant to the current technology you use at work?

Relevance in literature implied that micro-credentials should only be issued for competencies relevant to the labour market. Thus, the competencies of learners' achievements should be shown through task completion (McGreal et al., 2022). Therefore, participants were asked if the courses they enrolled in online were relevant to the technology they use at work. The findings were as follows:

- **Researched Learning**

The participants' findings indicated that they performed their research before taking any online courses. Most participants explained the importance of aligning the course with the technology they use in their work. One participant responded to this question by saying:

“Yes, I was targeting micro-credentials aligned or closely related to my task.

I would say it is a yes because whatever I am learning, I must apply” -Participant D.

The other participant explained why they selected a specific credential to measure up to the technology used in their workplace.

“The data engineering one, we are basically in a world of data now. So, if you can do something with data, then you have valuable skills because you find that everything is (data-driven). Alternatively,

maybe they want data from which the data engineering side of things is where we identify the right data source to extract using technologies” -Participant E.

Other participants also expressed that they do not use any technology at work. However, they try to align the credentials they receive online with the skills needed to use some of the technologies. One participant shared:

“I would not use any technology because I am not developing anything. However, some micro-credentials are aligned because I need the background information whenever I need to perform instance developments like a skills document or training”- Participant H.

Even though it was discussed in the literature Chapter that micro-credentials should be research-based, meaning they need to be designed around skills that have been researched with the impact on the work practices (Acree, 2016). There were few discussions of micro-credential learners doing thorough research about the courses they can register for online, even though Lim et al. (2022) mentioned that employees must select preferred reputable providers for each module learning outcome. In the literature, the discussions were around the challenges of quality assurance, as there was a significant increase in providers offering various forms of digital credentials.

4.2.8. Were you able to do your credentials at your own pace?

It was discussed in the literature chapter that micro-credentials were not a one-size-fits-all solution. However, instead, they were designed to foster personalised learning. Unlike traditional learning systems, they need to provide more flexible learning. The participants were then asked if the micro-credentials they received aligned with their interests and if they could do them at their own pace. The findings highlighted three themes, as follows.

- **Fixed Learning**

Some participants said that their micro-credentials had a fixed time to complete. They had to follow a strict schedule to complete tasks, and even if they finished the tasks early, they still needed to wait until the date the next capsule was open for them. One participant explained that:

“OK, both courses were timed; they had a timeframe; this one about cybersecurity basic was timed for six months. They had a schedule; a calendar was also uploaded on the platform that, by this month, we should be covering maybe the dark web topics. By the following months, we should be covering digital forensics stuff. So, we had to complete assignments,” said Participant B.

- **Semi-Fixed Learning**

The other participants shared that their courses combined fixed and flexible learning. The training was fixed and structured so they could take their time preparing for the exam. One participant shared that:

“Self-paced, but the training was timed because you must attend three online courses. However, the exam was on me to decide when to go and do them on my own time” -Participant I.

- **Flexible Learning**

The other group of participants shared that their experiences were different; the credentials they did enable them to do them at their own pace. One participant shared that:

“I could do it at my own pace,” said Participant J.

Figure 12 illustrates the three different learning styles experienced by participants with micro-credentials: fixed learning, semi-structured learning, and flexible learning.

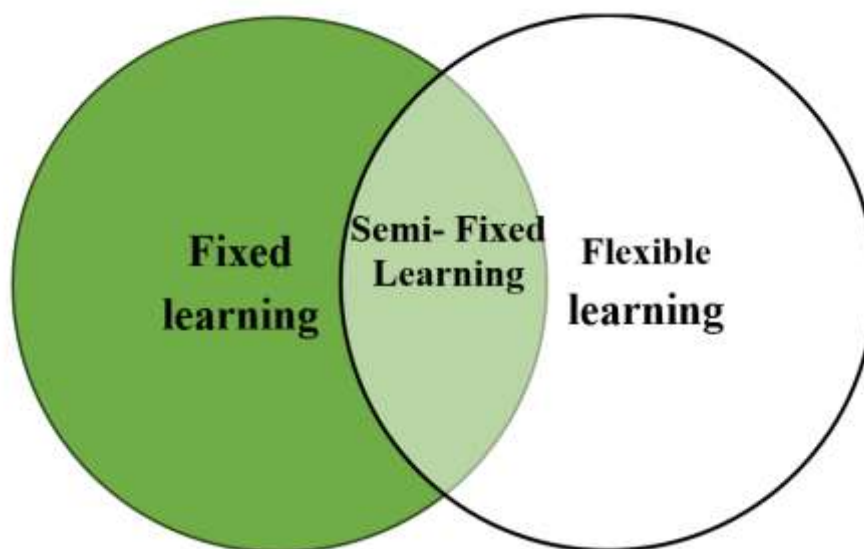


Figure 12 Learning experience from participants.

These findings were unexpected as most studies over-emphasize micro-credentials being self-paced. Their flexibility element may be overly exaggerated since most studies assume that all digital credentials are fully agile and flexible. It may be true that these credentials can be taken on any device, and users have the choice to select how frequently they want to log in to online sessions (Resei et al., 2019). Even allowing users to share ideas with other users, assist each other and discuss problems, as

was discussed in the literature chapter (Gibson et al., 2015; Resei et al., 2019; Wilson et al., 2016). However, maybe it should also be highlighted that flexibility is not absolute. Some credentials may have a bit of a fixed structure. Therefore, different providers may offer different micro-credential types to complement employees' needs.

4.2.9. Does your employer recognise the achievement you gained from online courses?

It has been discussed that the drive to learn can be intrinsically or extrinsically motivated for employees, but frequently, it is intentional to achieve a particular goal (Conrad & Openo, 2018). Therefore, adopting micro-credentials for reskilling or upskilling creates the opportunity for growth and recognition of skills achieved for professional development (Trepulé et al., 2021). Therefore, employers need to acknowledge the skill set achieved by each employee through micro-credentials. The participants were asked if their employers recognised their achievements after they received their digital badge credentials. The findings were as follows:

- **Recognition**

Some participants expressed that their employers recognise the achievements they receive after getting the digital credentials. Some participants explained that their employers recognised the achievement because they were the ones who recommended and paid for the credentials. One participant expressed that.

“OK, so both courses were prescribed by my employer. So yeah, it is not a question of if ever they recognise them because it is the organisation that suggested those courses and made an effort for all of us to do it” -Participant B.

- **Selective Recognition**

Some participants stated that their employers only recognised the courses they recommended or paid for them, and their employers did not recognise the rest of the courses they did. One participant explained.

“Not all of them, but the core ones, they recognise them because they are mostly paying for them” - Participant G.

- **Continuous Learning**

This one participant also further explained that employers only recognise the credentials they have recommended and encouraged the employees to keep on taking credentials for their self-development; however, they do not recognise those credentials:

“Whatever they give you, that is what they recognise.

However, I do not think the rest are recognised.

But, they do like to advise you to take on self-development credentials” -Participant D.

Therefore, the findings show two types of recognition from employers, the first being the full recognition of skills and the other one being partial recognition. There were no surprises from these findings. Employers and employees have different perspectives when it comes to understanding skills competency. Kostin and Weafer (2017) explained that employees consider themselves competent when they have learned knowledge in their field. Employers, on the other side, consider employees to be competent when they acquire the relevant skill set (Alam et al., 2022). It was also understandable that employers encouraged employees to take self-development credentials to promote the culture of lifelong learning.

4.2.10. What are the challenges you encounter when enrolling for micro-credential?

The discussion about challenges with micro-credentials was something most studies evaluated, and one of the common challenges was the lack of recognition of micro-credentials in the workplace. The reason for the lack of recognition was the discrepancy in the definition of micro-credentials, and the observation was that different studies have many definitions that could set a negative assumption for employers. Therefore, participants were asked what challenges they had encountered when enrolling for micro-credentials. The findings were as follows:

- **Credentials Administration**

Some participants expressed that the administration of some providers was a challenge. Other participants also expressed disappointment with instructors' lack of availability when they needed course assistance. One participant shared some of the administrative challenges.

“The challenge was writing an email saying that if you do not understand the concept, find the person, the facilitator. They take time to respond. Sometimes, you do not get the answer in time, and the assignment is due, so those were some of my challenges with these online courses,” said Participant B.

- **Quality Credentials**

The other challenge was finding reputable credentials, especially for those micro-credentials that are not internationally recognised. One participant shared that.

“I think the challenge is finding gold, like, for example, a credential ranked high with excellent reviews. It is challenging because sometimes you enrol and discover it is something you have learned from school” -Participant D.

- **Funding**

The other participants mentioned funding as the challenge; they stated that some credentials are very expensive. One participant shared this challenge.

“It is funding, and with some institutions, it is the admin behind the whole enrolment process, and their response time is terrible. The other challenge is juggling work life and study life and trying to balance the two because some of these courses cramp up everything in a short space of time, which can be a lot” -Participant G.

The findings had a few surprises. The poor administration issues were not widely discussed in the literature. When considering the large number of participants who shared a similar experience. However, the challenge was that most studies focused on the design of these credentials, for example, their stackability and transferability. Little to no events were shared about the delivery of these digital credentials. The findings about quality have been widely discussed in the literature as the challenge. Van der Hijden (2019) stated that the downfall of most new providers is that they over-emphasise their reputation. Therefore, quality assurance needs to be addressed regarding the adoption of micro-credentials. Costs were also a sensitive topic when it comes to micro-credential offerings. Therefore, funding remained a challenge.

4.2.11. What are benefits did you receive with micro-credentials?

Employees can take advantage and use micro-credentials to upskill or reskill their capabilities in several ways. Especially as new technology developments require an improved career perspective (Resei et al., 2019). Several benefits were discussed in the literature, such as access to learning demands. Therefore, participants were asked what benefits they received from achieving micro-credentials. The findings were as follows.

- **Recognition Across Sectors**

Some participants shared how achieving micro-credentials had set them apart from their co-workers. They also shared that achieving micro-credentials enables them the possibility of moving from one organisation to another. One participant shared that:

“These credentials allowed me to jump from one organisation to another. To maintain these credentials, I need to enrol in similar courses or workshops or webinars and another exam that secures the data, so it forces me to be up to date with the latest technology. If you need to be updated and provide that evidence after that three-year cycle, they take your credentials”-
Participant C.

- **Expertise**

One participant shared that learning through these online credentials can be beneficial since you are learning from experts, which can also make you an expert in your field if you take them seriously.

“If you are serious and keen on learning a new skill after you have taken an online course, you will become very competent. It opens many ideas and new ways of doing things because people who create online courses are experts in their fields”-Participant E.

- **Employee Growth**

The other benefit participants shared was career growth; they explained that achieving digital credentials enables them to grow in their field of work. One participant shared that:

“The benefits are that I was growing career-wise, and I was able to improve my CV by adding the course I received online”-Participant F.

The findings support the key benefits that were discussed in the literature chapter. Several studies supported all three benefits. For example, the benefit of recognition across sectors was supported by the study by Kota et al. (2020), who shared that when micro-credentials are viewed as a form of accreditation and validation of skills, employees will be recognised across different sectors for acquired skill sets. Lim et al. (2018) stated that employees who acquired new skill sets through micro-credentials tend to stand out compared to their peers. Finally, Oliver (2019) encouraged continuous learning for personal and career growth.

4.2.12. Were the digital badges received temporarily or permanently after completing an online course?

Participants were asked this question to investigate the providers' ownership and control of these micro-credentials. The participants were asked if their credentials were temporary or permanent. The findings were as follows:

- **Temporary**

Some participants stated that their credentials were temporary, and they had to renew them after 2-3 years. One participant shared that:

“Temporarily, I must renew them. One of them, I think, expired this year around November or December. So they are, most of them are temporal”-Participant I.

- **Permanent**

Some participants shared that their credentials were permanent. One participant shared that:

“They are permanent. They are all permanent”- Participant G.

- **Both**

One participant shared the experience of having both permanent and temporary credentials.

“I have both. In most cases, you find it temporary courses. Most cybersecurity and cloud courses typically expire after some time. You find that things change a lot, so you cannot have the course forever, but after three years, something massive happens or improves, and if you cannot keep up, you might not know how to use it, but you have a certificate which will not make sense, right? Nevertheless, some of the causes, for example, your programming languages, if we declare variables this way, are less likely to change drastically”-Participant E.

Therefore, from all the participants interviewed, 20% stated that they had experienced temporary credentials, 30% had experienced permanent credentials, and 50% had taken both temporary and permanent credentials, as shown in Figure 13.

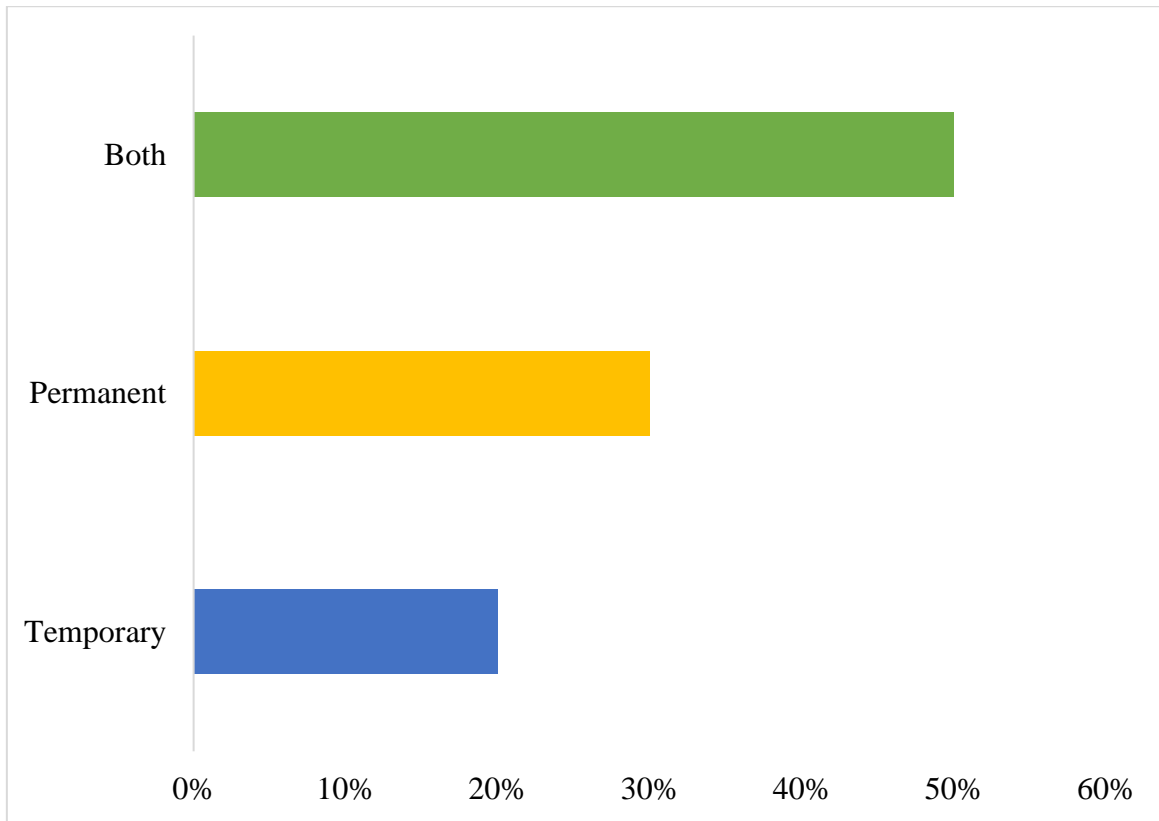


Figure 13 Micro-credentials ownership

The findings show that 50% of participants had experience with both temporary and permanent courses, and they explained that the temporary courses were courses such as cloud and cybersecurity since those technologies change frequently. However, programming or soft skills courses were more permanent since changes do not occur frequently. 30% of participants shared that they had permanent credentials, and 20% shared that they had only temporary courses that they needed to renew when they expired. Most participants with both credentials shared that they preferred temporary ones since there was continuous learning and they were updated about the changes occurring in their field.

4.2.13. Are the digital badges you received transferrable if you move to a different provider?

Micro-credentials were designed to be stand-alone learning for meeting scarce skill requirements (Fisher & Leder, 2022). They were designed to be stackable and transferable (Gibson et al., 2015; Liyanagunawardena et al., 2017; Oliver, 2019; Rossiter & Tynan, 2019). This means that micro-credentials completed by one provider should be recognised by another provider (Resei et al., 2019). Therefore, to investigate the transferability element, participants were asked the question mentioned above, and the findings were as follows:

Most participants shared that their credentials were transferrable since they received them from reputable providers. One participant stated that:

“Yes. C# is the universal language, and you can quickly learn other languages when you have them, and most organisations recognise it”- Participant J.

While one participant stated the credentials, they have been transferrable since they apply to any scenario.

“It is a transferable skill. It applies in almost every scenario you can think of, so they are transferrable” -Participant.

The findings for the transferability of micro-credentials were the most misunderstood question amongst the participants. It had various responses that were not related to the question. The question aimed to investigate if the participant's credentials could be transferred from one provider to a different provider and stacked into a potential macro-credential or a full degree. However, this may be the topic that needs to be explored further.

4.2.14. Were the courses you enrolled in expensive or affordable?

Micro-credentials have been perceived to be cheaper and more flexible options for learners to earn micro-credentials that can be stacked into macro-credentials in the future (Boud & Jorre de St Jorre, 2021). Therefore, participants were asked if their credentials were expensive or affordable. The findings were as follows:

- **Employers Paid**

Some participants were unaware of the costs paid for their courses. One participant shared that:

“I did not pay a cent. The organisation proposed the courses; we were told that day by email that you needed to attend the course, and everything was done from a strategic level”-Participant B.

- **Depends on the individual's Affordability.**

Other participants expressed how price is relative since what may be considered affordable to one person is expensive to another person. One participant shared that:

“That question depends on the individual. However, the course I did with IBM was not expensive, and even a Machine learning course. I am not sure how much the organisation paid, but I would like to believe that maybe it was expensive because it was another company training, as in most cases, it comes with a higher price”-Participant E.

- **It depends on the Institution.**

Some participants shared that it depends on the institution providing the micro-credentials, as some can be expensive while others may be affordable. One participant explained.

“It also depends on the institution; some courses are affordable because they are all like R3000 for the exam and studying. It is up to you,” said Participant C.

From the findings, the question of affordability regarding micro-credentials remained unclear. In literature, most studies carelessly state that micro-credentials are cheap. However, from the participants, affordability is relative; it may vary from individual to individual. Literature, however, acknowledges that from the employer’s perspective, some micro-credentials can be very expensive, challenging the organisations to have sufficient budget to address the employees' needs (Desmarchelier & Cary, 2022; McGreal et al., 2022). The other point raised by participants was that the costs of these credentials also depend on the institution that provides them. This was a good analysis, and with the institutions, it also depends on the type of credentials you are registering for. For example, an entry-level course may cost less than an expert-level course. Therefore, when it comes to price, it is a complex and sensitive topic.

4.2.15. How was the quality of each course validated? Please share the process.

As discussed in the literature chapter, quality assurance is another challenge regarding micro-credential adoption. Some studies suggested that validation entities are required to validate the credibility of these credentials. Therefore, participants were asked if they knew how their credentials were validated. The findings were as follows:

- **Reviews and referrals**

Most participants shared that they did not know how their micro-credentials were validated, but they checked if the micro-credentials were validated by reading the ratings and reviews about the course, they wanted to enrol in. Some participants also pointed out that recommendations from their co-workers also validated that the course was credible. One participant shared that:

“I do not know how their validation process works if they validate the course, but usually, the criteria you use to enrol for these courses is to check the ratings, and you check the People's comments”-Participant E.

- **Recognised Institutions**

Some participants said they only took digital credential courses through reputable institutions to avoid validation issues. One participant shared that:

“I do not know; my idea of validation is to do them through a recognised institution. I do not know how they are validated,” said Participant G.

- **Validation Institutions**

One participant shared that they were aware of the validation process, and they knew the organisation that was validating the credibility of that course:

“I also have Microsoft Certificates, which are validated using Credly validation,” said Participant I.

Validation and quality assurance were also widely discussed in the literature. Oliver (2022) stated that quality assurance was needed for micro-credential offerings. However, there was a concern that micro-credentials can be formal and non-formal. The findings demonstrate a gap in how these micro-credentials were validated. Most participants had no idea about the validation process for the micro-credentials they had completed. However, most participants relied on referrals and reviews as the validation process to determine if the course offered was legitimate or not. Other participants stated that they only registered to micro-credentials from recognised institutions. Therefore, it was clear that the lack of transparency on standards remains a problem (Halas, 2022; Romero-Llop et al.; Valero-García & Martín-Aragón, 2022).

4.2.16. What would you recommend to other organisations who want to move into the online environment for training employees?

Participants were asked if they would recommend organisations to encourage their employees to take these micro-credential courses. The findings were as follows:

- **Motivation**

All the participants shared positive feedback that they would recommend organisations to encourage their employees to register for these micro-credentials to develop skills. Some of the participants shared that:

- **Work-Learn Balance**

Most participants shared that, yes, they recommend micro-credentials for training for employees. However, employers must also provide a work-learn balance in their strategic planning since these credentials also require time. One participant shared:

“Yeah, I definitely would. More organisations would like to weigh the pros and cons and remember this is going to be a two-way street because despite having particular strategic objectives that colleagues are expected to meet, which is like what we paid for, they have to make provisions for them studying. They, let us say you have worked a 40-hour work week. They need to try to give these colleagues at least, like maybe, five hours a week based on the scope and requirement of the course that they will be enrolled in to help them complete these courses.

Because they are going to be beneficial to the organisation itself. For example, a 90/10 rule. Yeah, something along those lines because that will also promote the proper work-life balance and studies and whatnot and all of those things” -Participant G.

- **Work-Related Credentials**

Some participants shared that they recommend employers provide training for their employees, but they should only be work-related credentials. One participant shared:

“Yeah, I would recommend organisations. However, I think the parameters would be keeping it relevant and as close as possible to the line of work, not allowing the employees to do whatever they want. However, it would be best if you give them those credits to whatever would apply to the line of work, and then it would allow the employee to master the skill to have more knowledge to be productive” -Participant C.

- **Flexibility**

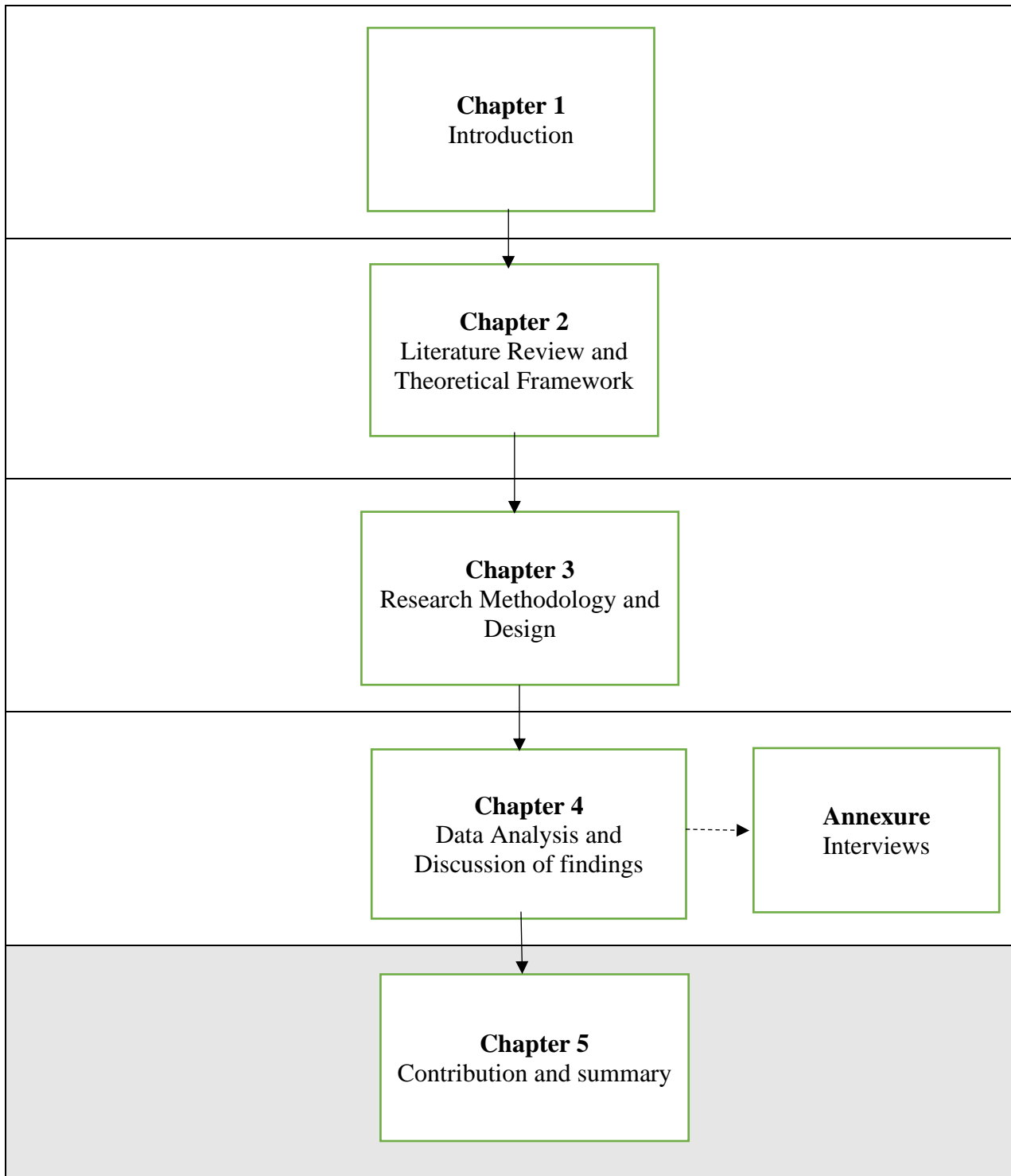
Some participants recommended that employers should consider integrating micro-credentials in their skills development plans. Micro-credentials are a flexible option as some employees work remotely.

“Yes, I can recommend online training since most people are working remotely. It will save them time to learn online instead of attending classes physically”-Participant A.

The findings supported the literature that employers need to integrate micro-credentials into their skills development strategies to provide employee training. The findings also supported the literature on providing work-related and flexible learning opportunities. The work-learn balance perspective was a surprise. However, it could be something employers may note when reskilling or upskilling their workforce.

4.3. CONCLUSION

The purpose of this study was to formulate guidelines for employers to integrate micro-credentials when reskilling and upskilling the workforce. Ten participants were interviewed. The findings show that many employees could not define micro-credentials, but others define them as online certificates, short courses or credits received after the exams. The findings also pointed out that participants registered for courses that were work-related or on-demand (trendy) in their industry; as a result, most participants enrolled for technical skills or work-related courses. Moreover, some participants expressed that most digital credentials require time management, as a discipline is essential in completing any course. The quality, funding, validation, and administration of digital credentialing was still challenging. The other mentioned challenges included ownership with micro-credentials, as they can be temporary, permanent or both. However, the benefits highlighted were recognition across sectors, becoming an expert in the field and employee growth. Therefore, micro-credentials can assist employees in skills development.



5. CONCLUSION

5.1. SUMMARY OF FINDINGS

The study aimed to formulate guidelines for employers to integrate micro-credentials when reskilling and upskilling the workforce. The main question was:

- *What guidelines can organisations use to adopt micro-credentials for reskilling employees?*

Therefore, the following research questions were explored.

- **What opportunities can micro-credentials have in reskilling employees?**

This research question aimed to investigate opportunities for micro-credential adoption in the workplace. The findings suggested that some employees can explore the opportunity of flexible learning since most digital credentials offer self-paced learning. However, it was also noted that some credentials can offer fixed learning options. The other opportunity employees can explore was to learn from the experts since it was noted that most of the credentials were offered by experts in their field. Finally, research learning was also an opportunity that was similar to expert learning because employees could have the opportunity to learn relevant skills from the experts.

- **How can employers and employees benefit from adopting micro-credentials?**

This research question highlights the benefits of adopting micro-credentials in the workplace. There were many benefits of micro-credential adoption highlighted in literature (Mahlasela & Steyn, 2023a). The benefits were that most micro-credentials offer work-related, industry-driven skills that employees can learn from. The other benefits were flexibility and accessibility of content and material anytime. Recognition across sectors as many people experience career growth through taking micro-credential courses. Motivation to learn was also a benefit that was explored in the findings.

- **How can organisations deal with challenges when adopting micro-credentials?**

Several challenges of adopting micro-credentials in the workplace were discussed (Mahlasela & Steyn, 2023b). Some of the challenges mentioned in the findings were time management and having to keep up with a work-learn balance. There was also a challenge of limited resources and trust, as data suggested that the administration was not always good regarding some providers. Funding was also a challenge, as some micro-credentials can be expensive. Quality and verification were also mentioned as the challenge, as data showed that it was a mystery to know who validates these credentials. Ownership was also challenging as some credentials were temporary while others were

permanent. Then, finally, transferability, the information of how these credentials can be transferred and stacked, was not known.

- **What are the different micro-credential frameworks?**

Then, finally, the question was to assist in constructing the micro-credential framework by reviewing different frameworks. The findings identified eight themes that can assist in constructing a micro-credential framework. The findings were as follows.

- Theme 1: Experience- Experience with a provider or the credential course will influence the resources or trust.
- Theme 2: Competency Learning- A skill set that sets an employee apart from other employees to assume an expert level.
- Theme 3: Work Related- Skill that assisted employees in performing their daily tasks.
- Theme 4: Researched Learning-Micro-credentials relevant to the current technologies.
- Theme 5: Personalised Learning- Flexible learning enables employees to learn at their own pace.
- Theme 6: Recognition- Being recognised in your field of work.
- Theme 7: Motivation- Continuous learning to encourage employee growth.
- Theme 8: Work-Learn balance- balance between work, upskilling, and reskilling (learning).

5.2. CONCEPTUAL FRAMEWORK

The constant change in technology is redesigning the work environment, forcing employers to reskill or upskill their employees to keep up with the new skills needed to meet business needs. This study recommends micro-credentials as the solution for upskilling and reskilling employers. However, with any new technology, it is subjected to resistance. This study proposed guidelines in the form of a conceptual framework for employers to integrate micro-credentials when reskilling and upskilling the workforce. The Andragogy in Practice Model was reviewed to assist in understanding adult learning and determining the effectiveness of micro-credentials for skills development in the work environment. The second theory applied was the UTAUT2 model to understand technology adoption. Therefore, after reviewing the literature, the two theories and the findings discussed in Chapter 4. The micro-credential framework was formulated to assist employers in integrating it for upskilling or reskilling employees. See Figure 16. **Appendix B** for the data analysis for the framework formulation network.

The framework consists of three layers: *The outer layer* consists of the technology itself; the purpose of this layer was to demonstrate that micro-credential technology (a digital badge) needs to be recognisable and to achieve that in its design, it needs to be shareable, authentic, and clearly state the ownership given to the end-user if it is permanently or temporary.

The middle layer consists of the work environment; in this case, the organisations adopting these micro-credentials for skills development. Therefore, in this layer, a work-learn balance needs to be established and to achieve that, the price value for micro-credentials the organisation wants employees to take to meet the business needs should be budgeted, transparency on the skills that will be attained and accessibility to the content for continuous reviews and learning should be made available to employees.

The inner layer contains the core micro-credential principles. In this layer, the drive is people (employees). To explain the core principles, the Fishbone diagram (Ishikawa diagram), as shown in Figure 14, illustrates the cause and effects of adopting micro-credentials to upskill or reskill the workforce. Six core principles were identified from the finding themes: competency-based learning, personalised learning, experience, research learning, work-related learning, and motivation. Thereafter, each principle had sub-categories that could contribute to adopting micro-credentials for skills development. Therefore, Figure 14 illustrates the proposed micro-credential framework for upskilling and reskilling employees.

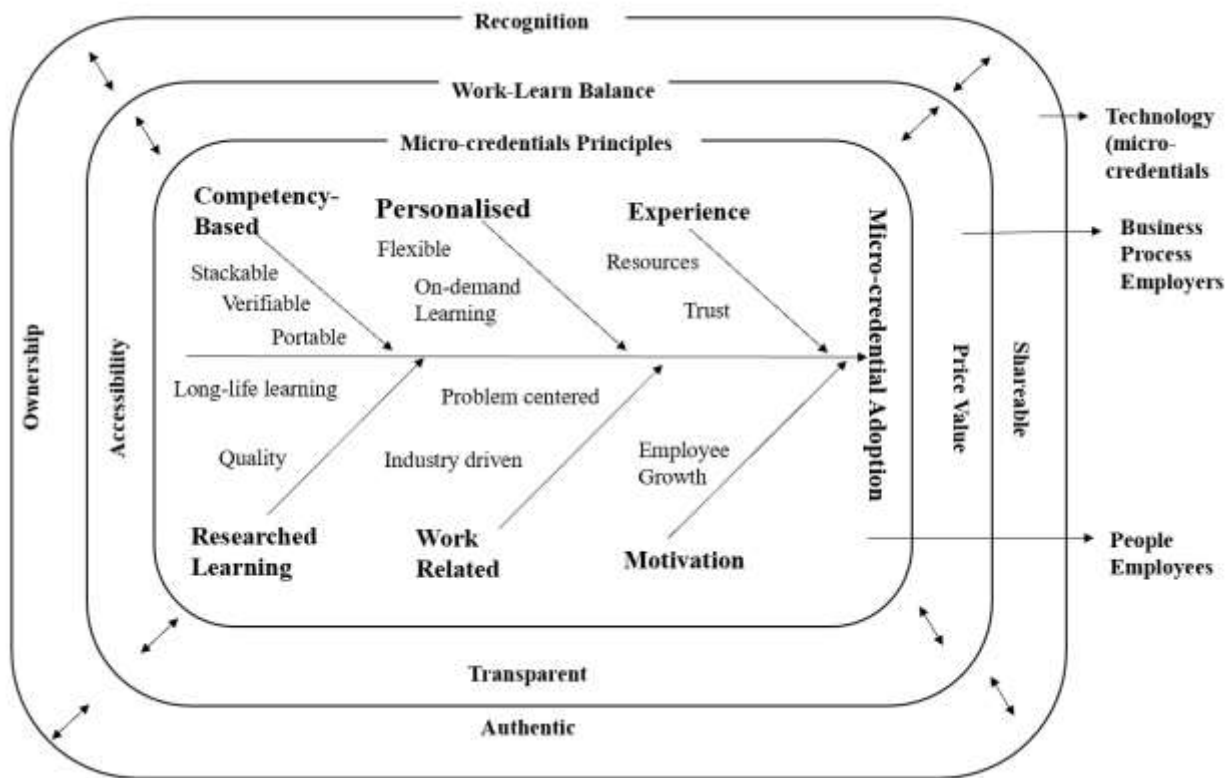


Figure 14 Micro-credential framework for upskilling and reskilling employees

5.2.1. Outer Layer

The outer layer represents the technology, the digital badge employers will receive after completing an online course. There are prerequisites each digital badge needs to have to be considered for any employee to register:

-Recognition: As stated in the findings, each badge should be recognised by employers or anyone in your field. Lack of recognition was stated as one of the challenges when adopting micro-credentials in the workplace. The recognition challenge was mostly due to stakeholders' lack of mutual understanding regarding micro-credential offerings (Ahmat et al., 2021). Thus, the importance of employers' involvement in micro-credential development was proposed as a way to mitigate the inconsistent value and for providers to fully understand what is required by employers (Copenhaver & Pritchard, 2017; Gauthier, 2020). Therefore, recognition is a crucial part of micro-credential adoption, and for any digital badge to be recognisable, it needs to have these three characteristics:

- **Shareable:** Each badge received after the completion of the course needs to be shared on other online platforms. Most studies agreed that micro-credentials can be shared across many online platforms and even on social media (Lim et al., 2018; Msweli et al., 2022). Therefore, sharing

micro-credentials that have been completed is a form of recognition of skills to current and future employers.

- **Authentic:** The badge needs to have unique features; as stated in the findings, one of the challenges employees faced was finding high-quality courses. Therefore, the importance of badge endorsers is required. This can include policymakers, which can ensure appropriate behaviour by all parties (Oliver, 2019). Authentic courses accredited by relevant stakeholders should form part of recognition, as people in that industry will recognise the digital credential.
- **Ownership-** Some credentials are permanent while others are temporary; therefore, the ownership needs to be communicated to employers. Little evidence is discussed in the literature regarding ownership of micro-credentials. Therefore, it is also important to state if the badges are given permanently or temporarily so employers can plan and budget for credentials that suit their business needs. Ownership also forms part of recognition since it can be apparent if the skills competency provided to employees will be permanent or temporary.

5.2.2. Middle Layer

The middle layer represents the work environment, and employers should consider the integration of micro-credentials as part of their skill development plan.

-Work-Learn balance- The findings also highlighted that employers should not just encourage employees to take the micro-credentials. However, they need to make provisions for employees to learn as they would in a physical setting. Three critical factors will determine the work-learn balance:

- **Price value-** Funding was mentioned as one of the challenges since some credentials were costly. Some studies expressed that organisations must have sufficient budget to address employees' skills development needs since some can be very expensive (Desmarchelier & Cary, 2022; McGreal et al., 2022). Therefore, price value should be considered when employers create the work-learn balance for their employees. This could assist organisations in selecting micro-credentials that are affordable and that will meet their business needs.
- **Transparent-** The learning outcomes for each badge need to be clearly stated and understood. Micro-credentials should present the employees' achievements to employers in a user-centric, transparent, and effective way to showcase skills attained (Baiocco et al., 2020; Brown et al., 2021; Kato et al., 2020). Therefore, transparency in employee skills will encourage employers to adopt a work-life balance mindset.

- **Accessibility-** Accessing and reviewing content for the micro-credential courses that have been completed was stated to be convenient in the findings. This was not widely discussed in the literature. Therefore, the accessibility of current and past courses for employees to perform their work can also contribute to their work-learn balance.

5.2.3. Inner Layer

The inner layer includes micro-credential principles. This layer is people centred. Employees should consider registering for the credentials that follow these six principles. These principles were the common themes highlighted in the findings after participants were interviewed.

- **Competency-based learning-** Skills that set an employee apart from other employees and cause them to be regarded as experts in their field were stated as competency-based learning in the findings. This means the micro-credentials earned by employees should demonstrate their ability for a particular skill at work (Hunt et al., 2020). Competency-based learning should at least contain the following characteristics.
 - **Stackable-** Include micro-credentials that can be stacked into macro-credentials, equivalent to a full degree or any macro-credential. Employees should be able to stack their credentials to form macro credentials or qualifications. Rossiter and Tynan (2019) also agreed that micro-credentials should be stacked or grouped into larger units or qualifications. Therefore, stacking credentials can be essential in showing the employees' skills and competencies.
 - **Verifiable-** The set of skills earned must be verifiable that the employee has gained the competency of that credential. In the findings, most participants mentioned that they were not aware of the verification or validation process for the micro-credentials they completed online. Therefore, verification is crucial for employees to prove their skills and competency.
 - **Portable-** The micro-credentials completed by employees should be portable from one organisation to another. In the findings, participants shared that completing micro-credentials makes them recognisable across other sectors. Therefore, the transferability or portability of micro-credentials should demonstrate the employees' skills and competencies.

Regarding competency-based learning, it was important to note that stackability did not apply to all micro-credentials, but other credentials can be single credentialing and cannot be stacked.

- **Work Related-** Skill that assisted employees in performing their daily tasks was also mentioned in the findings. The work-related element of micro-credentials implies that each credential should be directly aligned with the employee's job enhancement (Acree,2016). Therefore, work-related learning should be industry-driven and problem-centred.
 - **Industry driven-** The credentials earned by employees need to focus on the core or needed skills in their industry. Micro-credentials should be designed and implemented to be learner-centric and meet industry standards and needs (Australian Department of Education, Skills and Development, 2021). Therefore, work-related credentials should meet the needs of the industry.
 - **Problem-centred-** the credentials earned should focus on solving a specific problem that could enhance the employee's daily tasks. Some participants in the findings stated that they were applying the skills they were learning online to solve their work problems even before the course was complete. Therefore, work-related credentials should also have the element of being problem centred.
- **Researched learning-** Micro-credentials relevance to the current technologies were also a theme that merged in the findings. Digital Promise (2023) stated that micro-credentials should be supported by research demonstrating how that competency supports professional impact. Therefore, research learning is essential for quality and continuous learning in micro-credential adoption.
 - **Quality-** Employees need to register for credentials that are offered by reputable institutions and that have been accredited by accreditation institutions. Oliver (2022) stated that quality assurance was needed for micro-credential offerings. Therefore, researched learning can assist in improving the quality of micro-credentials.
 - **Continuous Learning-** Employees should seek relevant credentials to keep up with technological changes. The literature extensively discussed long-life learning to keep up with technological changes (Lim et al., 2018; Oliver, 2019; Resei et al., 2019). Therefore, work-related learning should offer continuous learning.
- **Personalised Learning-** Flexible learning enables employees to learn independently. Acree (2016) stated that learners should complete micro-credentials at their own pace and time

(Acree, 2016). Personalised learning allows employees to have access to flexible and on-demand learning.

- **Flexible learning-** Employees should be able to access and complete the credentials at their own pace. Thus, an agile approach to learning could be essential (Oliver, 2019). Therefore, personalised learning should accommodate flexible learning.
- **On-demand learning-** This includes credentials recommended in their industry to bridge the skills gap that an employee is interested in learning. Participants in the findings shared that they were likely to enrol for trendy micro-credentials in their industry. Therefore, personalised learning should also include on-demand learning.

- **Experience-** Experience with a provider or the credential course could influence the resources or trust. Experience also includes selecting the preferred reputable provider for each module learning outcome (Lim et al., 2018). Therefore, employees should be able to select the credentials they want to enrol in based on their available resources and the credential providers they trust.

- **Motivation-** Motivation to encourage employee growth was mentioned in the findings.
 - **Employee growth-** Employees who took their learning seriously stated that they could advance quicker in their career development. Copenhaver and Pritchard (2017) mentioned that integrating micro-credentials into a company's training programme could offer an innovative and customised way to certify and recognise learning. Therefore, the motivation for adopting micro-credentials should encourage employees to grow and remain innovative in their tasks.

Therefore, the six main principles with the subcategories will contribute to the problem of micro-credential for upskilling and reskilling the workforce. Furthermore, as illustrated in Figure 14, the three layers are in synergy, from the outer layer to the middle layer, and the inner layer is represented by arrows. This means all layers are working in collaboration with each other. For example, a recognised shareable digital badge (outer layer) should state the price value (middle layer) and consist of all six core micro-credential principles: competency-based learning, personalised learning, experience, research learning, work-related learning, and motivation. Therefore, this study proposed this framework for organisations to adopt when considering upskilling or reskilling their workforce through micro-credentials.

5.3. LIMITATIONS AND ADDITIONS

Table 23 shows the differences and similarities of the proposed framework compared with the three other frameworks discussed in the literature. One of this framework's limitations was that it did not discuss the partnership endorsements between employers and micro-credential providers. Therefore, factors such as issuing bodies were not covered. However, a few additions were also included in this framework, such as work-learn balance, since it is catered for the work environment. Price value was also not covered by the other four evaluated frameworks but is included in this framework since employers need to set a clear budget when reskilling employees. This framework also included flexibility; the finding stated that some credentials were either flexible, fixed, or semi-flexible. Thus, employees need to understand the nature of the credentials they wish to register. Experience comes with the availability of resources and reputable providers employees can trust. This was motivated by bad administration and a lack of resources when participants needed assistance with the findings. Then, finally, motivation was the additional element compared to other frameworks. This was mainly to encourage employee growth.

Table 23 Summary of micro-credential frameworks with the new framework

| European approach | Australian Approach | Digital Promise | e-Campus Ontario | New Micro-credential Framework |
|---------------------------------|------------------------------------|------------------------|--------------------------------|--|
| Transparency | Transparent and accessible | x | x | Transparent/ accessibility |
| Relevance | x | x | Relevance | x |
| Authentic/ Learning pathways | x | Verifiable | Verifiability | Authentic/Verification |
| Valid assessment | Outcome-Based | x | Outcomes | Problem centred |
| Information and guidance | Tailored/Support Lifelong Learning | On-demand | Extensibility | On-demand Long-life learning |
| Portable | x | Portable | x | Portable |
| x | Driven by Industry | Competency-based | Competency/ Skills targeted | Competency-based -Industry driven Work-related |
| Learning pathways | x | Shareable | x | Shareable Stackable |
| Quality | x | Research-based | x | Research learning Quality |
| Learning centred | x | Personalised | x | Personalised |
| x | x | Controllable | Ownership | Ownership |
| Recognition | x | x | Summative assessment | Recognition |
| x | x | x | Issuing Body | x |
| x | x | x | Transcriptive | x |
| Relevance | x | x | Partner endorsement | x |
| x | x | x | x | Work-learn balance |
| x | x | x | x | Price Value |
| x | x | x | x | Flexibility |
| x | x | x | x | Experience/Resources Trust |
| x | x | x | x | Motivation/ Employee growth |

5.4. SUMMARY OF CONTRIBUTIONS

The adoption of technological changes has brought changes in most organisations, forcing employers to find new ways of training their workforce. This study recommended micro-credentials as the solution for upskilling and reskilling employees. However, with any new technology is subjected to resistance. Thus, this study proposed guidelines for micro-credential adoption for skills development. Andragogy of practice and UTAUT2 were adopted to understand adult learning and technology adoption. The guidelines were formulated in the form of a micro-credential framework, as illustrated in Figure 15.

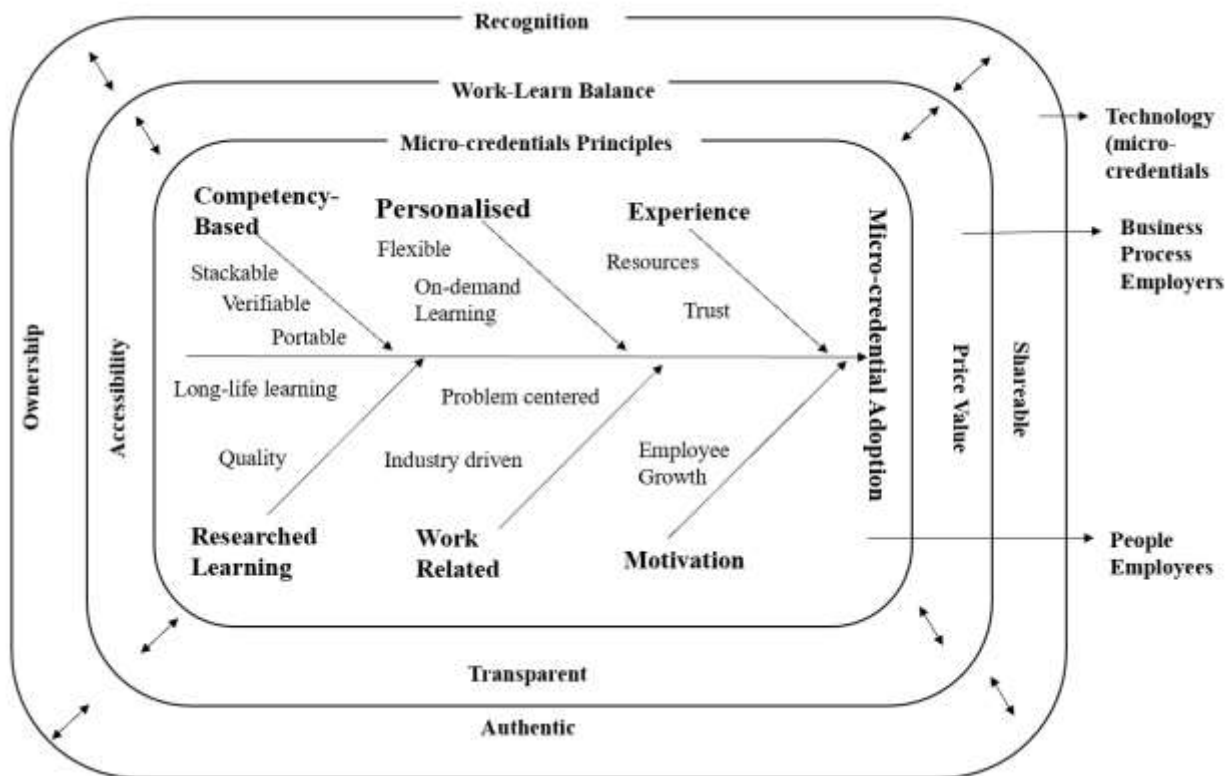


Figure 15 Micro-credential framework for upskilling and reskilling employees

The framework consists of three layers: *The outer layer* consists of the technology itself; the purpose of this layer was to demonstrate that micro-credential technology (a digital badge) needs to be recognisable and to achieve that in its design, it needs to be shareable, authentic, and clearly state the ownership given to the end-user if it is permanently or temporary.

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The inner layer contains the core micro-credential principles. In this layer, the drive is people (employees). To explain the core principles, the Fishbone diagram (Ishikawa diagram), as shown in Figure 15, illustrates the cause and effects of adopting micro-credentials to upskill or reskill the workforce. Six core principles were identified from the finding themes: competency-based learning, personalised learning, experience, research learning, work-related learning, and motivation. Thereafter, each principle had sub-categories that could contribute to adopting micro-credentials for skills development. The limitation of the framework included partnership endorsement and issuing bodies. While the additional elements compared to the frameworks discussed in the literature included work-learn balance, price-value, flexibility, experience, and motivation for employee growth.

5.5. FUTURE RESEARCH

Additional research could examine the collaboration of HEIs and employers to encourage stackable and transferrable learning. This can assist in clearly defining the value of micro-credentials in the work environment. The other area of interest can be to define the micro-credentials standards; as many MOOCs are taking up the digital space, it might be interesting to understand the possible agreed verification or credentialing processes and encourage employers to explore different types of micro-credentials to meet the organisation's needs. Some employers are still confused about the credentials they can adopt when reskilling employees, therefore, micro-credential policies and awareness can be.

After conducting this study, some gaps were identified:

- There was still a grey area in the micro-credential definition.
- There was inconsistency regarding their value, as they were still taken as informal education. Therefore, future research is needed to understand why university degrees are seen to be more of value or prestige compared to several micro-credentials.
- This study did not look at the work policies for learning to understand a work learn balance.
- Further research is also needed for micro-credential stacking elements.

○

5.6. CONCLUDING REMARKS

The main objective of this qualitative interpretive study was to formulate guidelines for organisations to use when adopting micro-credentials when reskilling or upskilling the workforce. The problem highlighted in this study was that organisations are challenged to upskill and reskill the workforce due to technological changes. The Andragogy of practice model and UTAUT2 theories were adopted to link empirical thoughts together with the literature review driven by these four research questions: looking at the opportunities, benefits, existing framework, and challenges of adopting micro-credentials for upskilling and reskilling the workforce. Thereafter, ten participants were interviewed. The participants stated that the benefits micro-credentials offer work-related, industry-driven skills that employees can learn from. Some of the challenges mentioned in the findings were time management and keeping up with a work-learn balance. The opportunity for flexible learning, since most digital credentials offer self-paced learning, was also mentioned in the findings. This study contributed guidelines in the form of a micro-credential framework to assist employers in adopting micro-credentials for skills development. The framework consists of three layers: the outer layer will be technology (digital badge), the middle layer will be the work environment, and the inner layer will be the core micro-credentials principle discussed. The limitation of the framework included partnership endorsement and issuing bodies. While the additional elements compared to the frameworks discussed in the literature included work-learn balance, price-value, flexibility, experience, and motivation for employee growth.

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APPENDIX A

Interview Questions

Table 24 Interview Questions

| Questions |
|---|
| 1. What do you understand about micro-credentials? |
| 2. Have you taken any online courses? |
| 3. What was your experience on online training? |
| 4. Which skills have you learn online? |
| 5. Were the skill set that you learn online aligned to the work that you do? |
| 6. Did the course you enrolled online respond to the organisations' needs? |
| 7. Were the courses you enrolled online relevant to the current technology you use at work? |
| 8. Was the micro-credential aligned with your interest, and could you do it at your own pace? |
| 9. Does your employer recognise the achievement you gained from online courses? |
| 10. What are the challenges you encounter when enrolling for micro-credential? |
| 11. What are the benefits you received with micro-credentials? |
| 12. Were the digital badges received after completing an online course temporary or permanent? |
| 13. Are the digital badges you received transferrable if you move to a different organisation? |
| 14. Were the courses you enrolled in expensive or affordable? |
| 15. How was the quality of each course validated? Please share the process. |
| 16. What would you recommend to other organisations wanting to move into the online environment to train employees? |

APPENDIX B

Framework Formulation Network

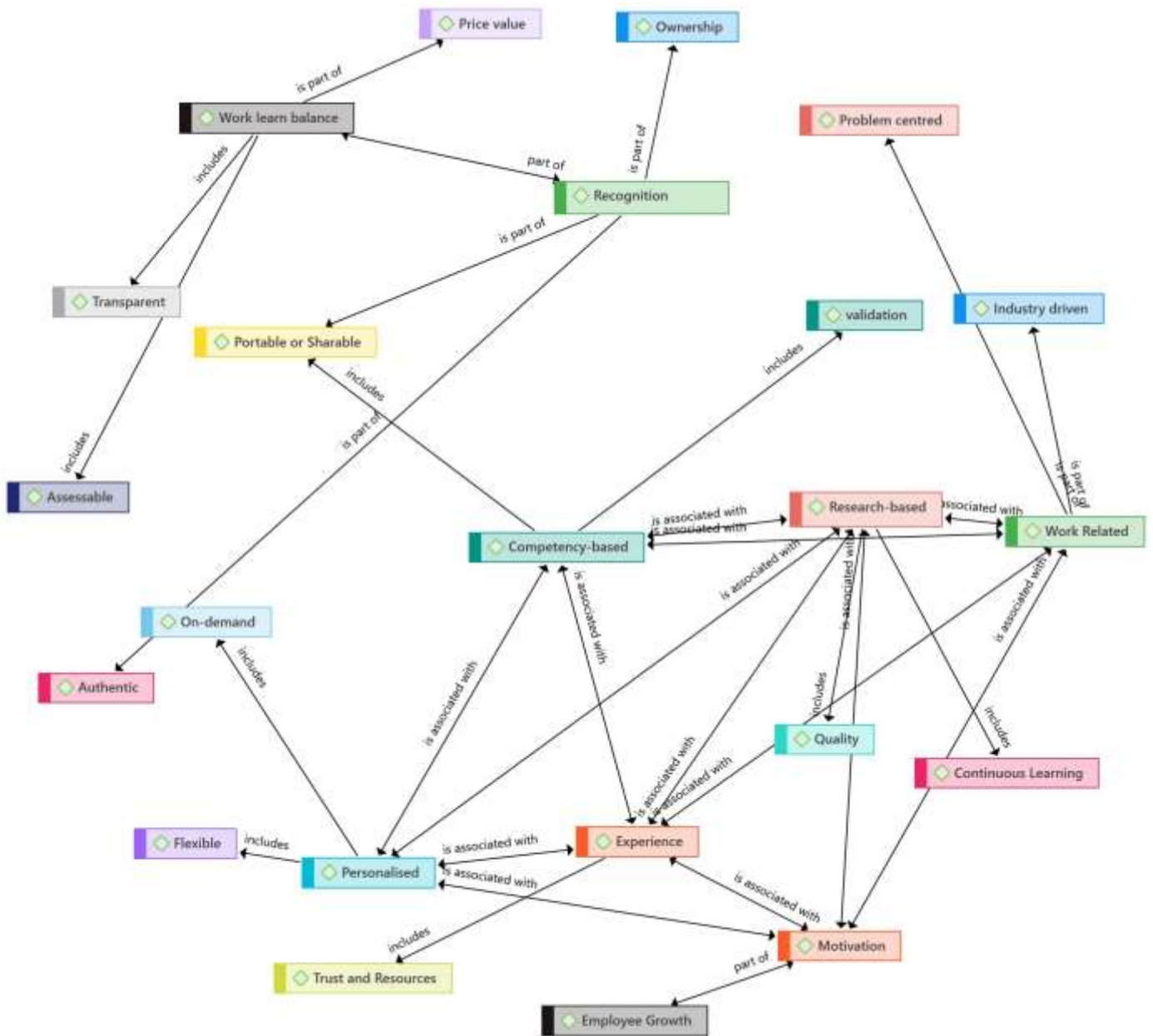


Figure 16 Micro-credentials Framework Formulation network

APPENDIX C
Informed consent form
(Form for research participant's permission)

1. Project information

1.1 **Title of the research project:** Micro-credentials for Employers: Guidelines in reskilling workforce impacted by the changes caused by Disruptive Technologies

1.2 **Researcher details:** Oyena Mahlasela, Department of Informatics, and u21686212@tuks.co.za.

1.3 Research study description

(i) The main objective of this study is to formulate a framework for organisations to use when adopting micro-credentials when reskilling or upskilling the workforce.

To achieve the main objective, the study specifically focuses on:

- To determine the opportunities micro-credentials can have in reskilling employees.
- To examine the benefit of adopting micro-credentials.
- To evaluate the challenges of adopting micro-credential when reskilling the workforce.
- To review different micro-credential frameworks.

(ii) The required participants should be anyone with the traditional qualification who desires to upskill or reskill their current skill sets. They should be available for a 45-minute virtual interview on MS Teams.

(iii) The participants should note that the information they will provide will be treated with confidentiality. Furthermore, the results obtained from the interviews will be used towards a master's research report. The master's research report will be the property of the University of Pretoria. At no point before, during or after the research study or in subsequent publication will the data collected and /or the organisation be exposed anyway. In addition, participants should participate of their own free will and have the right to decline the interview. Since the interview will also be online, permission should be granted before the recording. Moreover, participants must sign the consent form to protect their rights and privacy if they choose to participate.

2. Informed consent

2.1 I..... hereby voluntarily grant my permission to participate in the project as explained to me by *Oyena Mahlasela*.

2.2 The nature, objective, possible safety and health implications have been explained to me, and I understand them.

2.3 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.

2.4 Upon signing this form, the participant will receive a copy.

Signed: _____ Date: _____

Witness: _____ Date: _____

Researcher: _____ Date: _____