To Explore Strategies of Personalised AI based E-Learning to Add Value through Training and Development for Healthcare Staff: A case Study of a care home in the UK

Rokhsareh Kavian BSc, MSc

Supervised by: Dr Gladius David Kulothungan & Dr Anupam Mazumdar

Submitted in partial fulfilment for the award of the degree of Professional Doctorate,
Doctor of Business Administration (DBA)
University of Wales Trinity Saint David

March 2024

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed: *Rokhsareh Kavian*

Date: 31/03/2024

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed: *Rokhsareh Kavian*

Date: 31/03/2024

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for deposit in the University's digital repository**.**

Signed: *Rokhsareh Kavian*

Date: 31/03/2024

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my parents, whose unwavering love, encouragement, and support have been the cornerstone of my academic journey. Your belief in me, even during the most challenging times, has been a constant source of strength and inspiration. Thanks also should go to my brother, whose encouragement has been a constant source of strength and inspiration.

I would like to thank the University of Wales Trinity Saint David for giving me the opportunity to pursue my Doctor of Business Administration degree. Also, I would like to express my deepest appreciation to my Director of Study, Dr Gladius David Kulothungan, for his invaluable advice, continuous support, and patience during my research. His inspiration, motivation, expert guidance, and insightful feedback resulted in the successful accomplishment of my thesis.

Words cannot express my gratitude to my second supervisor, Dr Anupam Mazumdar, whose expertise, guidance, and support have been invaluable throughout the completion of my thesis. His insightful feedback, encouragement, and willingness to share his knowledge have significantly enriched the quality of my work and broadened my perspectives. I am profoundly grateful for his mentorship and dedication, which have played a pivotal role in shaping this research endeavour.

I would like to thank all the participants and the care home for giving me assistance and their precious time, this study would not have been possible without them.

I also would like to extend my heartfelt gratitude to my husband, for all the sacrifices, patience, love, and support have made it possible for me to pursue my dream. I could not have done this journey without you standing by my side and supporting me with your unwavering commitment.

ABSTRACT

Personalised e-learning empowered by Artificial Intelligence (AI) holds promise for tailoring e-learning experiences to the specific needs and preferences of healthcare professionals to enhance the efficacy of e-learning and thereby delivery of care within healthcare and social care organisations. However, the full potential of personalised AI based e-learning remains largely untapped in healthcare organisations in the UK, as issues and challenges caused barriers to the adoption of this advanced technology. The critical aspect often overlooked is the understanding of staff perceptions, expectations, and needs regarding the adoption of personalised AI-based e-learning. Also, as people live longer to the older age in the UK and the need for more complex treatment is also increasing, healthcare staff need to be updated and well-trained to the latest knowledges and technologies in order to respond vigilantly to the patients' needs. Therefore, it is important to understand healthcare staff perceptions, expectations and challenges to adopt an effective e-learning system that is personalised to their learning styles. The aim of this research is:

- to explore strategies of personalised Artificial Intelligence based e-learning to add value through training and development for healthcare staff in the UK.

Employing qualitative research methods, data was collected through interviews with healthcare professionals from a selected care home in the UK using purposive sampling techniques. A case study research approach was adopted to provide insightful responses to the research question and achieve the study's objectives. Thematic analysis was conducted on the collected data to explore the challenges faced by healthcare staff in the selected care home and to propose potential solutions for the adoption of personalised AI-based e-learning. Therefore, by applying thematic analysis, the analysed data is matched against proposed framework that identifies the barriers and incentives to the adoption of personalised AI based e-learning. The barriers and

incentives are categorised into 'Technology,' 'Organization,' and 'Environment' contexts which they are aligned with the proposed conceptual framework of this doctoral study.

This research contributes to the body of knowledge of personalised AI-based e-learning and its integration into healthcare environments by reviewing a comprehensive literature review focused on identifying the obstacles of adopting personalised AI based e-learning. Also, this study developed two frameworks based on incentives and barriers of adopting personalised AI based e-leaning; identified from interviewing healthcare staff of the selected care home in the UK. In addition, an innovative conceptual framework is introduced to assist healthcare organisations and ICT specialists in comprehending the underlying challenges associated with the adoption of personalised AI-based e-learning. Additionally, a roadmap is formulated to guide healthcare organisations in adopting personalised AI-based e-learning, bridging the gap between theoretical insights and practical application.

Keywords: Artificial Intelligence, E-learning, Personalisation, Healthcare organisations in the UK

Table of Contents

ACRONYMS

AEEs	Adaptive E-learning Environments
AI	Artificial Intelligence
AR	Augmented Reality
BRCA Gist	BReast CAncer and Genetics Intelligent Semantic Tutoring
CPR	Cardiopulmonary Resuscitation
CQC	Care Quality Commission
CME	Continuous Medical Education
DT-PAL	Digital Technology-enabled Personalized and Adaptive Learning
D&M	DeLone and McLean Information System Success Model
DOI	Diffusion of Information
FSLSM	Felder-Silverman Learning Style Model
GCSE	General Certificate of Secondary Education
GPT	Generative Pre-trained Transformers
HCPs	Healthcare Professionals
IT	Information Technology
ICT	Information and Communication Technology
IS	Information System
ILS	Index of Learning Styles
IDT	Innovative Diffusion Theory
LS	Learning Style
LSI	Learning Style Inventory
LSQ	Learning Style Questionnaire
ML	Machine Learning

NHS	National Health Service
NLP	Natural Language Processing
NVQ	National Vocational Qualifications
T&D	Training and Development
T&L	Training and Learning
OERs	Open Educational Resources
PALM	Personalized Adaptive Learning Model
PRS	Personalized Recommendation Systems
RNs	Registered Nurses
TOE	Technology-Organization-Environment
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
UTAUT	United Theory of Acceptance and Use of Technology
VR	Virtual Reality
VLEs	Virtual Learning Environments
WHO	World Health Organization

LIST OF TABLES

LIST OF FIGURES

Chapter 1.0: Introduction

1.1. Introduction

The landscape of healthcare education and training has entered a transformative phase, driven by the integration of cutting-edge technologies. Among these, Artificial Intelligence (AI) has emerged as a powerful catalyst, offering unprecedented possibilities to reshape how healthcare professionals undergo Training and Development (T&D). This study embarks on a journey into the heart of this digital transformation, focusing on the strategic integration of AI-based E-Learning to enhance the capabilities of healthcare staff. Within this context, the research narrows its focus onto the nuanced environment of care homes in the United Kingdom. These healthcare settings stand at the intersection of complex patient care and diverse professional responsibilities, demanding a workforce that is not only skilled but also agile in adapting to the evolving healthcare landscape. The primary objective of this study is to explore and evaluate the strategies employed in personalised AI-based e-learning, with a dedicated focus on their impact on the training and development of healthcare staff within care home settings. By delving into the unique challenges and opportunities within this context, the research aims to uncover insights that transcend generic approaches, providing tailored solutions for maximising the potential of E-Learning through AI integration.

The structure of this introductory chapter is designed to guide the reader through the origin and background of the research, followed by a statement of the research problem. As we navigate the intricacies of AI-enhanced E-Learning in healthcare, subsequent sections in this chapter will delve into the aim, objectives, and research questions. Additionally, the chapter will navigate through the significance and rationale of this study. The chapter will conclude by outlining the research and summarising the introduction chapter.

1.2. Origin of the Research

The origin of this research stems from concerns about issues and challenges of healthcare staff with e-learning. This concern emerged as a result of the researcher's interest in introducing Artificial Intelligence (AI) based e-learning in the UK. The goal was to innovate e-learning by leveraging the latest available technologies.

Upon extensive investigation, it became evident that healthcare organisations significantly lag in the adoption of new technologies, particularly in harnessing the potential advantages offered by AI. It has been observed that the NHS, who employ 1.6 million individuals (Bulut, 2023), and social care who engage 1.4 million (Fenton et al., 2023); collectively form a substantial workforce, crucial for determining the UK's care quality and efficiency. The potential advantages of advanced technologies, crucial for maximising how e-learning is perceived and embedded, are benefits borne by patients; enhancing the quality of care received within healthcare and social care organisations and remain largely untapped by both employees and businesses (Banerjee et al., 2021).

The government has expressed its commitment to investing in learning and development to aid staff members in utilising digital technologies (Department of Health and Social Care, 2022). This research delved into the government's strategies and initiatives within the health and social care sector for the implementation, adaptation, and enhancement of digital learning and training. However, a critical aspect, that has often been overlooked, is the careful consideration of staff expectations and needs for effective online learning. Consequently, this study aimed to investigate the challenges of e-learning from the perspective of employees and to explore potential strategies for integrating AI-based e-learning within health and social care.

1.3. Background of the Research

Technology has opened a new era in learning and training system in healthcare in the world (Gavriushenko, 2017). It has been recommended that information technology (IT) and its applications can improve the quality of care in healthcare sectors (Liu et al., 2010). The landscape of healthcare education, and Training and Development (T&D) for healthcare professionals has undergone a significant transformation in recent years (Regmi and Jones, 2020; Jha et al., 2022). Time and place are the limitations of traditional training system where these days, technology can facilitate training and learning for learners (Safavi, 2008). The integration of technology, particularly E-Learning, has emerged as a progressive solution to bridge the gap between traditional learning methods, and the evolving demands of the healthcare sector (Dong et al., 2021). However, challenges persist in effectively adapting e-learning solutions to meet the specific needs of healthcare professionals.

The UK healthcare sector is currently navigating significant challenges, including an aging population, escalating healthcare costs, and a pressing demand for high-quality care. Recent studies have highlighted a deceleration in life expectancy gains, with England experiencing a notable decline in annual improvements—from 0.25 years to 0.07 years—between 1990 and 2019 (Feigerlova et al., 2025). Concurrently, the financial burden of healthcare is intensifying, particularly concerning older demographics. Care home costs in the UK have been reported to range from £1,500 to £3,000 per week, amounting to £200,000 to £250,000 over a three-year period. These figures underscore the substantial expenses associated with elder care, which are markedly higher than those for younger populations (Kamel Rahimi et al., 2024). Therefore, continuous training and development of healthcare staff are imperative. The Department of Health and Social Care is expanding the number of clinical placements for nursing degree programs by 5,000 starting from 2018, representing a 25% increase. This initiative will provide NHS employers, as well as those in the independent and care sectors, with a greater supply of

highly skilled domestic staff (HM Government, 2018). The Department of Health and Social Care continues to provide funding to their delivery partner, Skills for Care, and is collaborating closely with them to enhance domestic recruitment and staff retention within adult social care (ibid).

Traditional training methods, however, often face limitations such as high costs, time constraints, and scalability issues. E-learning has emerged as a viable alternative, with studies indicating that it can be as effective as traditional training methods for health professionals (Wong, 2015). The integration of Artificial Intelligence (AI) into e-learning platforms offers the potential to further enhance healthcare education. AI can provide personalised learning experiences, adapt content to individual needs, and offer flexible access to training materials. A recent study highlighted that trainee doctors perceive AI technologies as having a positive impact on clinical training, particularly in improving research and audit skills (Banerjee, 2021). This study aims to investigate strategies for leveraging AI-based e-learning to enhance the training and development of healthcare staff in the UK. By exploring the experiences and perceptions of healthcare professionals and stakeholders, the research seeks to develop a robust framework that supports the effective implementation of AI-driven e-learning solutions in healthcare training programs.

1.3.1. Challenges with Traditional E-Learning

The traditional pedagogy centred around in-class lectures, is insufficient in fostering healthcare staff's development of higher-order thinking skills like critical thinking and problem-solving. Dong, Yen et al. (2021) expressed that solely relying on traditional education fails to adequately equip learners to apply acquired information in novel or real-world situations. Regmi and Jones (2020), in their systematic review of e-learning in health sciences education, highlighted critical enablers and barriers to e-learning, including the importance of interaction, collaboration, learner motivation, and user-friendly technology. These findings emphasise the

need to address learner expectations and technological usability when designing modern e-learning solutions. While these studies illuminate systemic issues in healthcare education, their focus is broad, leaving a gap in understanding how these challenges manifest in specific settings, such as care homes in the UK. This gap underscores the need for innovative approaches, including the integration of AI-driven solutions.

1.3.2. AI-Based E-Learning: A Transformative Approach

The advent of Artificial Intelligence (AI) has introduced a paradigm shift in educational strategies (Chen et al., 2020). AI-driven E-Learning offers the potential for personalised, adaptive, and data-driven learning experiences, catering to the specific needs and learning styles of health and social care staff. For instance, Wongwatkit, Panjaburee et al. (2020) studies a personalised e-learning system, considering students' individual learning preferences, whilst also assessing the efficacy of the system. The results from this empirical investigation provided significant insights, contributing substantially to the field of online learning systems that offer personalised learning support. Similarly, an adaptive e-learning system designed around learning styles and types of Dyslexia, demonstrated that aligning the learning materials with the user's specific learning style, or Dyslexia type, improves their learning outcomes (Alsobhi and Alyoubi, 2019). Nazempour and Darabi (2023) proposed an approach to personalising learning resources based on students' learning styles in a virtual learning environment. They used the Felder-Silverman Learning Style Model (FSLM) to align learning materials with specific learning style characteristics. It was declared that students' performance can be significantly improved by adopting an appropriate educational intervention based on their learning styles (Malek et al., 2023). However, despite the potential advantages, these studies are often situated outside the healthcare domain or focus on general education, the full utilisation and impact of AI-based E-Learning in the healthcare sector, particularly within the context of care homes in the UK, remains relatively unexplored.

1.3.3. Challenges in Healthcare-Specific E-Learning

Malek et al. (2023) argue that amid the COVID-19 pandemic, healthcare witnessed a higher uptake of digital media training compared to other sectors. Due to necessity, numerous clinics and academic entities have independently crafted their own distinct solutions. Despite the promise of AI-based E-Learning, its integration into healthcare training has faced several obstacles. Malek et al. (2023) emphasised the lack of interoperability among bespoke digital solutions developed during the COVID-19 pandemic, which limits their scalability and long-term viability. Additionally, Saint-Marc, Ratiney and Sclatter (2019) assessed the effectiveness of an e-learning initiative focusing on syringe pump usage, recognising the challenges posed by traditional classroom instruction in terms of complexity and time requirements. The feedback received from 98% of participating nurses regarding the e-learning program indicated its efficacy in enhancing their proficiency in this skill. Despite its effectiveness, only 54% of nurses chose the e-learning program over traditional training methods as nurses expressed their lack of confidence in training that relied solely on online delivery (Saint-Marc et al., 2019). This sentiment is echoed by Azlan et al. (2020), who argue that *"Certain aspects, such as hands-on practical and clinical experience, could never be replaced"* (Azlan et al., 2020, p. 10). Trainee doctors in the Banerjee et al. (2021) study generally viewed the impact of AI technologies on clinical training positively. Nevertheless, there is a concern that it might limit educational opportunities for acquiring practical skills. These findings underscore the importance of hybrid models that balance digital innovation with hands-on training opportunities.

1.3.4. The UK Care Home Context

Care homes in the UK represent a critical segment of healthcare delivery, providing diverse and complex care services to a vulnerable demographic. The significance of a skilled and adaptable workforce within these settings is undeniable (Malek et al., 2023; Jack et al., 2019).

Jack et al.'s (2019) qualitative study of care homes based in England declared that insufficient knowledge and expertise significantly affected the physical and mental well-being of individuals with neurological conditions. Addressing these challenges requires targeted training solutions that are flexible, scalable, and effective in enhancing staff competencies. Despite the potential of AI-based E-Learning to meet these needs, examining the efficacy of AI-based E-Learning strategies in fortifying T&D for healthcare staff within care homes becomes imperative.

1.3.5. Research Gap

While prior studies, such as those by Wongwatkit et al. (2020) and Nazempour and Darabi (2023), demonstrate the potential of AI-based E-Learning, their applicability to the unique context of care homes in the UK is unclear. Existing research highlights barriers such as limited interoperability, staff reluctance, and the challenges of balancing digital and practical learning components; difficulties associated with the hands-on, or practical component of e-learning. This study addresses these gaps by exploring, analysing, and evaluating AI-based E-Learning strategies within care home settings. Therefore, this study aims to explore, analyse, and evaluate the strategies of AI-based E-Learning within the unique framework of a care home setting in the UK. Through a comprehensive case study approach, it aims to elucidate the feasibility, challenges, and potential contributions of AI-based E-Learning in enhancing the Training and Development (T&D) initiatives for healthcare staff, ultimately improving care quality for vulnerable populations.

1.4. Statement of the Research Problem

Technology has become increasingly prominent within the sphere of education, where e-learning can provide positive learning results by enabling learners to actively engage in the learning process anytime and anywhere (El-Sabagh 2021; Lee et al., 2019). In the context of face-to-face education, obstacles manifest due to substantial workloads, limited time

availability, geographical barriers, financial constraints, inadequate local learning opportunities, and insufficient supervisory support (Alfaleh et al., 2023). Consequently, e-learning serves as a flexible, accessible, and convenient platform for the ongoing education of health and social care staff (El-Sabagh, 2021).

The integration of technology in health and social care has significantly increased in recent decades (Chua, 2020; Konttila et al., 2019). Previous studies have identified numerous limitations and factors that impact the efficacy of current e-learning initiatives (Alfaleh et al., 2023; Wongwatkit et al., 2020; Xie et al., 2019; Xing et al., 2018). Studies have highlighted some e-learning challenges, such as; insufficient information technology skills, technical issues with online resources, limitations in software capacity, and the necessity for training and practical support (Alfaleh et al., 2023; Guven Ozdemir and Sonmez, 2021; Xing et al., 2020).

A survey conducted among 534 registered nurses across eight hospitals in Shanghai highlighted ‘lack of time’ as the primary barrier reported by nurses (Xing et al., 2020, p. 87). This limitation was directly linked to the severe shortage of nursing staff (Xing et al., 2020). Kynge (2020) also pointed out that lack of time stood as a significant reason for nurses' reluctance to engage in online learning. Furthermore, nurses without prior experience in e-learning cited a lack of familiarity with computer proficiency, e-learning tools, and platforms as a hindrance (Xing et al., 2020; Kynge, 2020). Previous studies by Zaman et al. (2021) suggested a correlation between nurses' general computer skills and their perception of the ease of using electronic documentation systems. They argued that nurses adept in computer usage tend to display a positive attitude towards utilising various equipment and software in their professional environment (Zaman et al., 2021). Additionally, challenges related to the availability of relevant learning materials emerged as a barrier for healthcare workers. It was emphasised that materials should not only be contextually appropriate, interesting, and engaging across various devices, but should also offer easy access with minimal obstacles (Kynge, 2020). Accessing

learning materials through preferred means, posed a challenge for healthcare workers, emphasising the importance of delivering materials with minimal barriers (Kynge, 2020).

Despite the growing body of research on e-learning in the health and social care sectors, researchers continue to explore diverse strategies and approaches to enhance its effectiveness. While the integration of AI into e-learning remains relatively novel, intelligent devices and technologies offer potential for fostering an intelligent learning environment (Price, 2015; Singh and Alshammari, 2021). These digital technologies have the potential to promote the development of personalised e-learning in the health and social care sector. Therefore, this research seeks to delve into the practical implications of AI-driven E-Learning specifically within the unique context of care homes, providing insights into its feasibility, challenges, and potential benefits for healthcare staff. The rationale behind this study is rooted in the need to address a critical gap in the existing literature, which often lags behind in adopting innovative pedagogical approaches within healthcare education.

Prior studies on AI-based E-Learning in the UK have largely overlooked its application within care homes, leaving a significant gap in understanding how such technologies can enhance training and development initiatives for healthcare staff in this setting. By examining these inadequacies, this research not only sheds light on the challenges associated with adopting personalised AI-based E-Learning in care homes but also provides a much-needed exploration of its practical implications, thus filling a significant void in current literature. This research prioritises understanding learners' perceptions and expectations regarding e-learning, to comprehend the barriers and challenges to its acceptance in health and social care. Hence, employing a qualitative approach could assist the researcher in exploring AI-based e-learning strategies to enhance the training and development of healthcare staff.

1.5. Aim of the Research

The aim of this research is to explore strategies of personalised Artificial Intelligence based e-learning to add value through training and development for healthcare staff in the UK.

1.6. Objectives of the Research

- To understand the context of personalised AI based e-learning strategies for the healthcare staff.
- To investigate the issues and challenges of personalised AI based e-learning encountered by healthcare staff.
- To analyse the impact of personalised AI based e-learning for the healthcare staff.
- To develop and propose a conceptual framework to address identified barriers of adoption of personalised AI-based e-learning within the healthcare sector.

1.7. Research Question

Previous studies such as Baniasadi et al. (2020), Wolff et al. (2021) and Maghsudi et al. (2021) discussed the issues and challenges of adopting personalised AI based e-learning; discussed in literature review section. By reviewing previous studies, it is believed that understanding and investigating the learner's issues and challenges of adopting personalised AI based e-learning within the healthcare sector is a crucial step of adopting new technologies. In addition, existing literature elucidated the positive and negative impacts of integrating personalised AI-driven e-learning, Malek et al. (2023), Wongwatkit et al. (2020), Abd-alrazaq et al. (2023) and Sutoi et al. (2023); discussed in literature review section. As a result of directly informed by the issues, challenegs and impact identified in literature review, the research question is rooted in existing scholarship and reflect real needs in adoption of personalied AI based e-learning in healthcare sector. Therefore, the following research question has developed through the literature review.

- How do healthcare staff address issues, challenges and impact of adoption of personalised AI based e-learning to add value within the healthcare sector in the UK?

1.8. Significance of the Research

The healthcare sector operates within a dynamic landscape, constantly evolving due to technological advancements and changing patient needs (Chan and Zary, 2019; Martin-Parra et al., 2014; Materla and Cudney, 2020). However, existing literature and practices within healthcare education often lag behind in embracing innovative pedagogical approaches (Bohr and Memarzadeh, 2020). Therefore, this study argues that previous research on AI-based E-learning in the UK has mostly neglected its adoption in care homes, resulting in a notable gap in understanding how such technologies can be adopted and improve training and development programs for healthcare staff in these environments. So, this research aims to bridge this gap by examining the potential of AI-based E-Learning to modernise and enhance T&D methodologies for healthcare staff. The study's focal point on a case study of a care home in the UK offers a unique lens into the day-to-day challenges and opportunities present within a crucial segment of healthcare. By exploring the integration of AI-based E-Learning within this setting, the research aims to elucidate how such strategies can add tangible value to the ongoing Training and Development of healthcare staff. This exploration extends beyond traditional training methods, aiming to empower employees, personalise learning experiences, and foster adaptability among healthcare professionals. The implications of this research extend beyond the confines of training methodologies. By potentially revolutionising how healthcare staff acquire and retain knowledge, this study anticipates a ripple effect on the quality of care provided within care home settings. A more adept and knowledgeable workforce could translate into enhanced patient outcomes, improved care practices, and increased operational efficiency, thus significantly impacting the overall quality of healthcare delivery.

The outcomes of this research endeavour have the potential to offer insights and recommendations that could shape the future landscape of healthcare education and staff development. Successful integration of AI-based E-Learning strategies within the care home setting could set a precedent for innovative educational approaches, not only within care homes but also across various healthcare sectors. Therefore, this research aspires to unravel the transformative potential of AI-based E-Learning in the context of T&D for healthcare staff, paving the way for more efficient, adaptive, and personalised educational practices within the healthcare domain.

1.9. Rationale of the Study

The healthcare sector is in a continuous state of evolution, driven by technological advancements and the need for up-to-date, and adaptable workforce competencies (Xing et al., 2018; Azlan et al., 2020). However, the current methodologies for T&D often face challenges in keeping pace with this rapidly changing landscape (Wongwatkit et al., 2020; Alfaleh et al., 2023; Xing et al., 2020; Alsobhi and Alyoubi, 2019). This study aims to respond to this evolving landscape by investigating the potential role of AI-based E-Learning in reshaping and optimising T&D approaches within healthcare settings.

The integration of Artificial Intelligence (AI) into E-Learning platforms presents a promising avenue to enhance learning experiences, customise education to individual learner's needs, and improve knowledge retention among healthcare professionals (Banerjee et al., 2021; Alsobhi and Alyoubi, 2019). This research seeks to delve into the practical implications of AI-driven E-Learning specifically within the unique context of a care home environment, providing insights into its feasibility, challenges, and potential benefits for healthcare staff. The choice of a care home setting for this study holds substantial significance. Care homes represent a critical segment of healthcare, catering to vulnerable populations with diverse care needs. By conducting a case study within this setting, the research aims to illuminate the specific

challenges and opportunities for AI-based E-Learning integration. This focus allows for a nuanced examination of how such strategies can add tangible value to the ongoing T&D of healthcare staff within a real-world healthcare environment.

Understanding the potential impact of AI-based E-Learning strategies on T&D within healthcare staff can have far-reaching implications. An innovative and effective approach to staff development holds the promise of improving care quality, enhancing patient outcomes, and fostering a more adept and responsive healthcare workforce. The rationale behind this study is rooted in the need to explore and understand the practical implications of leveraging AI-based E-Learning to enrich Training and Development initiatives for healthcare staff within the specific context of a care home setting in the UK.

1.10. Outline of the Research

Chapter 1.0: Introduction

Chapter one will define the research problems and clarify the significance of this study. Furthermore, it will explicitly specify the research aim, objectives, and questions. The chapter will conclude by presenting an outline of the research's overall structure.

Chapter 2.0: Literature Review

Chapter two aims to elucidate the current body of literature and theories, delving into the challenges surrounding the adoption of personalised AI-based e-learning. It will pinpoint relevant literature addressing these challenges and identify any knowledge gaps therein. Furthermore, it will delve into the theoretical underpinnings of issues highlighted in prior studies. Additionally, this chapter will conduct a literature review to construct a suitable framework integrating the Technological, Organizational, and Environmental (TOE) framework with the Felder-Silverman Learning Style Model (FSLSM). This integration will

facilitate the proposal of a conceptual framework tailored to the adoption of personalised AI-based e-learning, particularly in the healthcare sector in the UK.

Chapter 3.0: Research Methodology

Chapter three will explore the selected research methodologies and methods for this study, elucidating how they will contribute to achieving the research aim and objectives. It will outline the chosen research methods, philosophies, approach, and strategies, detailing how they support the research goals. Furthermore, it will expound upon the planned data collection and analysis methods. Additionally, a comprehensive overview of the research design will be provided, accompanied by a thorough justification of all the techniques, tools, methods, paradigms, and approaches to be employed.

Chapter 4.0: Analysis and Findings

Chapter four will showcase the analysis of qualitative data themes extracted from the interviews. This chapter will illustrate the participants' perceptions, experiences, obstacles, and motivators concerning e-learning, along with their readiness to embrace personalised AI-based e-learning in the future.

Chapter 5.0: Discussion

Chapter five will provide a discussion of the data uncovered during the analysis, categorising it into three main sections: Technological, Organisational, and Environmental Barriers and Incentives. Additionally, this chapter will showcase two distinct frameworks derived from the barriers and incentives associated with the adoption of personalised AI-based e-learning. These frameworks will offer a comprehensive overview of all the findings and discussions.

Chapter 6.0: Proposed Conceptual Framework

Chapter six will delve into the integrated framework that has been developed, offering a detailed guide for healthcare organisations, managers, the Care Quality Commission (CQC), and the UK government concerning the adoption of personalised AI-based e-learning. Additionally, this chapter will outline how healthcare organisations can implement personalised AI-based e-learning. It will also elucidate the sequential process involved in adopting personalised AI-based e-learning within the healthcare sector in the UK.

Chapter 7.0: Validity & Reliability of Research Findings

Chapter seven will provide a comprehensive justification of the research, covering both internal and external aspects. It will also discuss the trustworthiness of the integrated framework that was developed.

Chapter 8.0: Conclusions

Chapter seven will offer a summary of the conclusions drawn, highlighting the unique contributions of the research, proposing areas for future research, discuss research confines, and outline implications for future studies.

1.11. Summary of the Chapter

Chapter one has laid the groundwork by detailing the origin and background of the research while presenting aims and objectives associated with the topic. It has introduced the research question, and delved into relevant literature that underpins the research background. The reviewed literature expressed the growing necessity to explore further into identifying and explaining the challenges surrounding the acceptance, adoption, and effectiveness of e-learning in the health and social care sector. Furthermore, this chapter clarified the problems, the significance, and the rationale of the study, focusing explicitly on the potential contributions of the research. In summary, an outline of the entire research was provided, offering a preview of the content of the subsequent chapters. In chapter 2 (below); the researcher will review existing

literature based on AI, personalised AI based e-learning, and theoretical perspectives of AI adoption in e-learning within the health and social care sector.

Chapter 2.0: Literature Review

2.1. Introduction

The literature review serves as a critical component of this study, aiming to offer a thorough understanding of the historical and theoretical landscape surrounding the intersection of artificial intelligence (AI), e-learning, and personalised learning in the healthcare sector. To begin, the introduction sets the stage by elucidating the broader significance and context of AI, e-learning, and the derivative of personalised AI-based e-learning. As technological advancements continue to reshape the landscape of healthcare education, understanding the evolution of these key components becomes imperative. This review not only navigates through the historical trajectory of AI and e-learning within the healthcare sector, but also delves into their amalgamation in personalised AI based e-learning environments.

The literature review encompasses a broad spectrum of studies, theories, and models relevant to the research topic. It explores various technology adoption models, learning style frameworks, and empirical studies; contributing to a nuanced understanding of the complexities and challenges associated with personalised AI-based e-learning. Among the models under scrutiny are the influential Technology-Organization-Environment (TOE) model (Tornatzky and Fleischer, 1990) and the Felder-Silverman Learning Style Model (Felder and Silverman, 1988), each offering unique insights into the conceptual foundation of this research. As this study navigates its journey through the literature, it becomes evident that the synthesis of past research is instrumental in shaping the current study. The ensuing chapters will delve deeper into the adopted methodology, empirical findings, and the overall contribution of the research, to the evolving landscape of AI-based education within healthcare.

2.2. E-learning

2.2.1. E-learning – Definition and Background

Throughout history, the origins of e-learning can be pinpointed to the mid-20th century, marked by the emergence of the idea of leveraging technology for educational purposes (Saner et al., 2023). Nevertheless, the widespread introduction and embrace of e-learning in its contemporary form surged during the late 1990s and early 2000s, coinciding with the widespread availability of the internet and advancements in digital technologies (Saner et al., 2023). Various interpretations exist regarding e-learning, but its fundamental essence revolves around utilising technology to offer online access to educational materials, primarily aimed at enhancing the learning experience (Regmi and Jones, 2020). Therefore, previous studies highlighted that the term "e-learning" has often been used interchangeably with various related terms such as *"web-based learning, online learning or education, computer-assisted or -aided instruction, computer-based instruction, internet based learning, multimedia learning, technology-enhanced learning and virtual learning"* (Regmi and Jones, 2020, p. 2; Cook et al., 2008; Ruiz et al., 2006). This interchangeable use has led to confusion about whether e-learning pertains to the medium, like computer-assisted instruction, or the method of delivery, such as online learning (Regmi and Jones, 2020). This study presents several prior definitions of e-learning as follows:

Mahdavi Ardestani et al. (2023) expressed that *"E-learning refers to the use of electronic technologies and digital platforms to facilitate learning and education remotely"* (p. 3). *Also,* Konstantinidis et al. (2022) stated that "*the term e-learning describes the principles of effective multimedia distance learning using electronic educational technology, resources and data"* (p. 566). In addition, e-learning was defined *"as representing web-based delivery of personalized, interactive, immersive learning content, assisting practitioners with experts, building information communities and linking learner"* (Sinha et al., 2021, p. 122). In the study of Xing

et al. (2020) *"e-learning was defined as online or local network-based learning" (p. 88)*. Furthermore, e-learning was defined *"as any educational intervention that is mediated electronically via the Internet"* (Vaona et al., 2018, p. 5). However, Eze et al. (2018) indicated that *"the term e-learning defines technology mediated and digitally empowered learning that utilizes hardware (e.g., PCs, tablets, printer, digital camera, digital videos, scanner, overhead projector; OHP, and OHP screen), software (operating systems, cloud technologies, applications (apps), writing, editing, MS Office) and (CD textbooks that fall in the category of courseware, OERS, e-content) and others (e.g., USB drives, CD-ROM), whether from a distance or face-to-face classroom setting (PC helped learning), to empower teacher to student interactions"* (p. 3). Additionally, Reeves et al. (2017) related e-learning to *"learning that uses electronic technologies to access educational curriculum outside of a traditional classroom. In most cases it refers to a course or program delivered on an online basis"* (p. 1). McCutcheon et al. (2015) also expressed that *"online learning is recognized as a mode of learning that is technology based and is primarily conducted through the Internet and is exclusive of face-to-face contact with a lecturer"* (p.258).

Therefore, it is believed that e-learning involves utilising electronic technologies and digital platforms to deliver *"personalised, interactive and immersive learning content"* (Sinha et al., 2021) for healthcare staff. E-learning is considered to empower learners to take control of their training and development, providing an opportunity to acquire and retain their knowledge. In the next section, the key features of e-learning within health and social care sectors will be discussed.

2.2.2. E-learning – Key Characteristics

E-learning, as described in definitions and background information, utilises electronic technologies and digital platforms. It is believed that e-learning ought to deliver customised content to actively involve learners and establish an interactive setting that replicates real-world

situations for healthcare personnel. E-learning covers a range of elements designed to customise educational experiences for healthcare professionals based on their unique requirements and preferences. As a result, specific characteristics and principles have emerged in the realm of e-learning. Accessibility is notably highlighted as the core feature that distinguishes e-learning from traditional face-to-face training. This section will discuss these key characteristics of e-learning and expand upon the diverse features that outline its capabilities and functionalities within the health and social care sectors.

2.2.2.1. Accessibility

E-learning offers enhanced accessibility through its flexible scheduling and geographical independence, allowing individuals to access knowledge conveniently (Alfaleh et al., 2023). Ensuring inclusive accessibility is crucial in e-learning; ensuring that courses cater to learners of all physical abilities and disabilities (Mahdavi Ardestani et al., 2023). This accessibility and flexibility augment education, offering healthcare staff an alternative avenue for ongoing professional development (Xing et al., 2020).

2.2.2.2. Cost-effectiveness

E-learning presents a cost-effective and convenient learning method, offering multiple advantages over traditional face-to-face learning. It was mentioned that e-learning significantly reduced expenses related to transportation, accommodation, and potentially, course materials (Gooshi et al., 2014; Alfaleh et al., 2023). Internet-based e-learning emerges as a more convenient and budget-friendly alternative to traditional classroom education (Azlan et al., 2020). They perceived this learning method as an excellent means to deliver conventional lectures and tutorials (Azlan et al., 2020) highlighting its potential cost-effectiveness compared to the traditional face-to-face learning approach (Alfaleh et al., 2023).

2.2.2.3. Assessment and Monitoring

Assessing and monitoring student learning in e-learning systems is a crucial aspect (Liu and Yu, 2023). The use of online technology facilitates a smoother exchange of evaluation and assessment tasks, creating a lasting and accessible record for both learners and instructors (Picciano, 2017). E-learning platforms can; manage online learning, serve as delivery tools, track student activities and assessments, and grant access to digital resources (Azlan et al., 2020). The e-learning system layer incorporates educational resources through functions like course management, user profiles, teaching assessments, and communication tools (Liu and Yu, 2023).

2.2.2.4. Scalability

As technology advances rapidly, e-learning systems expand significantly, requiring a scalable infrastructure capable of managing heightened traffic, users, and applications while easily adapting to evolving business needs (Holme et al., 2023). The scalability of e-learning brings the ability to train thousands of employees concurrently (M and Nazeer, 2023). E-learning platforms, as highlighted by Setia et al. (2019) and Gutierrez et al. (2023) offer a diverse range of advantages that includes flexible access to learning materials, cost-effectiveness, scalability, and reusability, contributing to their adaptability and widespread applicability in diverse learning environments.

2.2.2.5. Collaborative Learning

E-Learning platforms actively encourage interactive and collaborative learning environments. Utilising tools like; discussion forums, virtual classrooms, and social learning features, employees can actively participate in discussions, exchange insights, and collaborate both with peers and instructors (M and Nazeer, 2023). These online platforms facilitate connections among learners from diverse backgrounds, enabling interactions and the exchange of ideas, thereby nurturing a global learning community (M and Nazeer, 2023). Additionally, e-learning

serves as a facilitator for collaboration and communication, facilitating the transfer, sharing, and co-construction of knowledge, along with the exchange of experiences within instructor-learner and peer-to-peer relationships (Chiu and Hew, 2018).

It is evident that e-learning platforms can actively foster interactive and collaborative learning environments through features like discussion forums and virtual classrooms. However, research by Hari Rajan et al. (2024) indicates that the online learning environment itself can contribute to reduced motivation and engagement. Factors such as the absence of immediate feedback, feelings of isolation, and external distractions inherent to remote settings can impede students' ability to stay focused and committed to their studies (ibid). In addition, accessibility is considered as one of the key characteristics of e-learning, but Maita et al.'s (2024) scoping review argue that inadequate internet access and insufficient familiarity with digital tools pose significant challenges in rural regions. As this section discussed some of the key characteristics of e-learning, an overview of the broader landscape of e-learning will be discussed in the following section, examining its diverse applications in education and training in health and social care sectors.

2.2.3. E-learning – Overview of E-learning in healthcare

E-Learning; an innovative educational approach facilitated by electronic technologies, has emerged as a transformative force within the healthcare sector. The evolution of e-learning within healthcare has been marked by significant milestones, transitioning from basic online courses to a sophisticated array of immersive technologies and adaptive learning platforms.

Early applications of e-learning in healthcare primarily focused on delivering didactic content through online modules and videos. However, the landscape has since expanded to encompass a diverse range of educational methodologies. Virtual simulations, augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) are now integrated into e-learning platforms,

providing healthcare professionals and students with immersive, interactive, and practical learning experiences.

Numerous studies have highlighted the advantages of e-learning in healthcare. Its ability to transcend geographical barriers and time constraints makes it a valuable tool for continuous medical education (CME) and training. The flexibility of self-paced learning accommodates the demanding schedules of healthcare professionals while fostering knowledge retention through interactive multimedia content and simulations.

However, alongside its numerous advantages, e-learning in healthcare faces several challenges. The digital divide remains a concern, limiting access to quality education in certain regions or among specific demographics. Additionally, ensuring the credibility and quality of online content poses ongoing challenges, emphasising the need for rigorous evaluation and accreditation processes.

Despite these challenges, the future of e-learning in healthcare appears promising. Technological advancements in AI, personalised learning algorithms, and the integration of immersive technologies are anticipated to revolutionise the educational landscape. These developments are expected to optimise learning experiences, facilitate better skill acquisition, and support the evolution of healthcare practices.

2.2.4. E-learning – Significance

In recent years, the healthcare industry has witnessed a paradigm shift in education and training methodologies, owing to the advent of e-learning. This section delves into the profound impact of e-learning on healthcare; exploring its multifaceted significance in transforming how healthcare professionals are educated, trained, and updated in their fields. A global survey conducted by World Health Organization (2016) illustrated *"the main reasons for using eLearning in pre-service education and in-service training"*, the results are shown in Figure 1.

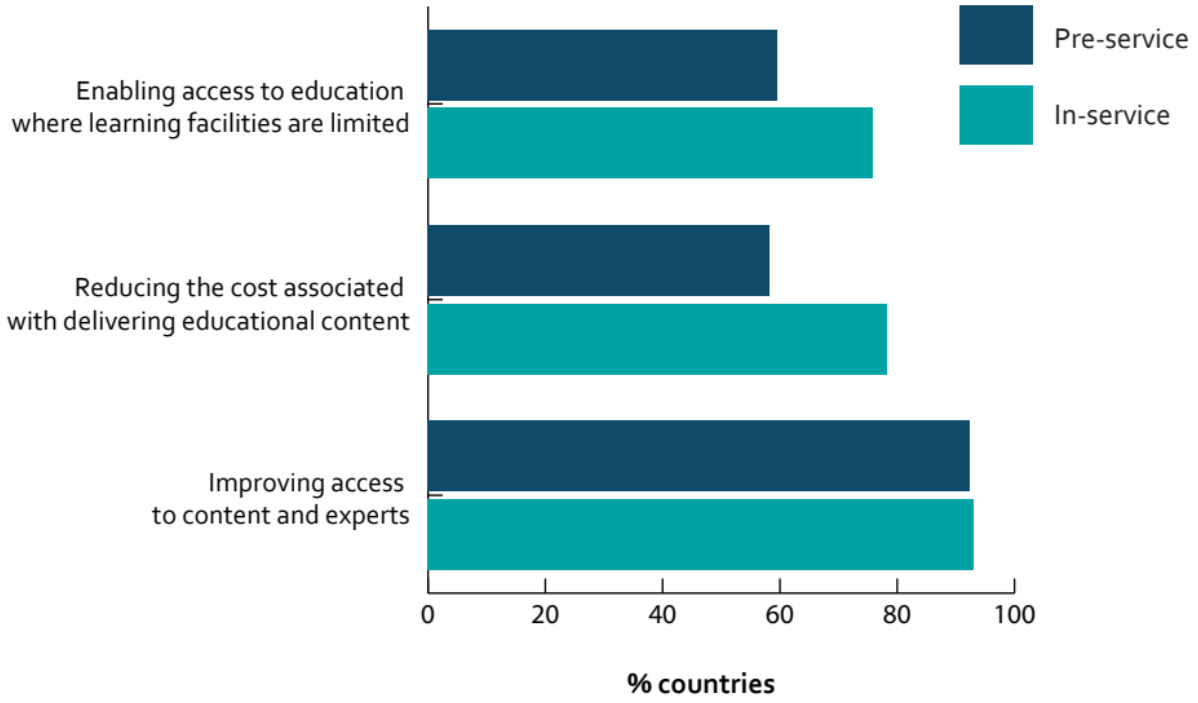

Figure 1: A global survey, "the main reasons for using eLearning in pre-service education and in-service training" (World Health Organization, 2016).

2.2.4.1. Accessibility and Flexibility

E-learning has widened access to education in the healthcare sector. It transcends geographical barriers, providing healthcare professionals with remote access to high-quality educational resources. Its asynchronous nature allows flexibility, enabling practitioners to learn at their own pace, thereby accommodating their demanding schedules. According to Mahdavi Ardestani et al. (2023), the growing daily requirement of individuals for adaptable and efficient learning to enhance their knowledge, results in various alternatives to meet these needs. One such option is online learning or internet-based learning, as the internet provides users with access to limitless information. Also, Omar et al. (2012) pointed out that online learning has significantly increased the accessibility of lifelong learning compared to earlier times.

2.2.4.2. Cost-Efficiency and Scalability

The cost-effectiveness of e-learning cannot be overstated. It significantly reduces expenses associated with traditional training methods, such as travel, accommodation, and printed materials. Moreover, its scalability facilitates the simultaneous training of a large number of healthcare professionals, addressing the industry's growing demand for skilled personnel. The study of Thapa et al. (2021) described distance learning as an effective method due to its capacity to reach remote areas and its contribution to a 51.3% reduction in accommodation and transportation costs. Moreover, Setia et al. (2019) emphasised the importance of cost-effectiveness, scalability, and reusability when opting for online e-learning as opposed to traditional training methods. Consequently, e-learning can be adjusted and applied to multiple training cohorts, leading to a substantial reduction in operational costs (Gutierrez et al., 2023).

2.2.4.3. Standardisation and Consistency

The standardisation of training through e-learning ensures that healthcare professionals receive uniform, up-to-date information, and guidelines, thereby maintaining consistency in the quality of care across diverse healthcare settings. This standardisation contributes to improved patient outcomes and safety. The findings from Hayat et al.'s (2021) study in a medical science university underscored that the standardisation of e-learning is crucial and can impact the evolution of medical e-learning.

2.2.4.4. Interactive Learning and Engaging Experiences

E-learning employs multimedia elements, simulations, case studies, and interactive modules, fostering engaging and immersive learning experiences. Such methods enhance knowledge retention and application, making learning more effective and enjoyable for healthcare professionals. Mahdavi Ardestani et al. (2023) articulated that a crucial element influencing learners' involvement in virtual learning settings is the presence of effective teaching. Hence, a thoughtfully crafted e-learning environment plays a pivotal role in enhancing the engagement

and enjoyment of learners. Furthermore, Leinster et al. (2021) proposed that online learning, particularly when characterised by high interactivity; can enhance clinical training experiences. In addition, Figure 2 explains the benefits of using interactive and animated e-learning in healthcare:

Figure 2: benefits of using interactive and animated e-learning in healthcare (Sanal, 2018).

E-learning has emerged as a cornerstone in healthcare education, revolutionising how knowledge is acquired, disseminated, and applied in the field. Its far-reaching impact on accessibility, cost-efficiency, standardisation, adaptability, engagement, and continuous education, signals a future where healthcare professionals are empowered to deliver superior care through lifelong learning facilitated by innovative e-learning technologies. Moving forward, the following section will explore the abundant advantages of e-learning, clarifying its diverse benefits in revolutionising education and training within the healthcare sector.

2.2.5. E-learning – Advantages of e-learning in healthcare training

In recognising the profound significance of integrating e-learning within healthcare education, it becomes evident that this innovative method offers diverse benefits. According to Setia et al.

(2019); online platforms present several advantages over traditional methods, including flexible access to learning materials, cost-effectiveness, and improved accessibility and reusability. A study examining medical students' perspectives of online learning in Northern India, as indicated by Uma et al. (2020), showcased the advantages of e-learning compared to face-to-face instruction. Figure 3 in the study illustrated these benefits, consolidating *"structured schedule"* and *"convenience"* under accessibility, *"ease for reserved students"* and *"learning pace"* under flexibility, and *"cost-saving"* under cost-effectiveness (Uma et al., 2020, p. L7). Notably, the majority of medical students viewed these aspects as significant benefits of e-learning.

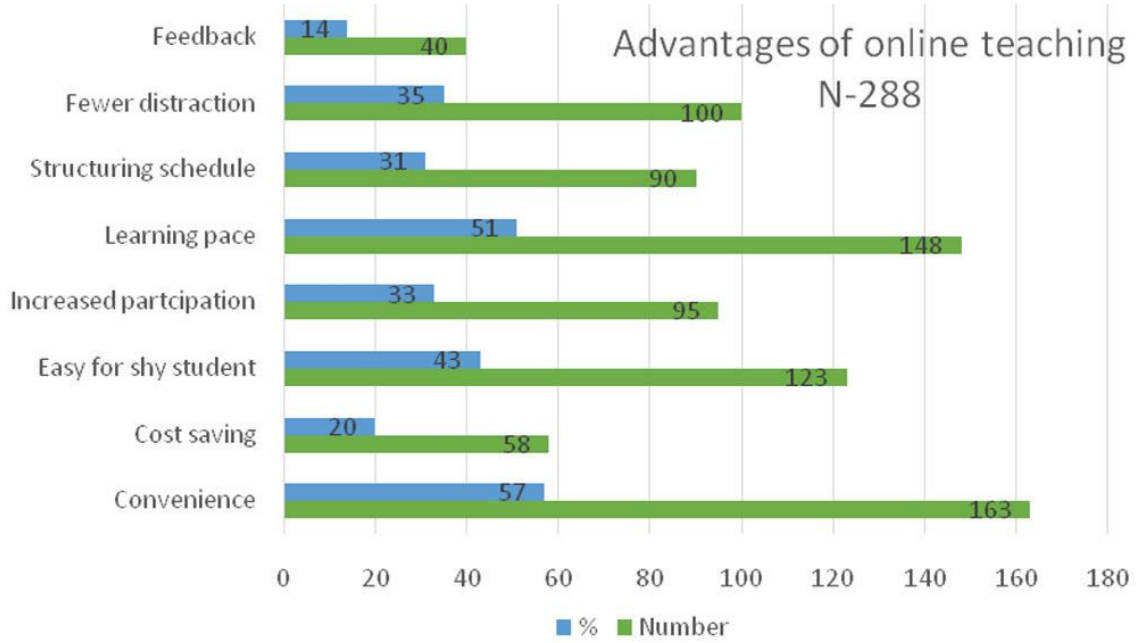

Figure 3: Advantages of e-learning stated by medical students in Northern India (Uma et al., 2020, p. L7).

2.2.5.1. Accessibility

E-Learning platforms serve as dynamic tools for keeping learning materials current, granting access to the most recent information and resources. Organisations can swiftly update training content to align with the latest trends and advancements, ensuring employees are equipped with

the most up-to-date skills and knowledge (M and Nazeer, 2023). Setia et al. (2019) highlighted the flexibility of online platforms in providing access to learning materials and their reusability, offering extensive access to information. Moreover, Alfaleh et al. (2023) emphasised how online education facilitates tailored access to clinical knowledge, catering to the specific preferences of registered nurses in their daily nursing practice.

2.2.5.2. Flexibility

Recent studies examining the perspectives and experiences of registered nurses regarding e-learning have emphasised that online education offers crucial advantages; notably providing flexibility in time and location for staff (Alfaleh et al., 2023). The challenges posed by heavy workloads, time constraints, and geographical limitations in the healthcare sector underscore the value of such flexible learning approaches (Alfaleh et al., 2023). Researchers have consistently highlighted the pivotal role of time and geographical flexibility in driving the adoption of e-learning among healthcare staff (Alfaleh et al., 2023; Xing et al., 2020; Bahrambeygi et al., 2018; Laukkanen et al., 2022). Additionally, e-learning has been recognised for its capacity to allow learners to revisit challenging material, review content as needed, and dedicate extended time to subjects requiring in-depth study (M and Nazeer, 2023). On a broader scale, e-learning transcends the limitations of time and place, facilitating access to training materials for employees across different countries and time zones, enhancing convenience and accessibility (M and Nazeer, 2023).

2.2.5.3. Cost-effectiveness

E-Learning platforms present considerable cost-effectiveness in contrast to traditional training methods. By eliminating the necessity for *"physical classrooms, travel expenses, and printed materials"*, organisations stand to achieve substantial cost savings (M and Nazeer, 2023, p. 592). The scalability of e-Learning allows for the efficient training of a large number of

employees without extra financial burdens. Furthermore, the expense associated with developing and updating E-Learning content often proves to be more economical than the continuous delivery of face-to-face training (M and Nazeer, 2023). Setia et al. (2023) emphasised that online platforms, adaptable for various training groups, have the potential to notably reduce operational costs. Alfaleh et al.'s (2023) research on registered nurses (RNs) found that online education offered cost-effective advantages over traditional face-to-face learning methods.

In summation, the advantages presented by e-learning in the healthcare domain represent its transformative potential. The accessibility, flexibility, and cost-effectiveness of e-learning platforms have emerged as key drivers towards revolutionising the landscape of healthcare education and professional development. However, amid the vast array of advantages that e-learning brings to the forefront of healthcare education, it is crucial to acknowledge the nuanced disadvantages that accompany this innovative approach. The following section will explore these limitations to gain a comprehensive understanding of the multifaceted nature of e-learning, and to formulate effective solutions in harnessing its full potential within the healthcare sector.

2.2.6. E-learning – Disadvantages of e-learning in healthcare training

In the realm of healthcare education, the integration of e-learning methodologies has marked a new era of accessibility, flexibility, and efficiency. However, as with any transformative shift, the adoption of e-learning in healthcare is not without its challenges. This chapter delves into the nuanced landscape of disadvantages associated with e-learning in the healthcare sector. While the digital frontier has opened avenues for widespread education, its limitations become apparent when compared against the intricate demands of healthcare training and practice. From the necessity of hands-on experiences to technical challenges, this chapter explores the multifaceted drawbacks that may moderate the otherwise promising prospects of e-learning in

healthcare. Understanding these challenges is crucial for educators, administrators, and policymakers as they navigate the dynamic intersection of technology and healthcare education.

2.2.6.1. Lack of Hands-on Training

Azlan et al. (2020) identified limitations in delivering certain components of Teaching and Learning (T&L) in the postgraduate medical physics domain due to its clinical and practical nature. Moreover, Chaudhary et al. (2022) conducted a study revealing that 91.5% of students in health sciences expressed their inability to acquire practical skills adequately through online teaching methods. This corroborates the persistent challenge highlighted by Chaudhary et al. (2022) regarding the efficacy of online instruction in imparting practical skills, thereby emphasising the potential disadvantage of online teaching methodologies in facilitating hands-on learning experiences. Also, Bączek et al. (2021) declared that e-learning is less effective in terms of increasing clinical skills within Polish medical students, Figure 4.

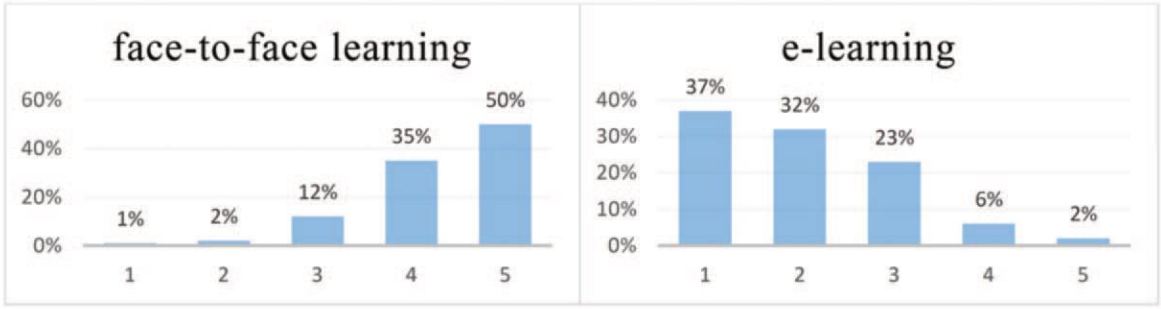

Figure 4:Polish medical student perception on the ability to increase clinical skills during face-to-face and e-learning. Likert scale: 1=definitely ineffective, 5=definitely effective (Bączek et al., 2021, p. 3).

2.2.6.2. Limited Interactivity

In Uma et al.'s (2021) investigation; medical students highlighted the absence of face-to-face interaction and limited engagement with instructors as a primary drawback of e-learning. This sentiment aligns with the findings of Găman et al. (2020), who emphasised the indispensable nature of learning directly from patients in a clinical environment within medical education, suggesting that distance learning cannot fully replace this crucial aspect. Furthermore, Bączek et al. (2021) revealed that a significant majority of medical students; around 70%, identified the lack of interaction with patients as a major disadvantage of e-learning, particularly during the challenges imposed by the COVID-19 pandemic, Figure 5.

Figure 5: Interactivity of Polish medical students during face-to-face and e-learning (Bączek et al., 2021, p. 4).

These collective insights underscore the consistent concern among medical learners regarding the limitations of e-learning in facilitating essential face-to-face interactions and direct patient engagement critical to their educational experience.

2.2.6.3. Lack of Social Interaction

Leinster et al. (2021) identified a potential drawback associated with e-learning, emphasising the isolated nature of individualised student-computer interactions. Uma et al.'s (2021) study reported that during the COVID-19 period, 51% of medical students cited social distancing as a constraining factor impacting their engagement with e-learning platforms. Additionally, Wu et al. (2022) highlighted the potential limitation of e-learning environments in concealing

emotional facets inherent in interactions with instructors or peers, such as the expression of mood or non-verbal cues; characteristics typically present in collaborative learning settings. Consequently, this absence of emotional connectivity might engender a perception of disadvantage among learners, potentially reducing their inclination to actively utilise e-learning courses (Wu et al., 2022). In addition, Bączek et al. (2021) illustrated medical students' perceptions on the ability to increase social skills during face-to-face learning vs. e-learning, Figure 6. The survey declared that face-to-face learning is an effective method of increasing students' social skills compared to e-learning (Bączek et al., 2021).

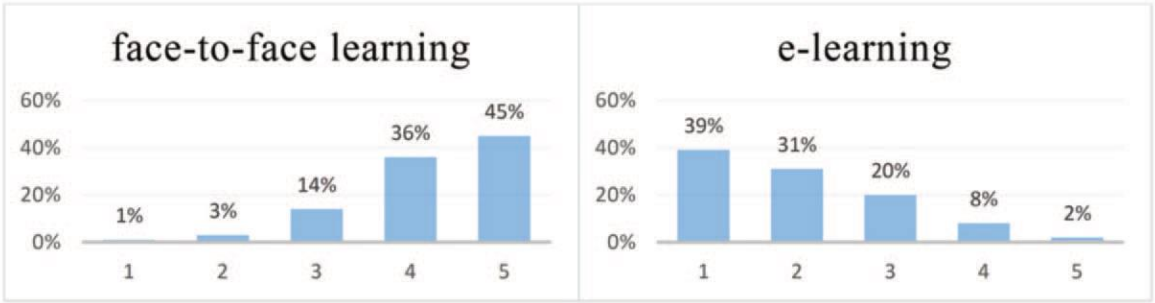

Figure 6: Polish medical student perception on the ability to increase social skills during face-to-face and e-learning. Likert scale: 1=definitely ineffective, 5=definitely effective (Bączek et al., 2021, p. 3).

2.2.6.4. Technical Challenges

The primary challenges encountered by learners in the realm of e-learning were predominantly associated with internet-related issues and technical hindrances (Thapa et al., 2021; Almaiah et al., 2020; Subedi et al., 2020). Kynge's (2020) research specifically within healthcare workers reiterated the prevalence of poor internet connectivity and limited computer access as principal drawbacks of e-learning. Furthermore, a survey involving 804 medical students during the COVID-19 era, emphasised the widespread occurrence of technical problems concerning IT equipment, with 54% of students citing this as a major disadvantage in the context of online learning (Bączek et al., 2021).

In closing, while e-learning in healthcare presents valuable advantages, its limitations emphasise the importance of blending digital resources with hands-on experiences and interpersonal learning. Addressing these limitations collaboratively enables a more well-rounded approach to prepare healthcare professionals effectively. Striking a balance between digital innovation and traditional methods is key for equipping future practitioners with the skills and empathy needed in their field. As the focus shifts from the disadvantages of e-learning in healthcare, the next chapter will explore the specific challenges that arise in the implementation and adaptation of these digital methodologies within the complex and dynamic healthcare landscape.

2.2.7. E-learning – Challenges and complexities

In the dynamic landscape of healthcare education, the integration of e-learning has brought about significant advancements, yet concurrently posed complex challenges. This section embarks on an exploration of the intricate challenges embedded within the realm of e-learning specific to healthcare. As healthcare increasingly embraces digital learning, a spectrum of hurdles emerges, ranging from technological limitations to pedagogical nuances. This examination aims to dissect these challenges comprehensively, shedding light on their multifaceted nature and implications.

2.2.7.1. Learning Style Adaptation

In a recent study conducted at the College of Medicine, researchers delved into the perceptions of teaching staff concerning the implementation of e-learning methods. Interestingly, one of the key findings of this investigation, led by Osman Abdelmola et al. (2021), revealed a surprising challenge in the realm of e-learning design. Specifically, it uncovered an unexpected hurdle associated with the creation of educational materials tailored to meet the diverse learning needs of students with varying abilities. This unanticipated complication highlighted the

complexities and nuances inherent in crafting e-learning content that caters effectively to the diverse learning spectrum within the student body.

2.2.7.2. Technical Issues and Accessibility

Mahdavi Ardestani et al. (2023) believed that *"there has always been frustration with technological issues among learners"* (p. 2). These issues encompass a range of barriers affecting e-learning, such as inadequate internet access, infrastructure limitations, and subpar internet quality (Al-Balas et al., 2020). Subedi et al.'s (2020) research underscores the critical role of technological factors in influencing the usage of e-learning systems, with over half of the students (63.6%) experiencing disruptions due to internet-related problems. Moreover, Kynge (2020) emphasises the repercussions of limited access to computers in clinical settings, which can lead to constraints, unreliability, and inefficiency in utilising online learning resources. Furthermore, Hayat et al. (2021) documented significant challenges within e-learning caused by infrastructural deficits. They detailed unpleasant encounters related to *"internet speed, uploading information on e-learning systems, downloading the contents, and weak support"* (Hayat et al., 2021, p. 11).

2.2.7.3. Content Quality

In the examination of e-learning challenges faced by nurses in China, Xing et al. (2020), they deduced that a significant obstacle lies in the lack of enthusiasm for the available courses. They posited that the content quality itself could be a contributing factor, potentially hindering both the understanding and active participation of the learners. Furthermore, Xing et al. (2020) noted a prevailing issue concerning health-related open courses tailored for nurses, which are frequently presented in English. This linguistic disparity often serves as an obstacle, resulting in diminished interest and engagement among the nursing community. Consequently, the language barrier acts as a formidable barrier, limiting accessibility and reducing the appeal of these educational opportunities for nurses.

2.2.7.4. Tech Literacy

Xing et al. (2020) highlighted that in their study, the primary hindrance dissuading nurses from engaging in e-learning was their limited understanding of computers. They noted that nurses without prior e-learning exposure faced more significant barriers, particularly stemming from unfamiliarity with e-learning and its platforms. Similarly, Alfaleh et al. (2023) observed a deficiency in digital literacy among registered nurses, identifying it as an obstacle to e-learning adoption. Furthermore, challenges such as inadequate information technology skills, technical complications with online resources, software limitations, and the need for training and practical support have all been recognised as significant issues in the realm of e-learning (Guven Ozdemir and Sonmez, 2021).

2.2.7.5. Lack of Personal Interaction

In Hayat et al.'s (2021) research, participants voiced a primary concern centred on the creation of meaningful interactions aimed at maximising the learning experience. The study sheds light on the participants' struggle with carving out adequate time dedicated to interactions and active engagement. This limitation in time allocation directly affected their ability to participate fully, hindering their capacity to foster effective learning interactions within the educational context.

2.2.7.6. Self-Motivation and Discipline

The shift from physical classrooms to a complete e-learning setup can present students with a myriad of challenges, as outlined in Azlan et al.'s (2020) study. Among the reported difficulties were a notable decrease in overall morale, a substantial loss of motivation, and considerable struggles in maintaining concentration and focus while navigating the online learning environment (Azlan et al., 2020). Moreover, in a comprehensive exploration of e-learning challenges within the medical student community in Pakistan, Qamar et al. (2021) clarified on a crucial issue faced by educators. They highlighted the significant challenge of ensuring active engagement among learners during online classes. This challenge originated from multifaceted

factors, including the lack of inherent self-motivation among students, difficulties in cultivating patience, inadequacies in self-discipline, and the broader classroom discipline in an online setting (Qamar et al., 2021). The intricate interplay of these factors made it particularly challenging for instructors to foster an engaging and participatory learning atmosphere within the virtual classroom.

In conclusion, the landscape of e-learning in healthcare presents a number of challenges, ranging from technological barriers to the complexities of instructional design and engagement. However, within these challenges lie opportunities for innovation and growth. By addressing these hurdles through collaborative efforts, technological advancements, and tailored pedagogical strategies, the potential for enhancing the efficacy and accessibility of healthcare education via e-learning becomes ever more tangible. The following section will explore the impact of e-learning on healthcare staff competency, delving into the transformative effects of digital education on the skills, adaptability, and professional competence of healthcare practitioners. The journey continues as this study unravels the profound implications of e-learning in shaping a more competent and resilient healthcare workforce.

2.2.8. E-learning – Impacts on Healthcare Staff Competency

This chapter has extensively explored the advantages, disadvantages, and challenges associated with e-learning in the healthcare sector. However, it is imperative to recognise the profound impact of e-learning on healthcare staff. This recognition is fundamental for facilitating continual improvements, optimising resources, and ensuring that educational programs align with the evolving needs of learners and healthcare organisations.

2.2.8.1. Positive Impacts

2.2.8.1.1. Flexible and Accessibility of e-learning

Findings from Chinese nurses indicated that regardless of prior e-learning exposure, the primary motivators for engaging in e-learning were identified as; the flexibility offered in terms of both time and location (Xing et al., 2020). This inclination was thought to be attributed to the predominantly female demographic among nurses, enabling them to better balance learning alongside work and familial obligations (Xing et al., 2020). Thapa et al. (2021) demonstrated through their study that respondents perceived distance learning as effective, particularly due to its capacity to reach remote areas and reduce travel expenses. Additionally, Regmi and Jones (2020) asserted that e-learning significantly contributed to enhancing learning and performance, owing to its adaptable and accessible nature. Specifically, their study revealed a notable enhancement in nurses' diagnostic accuracy in fundus examination, compared to the conventional lecture-based teaching method (Regmi and Jones, 2020).

2.2.8.1.2. Cost-effectiveness

E-learning serves as a viable option for individuals situated in remote or hard-to-access areas, addressing challenges associated with reaching physical classrooms and mitigating travel expenses (Thapa et al., 2021). Furthermore, Gutierrez et al. (2023) highlighted the adaptability of online platforms for diverse training groups, emphasising their potential to significantly cut operational costs. According to Xing et al. (2020); e-learning could emerge as a more accessible and efficient avenue for ongoing education among Chinese nurses, potentially requiring fewer considerations regarding financial support limitations. Additionally, Saint-Marc et al. (2019) asserted that online learning not only proves effective as a teaching method for nurses, but also diminishes training expenses by enabling broader implementation, accelerated deployment, and flexible scheduling.

2.2.8.1.3. Up-to-Date Information

It was conveyed that a diverse array of electronically delivered resources, such as; video content, interactive simulations, easily modifiable written resources, and various types of assessments for both learning and evaluation purposes, ensured staff remained current with the latest information (Regmi and Jones, 2020; Leinster et al., 2021). Saint-Marc et al. (2019) noted that *"in most French hospitals, syringe pump use is not formally taught or evaluated during initial staff training because of the complexity of traditional training"* (p. 7). However, they highlighted the effectiveness of online learning, facilitated by advancements in multimedia technologies, as an efficient approach to teach syringe pump operation.

2.2.8.1.4. Continual Professional Development

Previous research studies have highlighted that Healthcare Professionals (HCPs), particularly those in rural or remote regions, can utilise technology as a means to pursue ongoing professional growth (Riley and Schmidt, 2016; Esteva et al., 2019; Mahdavi Ardestani et al., 2023). Consequently, e-learning has been recognised as a solution to address the challenges associated with accessing continuous professional development (Mahdavi Ardestani et al., 2023). Moreover, investigations involving healthcare students have indicated that those engaged in e-learning exhibited comparable knowledge levels and higher satisfaction compared to peers involved in traditional classroom settings (George et al., 2014; Xing et al., 2020). Hence, e-learning has demonstrated its potential advantages in the realm of learning, providing nurses with an additional avenue for ongoing education (Xing et al., 2020).

2.2.8.2. Negative Impacts

2.2.8.2.1. Lack of Hands-On Experience

E-learning may not provide hands-on practical experience, which is crucial for certain healthcare competencies. For skills that require physical practice, such as clinical procedures or patient interaction, solely relying on e-learning might result in a deficiency of practical

competence. Moreover, the absence of hands-on components in e-learning may influence healthcare staff's inclination to embrace e-learning over traditional training approaches. Thapa et al. (2021) noted that despite more than half of the 470 nursing students in Nepal expressing positivity towards e-learning; nursing students exhibited a preference for traditional face-to-face learning, due to the lack of practicality in e-learning. Figure 7 illustrates the motivation levels of medical students before and during the COVID-19 pandemic. According to Sutoi et al. (2023); Romanian medical students believed that the lack of in-person communication and hands-on learning opportunities, resulted in *"decreased motivation, disengagement, and reduced learning outcomes"* (p. 1083). They asserted that the absence of hands-on experience, particularly during the COVID-19 period, posed a negative impact for students in clinical fields, where substantial hands-on experience is often essential for skill and competency development.

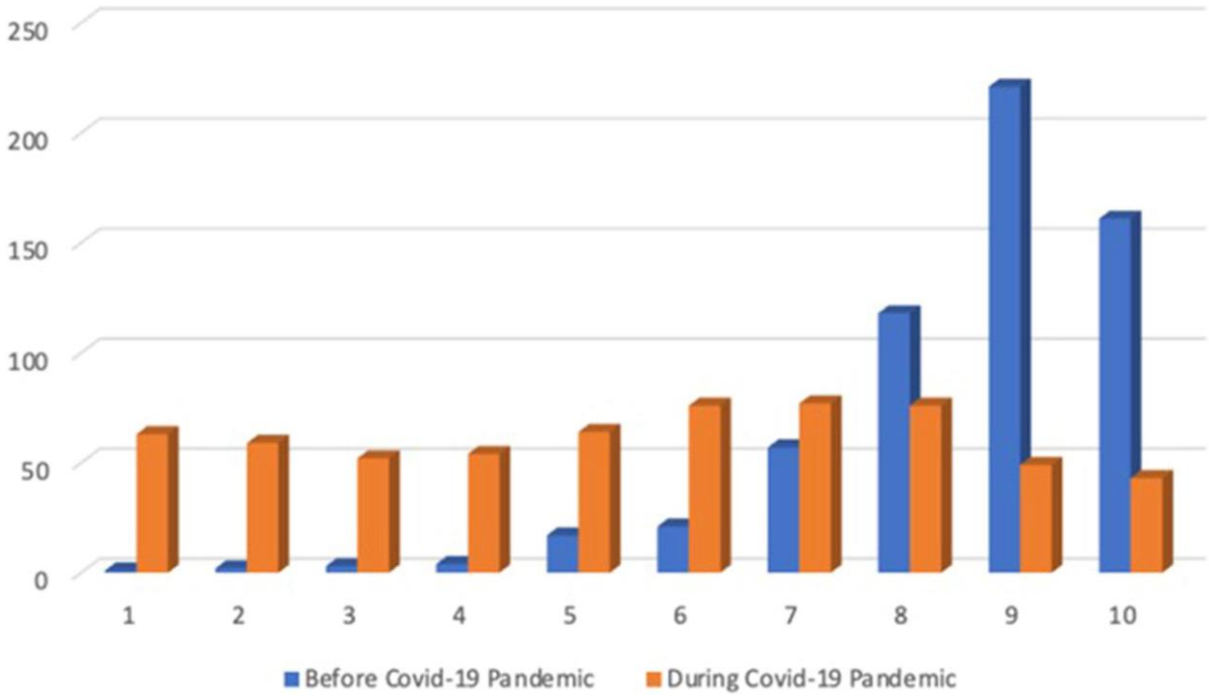

Figure 7: "Level of motivation to learn before and during COVID-19 pandemic on a scales from 1 to 10 (1 being the lowest and 10 the highest score)" (Sutoi et al., 2023, p. 1081).

2.2.8.2.2. Technological Barriers

Not all healthcare professionals may have equal access to technology or be comfortable with e-learning platforms. Technological barriers could hinder the participation and engagement of some staff members, affecting their ability to acquire and apply new competencies. According to Mahdavi Ardestani et al. (2023), healthcare professionals situated in remote or rural areas encounter obstacles such as, *"limited access to educational resources, lack of reliable internet connectivity, geographical isolation, and limited availability of specialized training programs and instructors"*. These obstacles not only restrict access to e-learning opportunities, but also hinder their professional development. Additionally, Al-Balas et al. (2021) observed that the absence of internet access, inadequate infrastructure, and poor internet quality, adversely affected medical students, thus interfering with the effective implementation of e-learning. Additionally, Regmi and Jones (2020) introduced a conceptual framework illustrating the factors that influence e-learning in health science education, as represented in Figure 8.

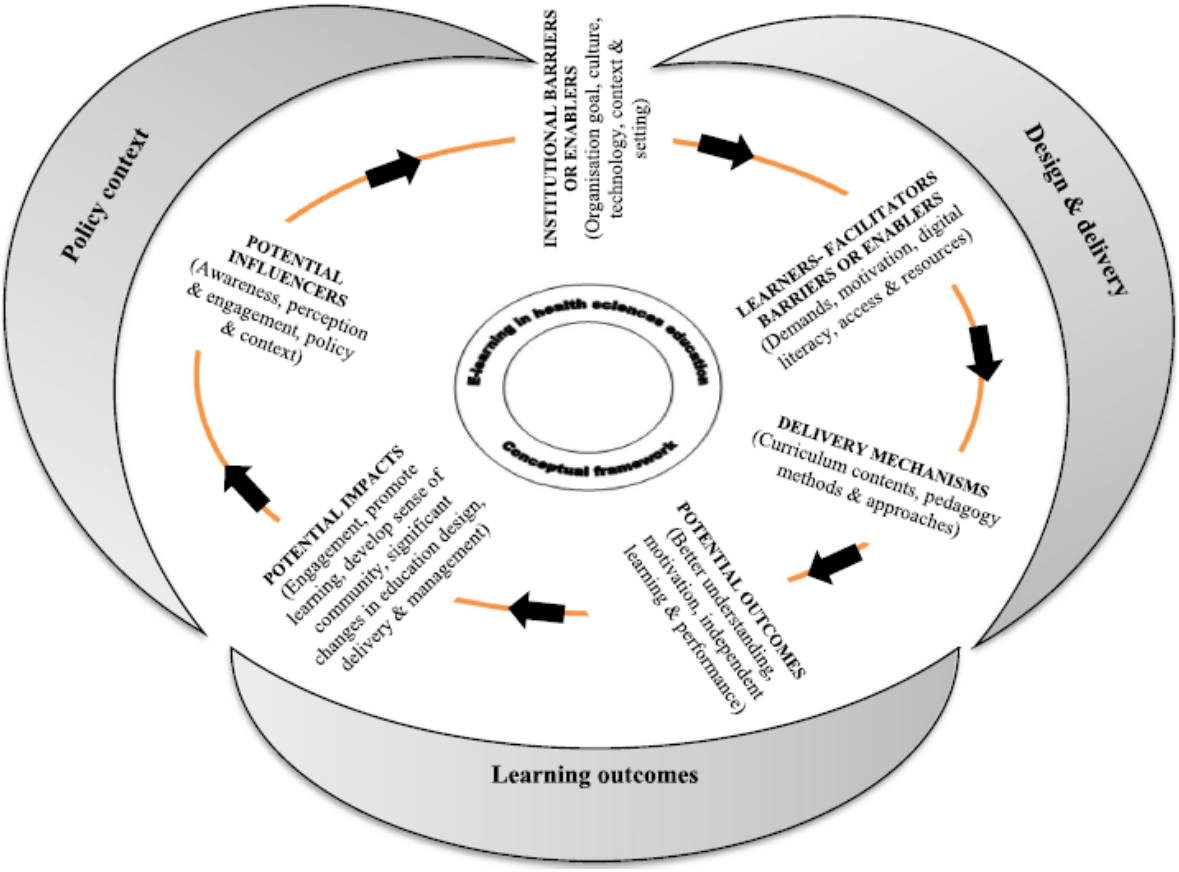

Figure 8: Factors presented by Regmi and Jones (2020) that influence e-learning in health sciences education (p. 9).

This E-learning section offered a comprehensive insight into e-learning within healthcare, exploring its features and significance. The research discussed both the advantages and disadvantages of e-learning in this field, and examined the complexities and hurdles faced by healthcare organisations in adopting e-learning. After assessing its impacts on the proficiency of healthcare personnel, the following section will investigate the role of AI in enhancing e-learning within the healthcare sector.

2.3. Artificial Intelligence (AI) – Insights

2.3.1. Artificial Intelligence – Definition and Background

AI has undergone advancements since Christopher Strachey developed the first AI program in 1951. During its early stages, AI was predominantly a subject of academic research (Alowais,

et al., 2023). AI possesses a history that extends beyond common perception, but its contemporary form is significantly influenced by Alan Turing (Turing, 1950) and the 1956 Dartmouth College conference (McCorduck, 2004). It was during this conference that the term "Artificial Intelligence" was officially coined and defined by John McCarthy; the start of the modern AI era. During the 1960s and 1970s, AI research centred on rule-based and expert systems, but this approach was constrained by limited computing power and data availability (McCorduck, 2004). In the 1980s and 1990s, AI research pivoted towards machine learning and neural networks, enabling machines to learn from data and enhance their performance over time. This era included notable advances like IBM's Deep Blue, which defeated world chess champion Garry Kasparov in 1997. In the 2000s, AI research further advanced, concentrating on natural language processing (NLP) and computer vision, which paved the way for virtual assistants like Apple's Siri and Amazon's Alexa to understand and respond to natural language requests (Russell, 2010; McCorduck, 2004). AI is now reshaping healthcare and numerous other sectors, with its role only expected to increase. In education, AI has enabled the creation of intelligent tutoring systems—programs that adapt to each student's unique needs—leading to improved learning outcomes in areas like math and science (Alowais et al., 2023). In healthcare, AI has been applied to develop diagnostic tools and personalised treatment plans. As AI technology advances rapidly, its applications in clinical settings offer the potential to revolutionize healthcare delivery. Alowais et al. (2023) illustrated *"the historical journey of Artificial Intelligence"* from 1942 to 2020, Figure 9.

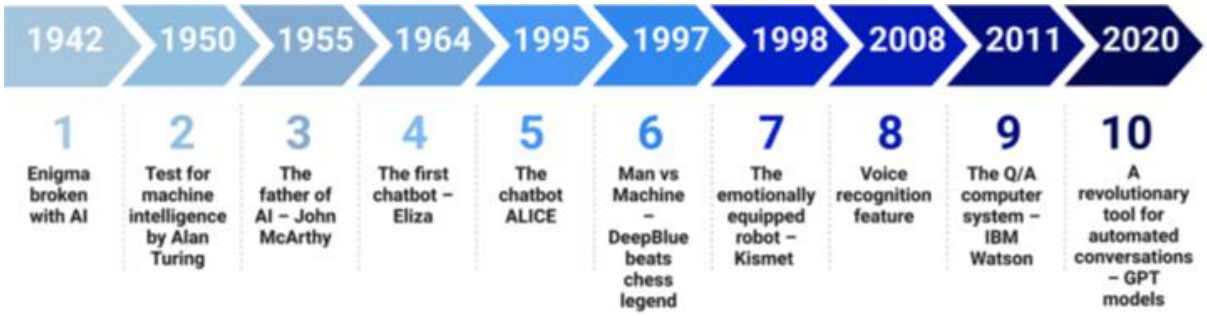

Figure 9: The historical journey of Artificial Intelligence (Alowais et al., 2023).

Despite its extensive history, defining AI remains challenging, and the existence of various definitions of artificial intelligence contributes to potential confusion (Sheikh et al., 2023). Some AI definitions in primary studies are stated here, and the complete list can be found in the article by Collins et al. (2021).

Kaushik et al. (2023) defined that *"when the quality to rationalize the scenarios and take decisions accordingly is mimicked by the models or systems, is called Artificial Intelligence (AI)" (p. 55).* In addition, Artificial Intelligence (AI) was defined that as *"the ability of computers to mimic higher cognitive processes of humans, such as the ability to reason, perceive, generalize and learn experientially"* (Rizvi and Zaheer, 2022, p. 118). Furthermore, Sinha et al. (2021) expressed that *"Artificial intelligence (AI) aims to imitate the human mind through technology. This means that it is an attempt to recreate human intelligence through machines. Machines can be programmed to perform, think and act like humans using AI. AI is the simulation of human intelligence in machines" (p. 107).* Moreover, AI was defined *"as the frontier of computational advancements that references human intelligence in addressing ever more complex decision-making problems"* (Berente et al., 2021, p. 1433). Also, Longoni (2019) used *"the term AI to refer to any machine that uses any kind of algorithm or statistical model to perform perceptual, cognitive, and conversational functions typical of the human mind" (p. 630).* Duan et al. (2019) stated that AI is *"the ability of a machine to learn from experience,*

adjust to new inputs and perform human-like tasks" (p. 2). Further, Rai et al. (2019) pointed that *"AI is typically defined as the ability of a machine to perform cognitive functions that we associate with human minds, such as perceiving, reasoning, learning, interacting with the environment, problem solving, decision-making, and even demonstrating creativity" (p. 3)*. Moreover, Plastino and Purdy (2018) defined AI as *"a capital–labor hybrid, which confers the ability to augment human labor at scale and speed, self-learn and continuously improve over time" (p. 18)*. Also, Artificial Intelligence (AI) was described as *"IT systems that sense, comprehend, act and learn"* (Kolbjørnsrud et al., 2017, p. 37).

Therefore, it is believed that Artificial Intelligence involves creating machines capable of exhibiting varying degrees of intelligence, enabling them to execute tasks, whilst resembling human abilities such as cognition, acquiring knowledge, decision-making, and adapting to their surroundings. To achieve this level of intelligence in an e-learning machine; understanding human perception and cognition is crucial for providing personalised learning materials that match human learning styles. In the upcoming section, the researcher will delve into some of the key characteristics of AI.

2.3.2. Artificial Intelligence – Key Characteristics

Artificial intelligence, as outlined in definitions and descriptions, involves developing machines capable of exhibiting a certain level of intelligence. These machines possess the capability to execute *"human like functions, including cognitive, learning, decision making, and adapting to the environment"* (Chen et al., 2020, p. 75267). Consequently, distinct characteristics and principles emerge as essential within AI. The capacity for intelligence or machine proficiency to demonstrate some level of intellect and perform an extensive array of human-like functions and abilities, stands out as a fundamental characteristic derived from this definition and discourse on AI. The upcoming section will discuss these key characteristics of

AI, and elucidate the diverse features that outline its capabilities, functionalities, and behaviours.

2.3.2.1. Adaptability

AI systems can adapt to new data and changing circumstances, improving their performance over time without explicit programming. Pokrivcakova (2019) noted that within education, AI manifests as intelligent systems equipped with adaptive capabilities. The author also emphasises AI's integration into education, citing machine translation tools, adaptive education systems, and intelligent tutoring systems as means to enhance the learners' experience. AI achieves personalisation and content customisation for individual learners based on their capabilities and specific needs (Pokrivcakova, 2019).

2.3.2.2. Learning

AI can learn from experience and data, refining its algorithms and improving its decision-making abilities. AI's learning attributes, such as recommendation systems, deliver personalised service assistance to users by understanding their past actions and forecasting their present product preferences (Zhang et al., 2021). These recommendation systems heavily depend on data, serving as the foundation for models produced through machine learning (ML) methods, aiming to anticipate user preferences (Horváth and de Carvalho, 2017). However, the precision of these forecasts noticeably relies on the quality and quantity of available data (Khanal et al., 2020).

2.3.2.3. Autonomy

AI systems possess the capability to continuously learn independently, driven and initiated by themselves, rather than necessitating periodic offline retraining prompted by human engineers (Liu et al., 2023). A genuinely intelligent system should have the capacity to learn within the open world autonomously and continuously, self-initiating the learning process after

deployment. It should adapt to the dynamic nature of the world, continuously expanding its knowledge and capabilities over time to enhance its power (Liu et al., 2023).

2.3.2.4. Natural Language Processing (NLP)

Aimed at developing a comprehensive theory of human language understanding, NLP strives, not only to create language technology, but also to ensure linguistic meaningfulness and cognitive plausibility in its applications (Lenci and Padó, 2022). Liu et al. (2023) highlighted that NLP endeavours to construct language-specific programs for machines, enabling them to comprehend and employ languages effectively. This field encompasses various levels of linguistic elements, encompassing *"characters, senses, words, phrases, sentences, paragraphs, and documents"* (Liu et al., 2023, p. 4). NLP primarily concerns itself with comprehending and processing these linguistic elements, posing a significant challenge in accurately modelling the intricate compositional patterns inherent in language structures (Liu et al., 2023).

2.3.2.5. Perception

"perception is the interaction interface between an intelligent system and the real world" (Tian et al., 2017, p. 58). Similar to how humans possess visual, auditory, taste, and other sensory systems; perception in an AI system usually commences with sensor data in diverse modalities and formats. Therefore, the creation of advanced artificial intelligence (AI) systems is unattainable without sophisticated and flexible perceptual capabilities (Tian et al., 2017).

2.3.2.6. Decision-Making

AI algorithms commonly utilise computerised predictive analysis techniques to sift through, organise, and detect patterns within extensive datasets sourced from multiple origins. This process enables them to furnish probability analyses, aiding in fast and well-informed decision-making (Lysaght et al., 2019).

2.3.2.7. Efficiency and Scalability

Managing substantial data throughputs is crucial for unlocking the full potential of AI, necessitating the expansion of computational infrastructure, and enhancing the capability of AI algorithms to process extensive volumes of data (Stevens et al., 2020). It is essential to have AI algorithms that demonstrate scalability in terms of intelligence and consistent performance, particularly when dealing with extensive data volumes or heightened user interactions (Stevens et al., 2020). With the ongoing increase in data volumes, there's a demand for improved, precise computational methods that effectively and promptly handle the rising complexity inherent in modern technological applications (Stevens et al., 2020).

The following section will provide an overview of AI's applications in learning and training within the healthcare sector.

2.3.3. Artificial Intelligence – Overview of AI in Healthcare

As it is discussed earlier, AI is revolutionising various sectors, including healthcare, finance, and transportation, with its influence prepared to expand further. AI is rapidly advancing within healthcare, with numerous applications developed to tackle the most urgent challenges currently encountered by health organisations (Chen and Decary, 2020), Potentially transforming healthcare services (Alowais et al., 2023). In addition, there exists an urgent need to tackle the strain on healthcare systems. Embracing and expanding the use of AI could potentially alleviate the scarcity of human resources in the sector (Rizvi and Zaheer, 2022). AI is believed to offer immediate solutions to various challenges confronting healthcare systems worldwide, including shortages of healthcare professionals, the aging and burnout physicians, and increased demand for managing chronic diseases (Rizvi and Zaheer, 2022). The World Health Organization (WHO) projected a deficiency of 18 million healthcare providers based on needs by 2030, primarily in developing and underdeveloped nations (WHO, 2024). In

addition, Figure 10 illustrates that there are anticipated shortages in the healthcare workforce on a global scale.

Figure 10: Anticipated shortages in the healthcare workforce on a global scale (Australian Digital Health Agency, 2019).

Therefore, researchers and healthcare professionals are devoting their attention to artificial intelligence (AI) within the healthcare sector (Secinaro et al., 2021). In addition, Alowais et al. (2023) presented the relationship between AI applications in Figure 11.

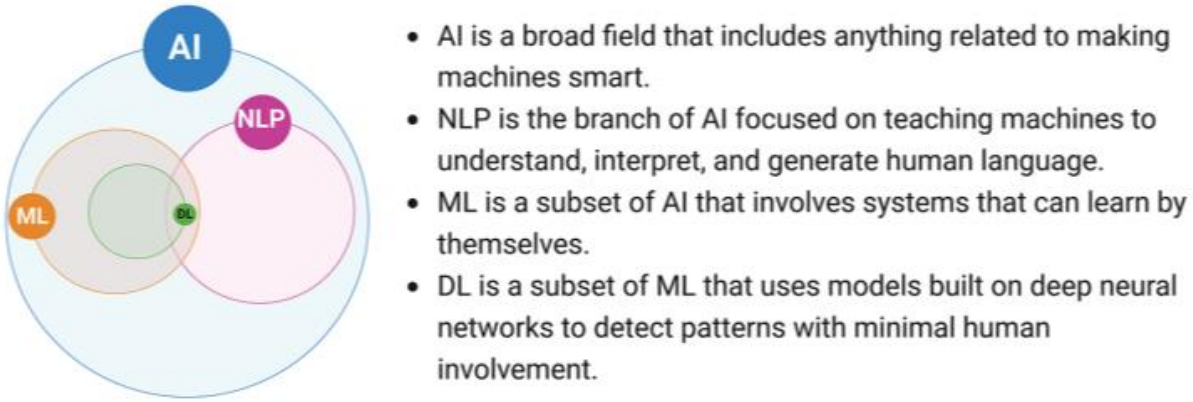

Figure 11: Understanding of the Relationship Between Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP) (Alowais et al., 2023).

Furthermore, Rizvi and Zaheer (2022) stated some of the common applications of AI used in healthcare, shown in Figure 12.

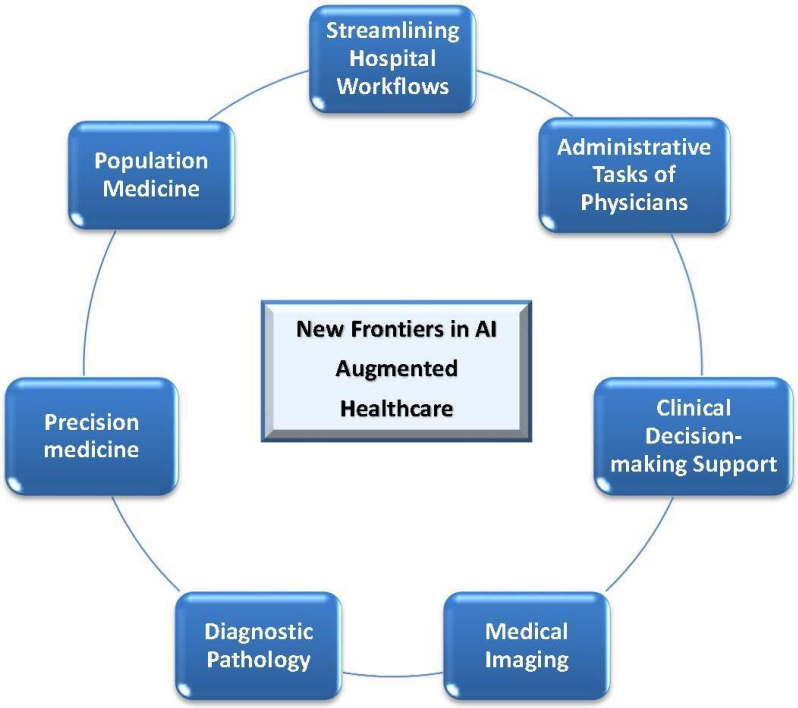

Figure 12: Rizvi and Zaheer (2022) stated some common applications of AI in the medical field.

In this context, electronic learning (e-learning) methods integrated with AI, where its applications contribute significantly to infusing intelligence into the learning and training procedures for healthcare personnel (Sinha et al., 2021).

AI has the potential to transform how human and machine intelligence integrate, fundamentally changing our learning experiences (Seeber et al., 2020). It was discussed that data gathered from digitised workplaces can fuel workplace learning analytics, driving AI-based technologies to support enhanced learning and professional growth (de Laat et al., 2020). With AI increasingly shaping human behaviour in learning and work, the focus of learning should shift from merely enhancing human capital to fostering competencies and capabilities in the era of AI (Hachoumi et al., 2023).

For instance, AI chatbots are increasingly being adopted within healthcare education. These conversational systems, known as chatbots, are designed as machine conversation interfaces, engaging human users through natural and conversational language (Shankar, 2022). Metacognitive chatbots aid learners in comprehending their unique learning styles and encourage reflection on their academic coursework. These chatbots offer prompt responses to learners at all hours and extend continuous support to healthcare students dispersed across various geographical areas. Bohr and Memarzadeh (2020) highlighted AI's potential to revolutionise lifelong learning by aiding in material summarisation, personalised learning suggestions, facilitating remote education, and enhancing simulations and training. In addition, Bohr and Memarzadeh (2020) emphasised the significance of Augmented Reality (AR), and virtual reality (VR) within healthcare education. They believe that *"Interaction with the surroundings allowed us to gain further understanding of the world and provided us with the much-needed experience"* (Bohr and Memarzadeh, 2020, p. 36).

As an overview of AI was discussed, the following section illuminates the significance of AI in reshaping industries, fostering innovation and redefining our future.

2.3.4. Artificial Intelligence – Significance

At the heart of this exploration lies an appreciation for the profound significance of artificial intelligence, unravelling its potential to reshape the healthcare industry, drive innovation, and catalyse unprecedented progress in our rapidly evolving technological landscape. AI is thought to enhance various aspects of healthcare operations and delivery (Bohr and Memarzadeh, 2020). Additionally, it holds substantial potential to enhance the effectiveness of learning, such as providing more personalised and profound learning experiences that extend throughout an individual's life. This, in turn, can contribute to increased job satisfaction for educators by reducing educational workloads and fostering positive attitudes toward workplaces dedicated to ongoing and personalised learning (Randhawa and Jackson, 2020). Such advancements further create conditions conducive to improved patient care and safety (Randhawa and Jackson, 2020). The subsequent points distinctly underscore the significance of implementing AI within the healthcare industry:

2.3.4.1. Cost-Effectiveness

Bohr and Memarzadeh (2020) highlighted that the potential cost reductions AI offers to the healthcare system, serve as a significant motivator for adopting AI applications. A subsequent study proposed that AI has the potential to offer cost-effective resolutions to healthcare issues, a particularly significant prospect for countries with lower-middle income status (Ravi Shankar, 2022). During the COVID-19 pandemic, the urgency of the situation prompted AI training modules (known as Virti) to be deployed for the NHS. The utilisation of AI enabled this training solution to become scalable, captivating, and cost-effective (Sharma and Mohan, 2021).

2.3.4.2. Personalised Learning and Efficient Training

Chen et al. (2020) stated that AI has enhanced learning experiences by facilitating the customisation and personalisation of learning materials to cater to the specific needs and

capacities of learners. Hachoumi et al. (2023) also expressed that *"AI can greatly enhance and facilitate lifelong learning in the field of health sciences by providing personalized learning recommendations, summarizing and organizing information, facilitating remote learning, and enhancing simulations and training"* (p. 6). AI has the potential to greatly improve e-learning systems by delivering personalised content to individual learners (Bozkurt et al., 2021; Rahayu et al., 2022; Zawacki-Richter et al., 2019). Fontaine et al. (2019) stated that within the healthcare sector; Adaptive E-learning Environments (AEEs) have the capacity to offer personalised guidance to health professionals. This has the potential to enhance both the effectiveness and efficiency of learning for these individuals (Fontaine et al., 2019).

2.3.4.3. Continuous Skill Enhancement

Amid the persistent challenges and evolving landscape of healthcare; practitioners must continuously acquire new skills and knowledge. Consequently, through the adoption of AI-based e-learning; healthcare professionals can enhance their competencies, remain updated, and be proficient in their field (Hachoumi et al., 2023). They highlighted that AI technologies offer professionals the chance for ongoing enhancement of their expertise, thereby elevating the standard of healthcare provision.

2.3.4.4. Improved Patient Care

Rizvi and Zaheer (2022) stated that *"Artificial intelligence represents an approaching revolution that will bring about revolutionary changes and improvements in the quality of patient care"* (p. 120). Furthermore, Hachoumi et al. (2023) noted that utilising AI for continuous learning, enables healthcare professionals to stay updated with current research, adopt best practices, and deliver optimal care to their patients.

2.3.4.5. Adoption of Innovative Practices

In the context of integrating AI into training, Banerjee et al. (2021) emphasised the importance of involving healthcare staff in the development of AI algorithms. By engaging clinicians, the goal is to ensure that trainees can continue developing essential skills, as AI relies on their expertise to replicate human behaviour. This approach not only fosters trust in AI technologies, but also enhances their transparency to patients, showcasing the integration of innovative practices to enhance education and care delivery (Banerjee et al., 2021).

2.3.5. Artificial Intelligence – Advantages of AI in Healthcare

AI brings significant advantages to healthcare education and training. Among the key benefits of e-learning is its ability to empower learners to learn at their own pace and explore emerging content easily (Sinha et al., 2021). Rather than relying on binary responses, learners can delve deeply into subjects and test their abilities in complex scenarios using AI-based e-learning. These solutions not only provide answers to queries, but also *"recommend resources and create personalized curriculums and grade assignments apart from teaching"* (Sinha et al., 2021, p. 122). Therefore, the integration of AI into the learning process is anticipated to bring forth a range of benefits, including *"availability and affordability, speed, effectiveness and personalization"* (Sinha et al., 2021, p. 126). The NHS's long-term plan in 2019 highlighted technology as a crucial avenue to alleviate staff workload. It emphasised the necessity for educational modifications within the NHS to maximise the potential benefits that technology, particularly artificial intelligence, can provide (The National Health Ssrvice, 2019). Karabacak et al. (2023) stated the possible advantages related to the application of generative AI in the field of medicine in Figure 13. In this research, the initial three benefits will be examined, providing examples from the latest technologies investigated in the literature.

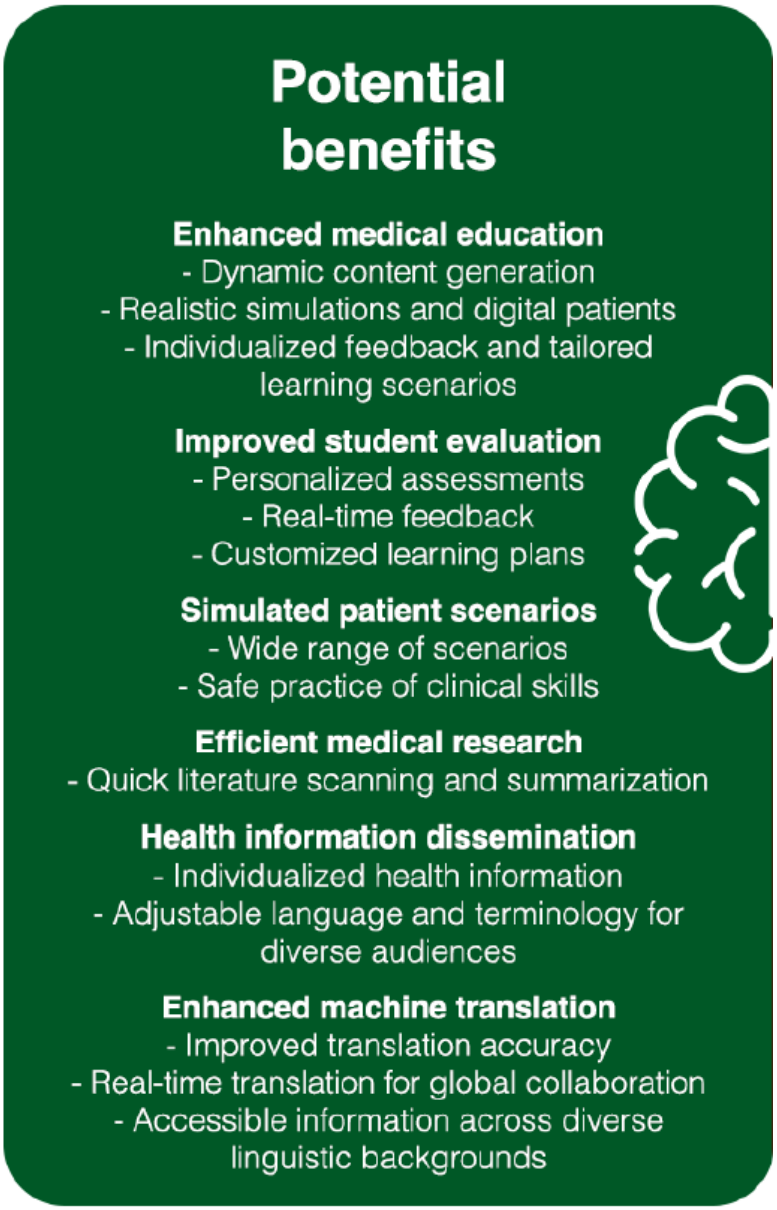

Figure 13:Possible advantages related to the application of generative AI in the field of medicine (Karabacak et al., 2023).

2.3.5.1. Enhanced medical education

One of the benefits of employing AI in medical education is the creation of dynamic content using realistic simulations and digital patients (Sharma and Mohan, 2021). Micheel et al. (2017) studies amongst oncology healthcare professionals, indicated that the creation of educational content on web platforms should prioritise the development of materials that incorporate various modes of communication simultaneously (multimodal educational

materials). This approach aims to offer a comprehensive learning experience that encompasses multiple modes of information delivery, catering to a wider range of preferences among learners (Micheel et al., 2017). Over the past years, online education has transformed into Virtual Learning Environments (VLEs). By employing the constructivist learning theory, every learner has shaped their unique approach to comprehending and utilising educational materials, aligning with their individual skills and learning preferences (Sinha et al., 2021). Consequently, a VLE sought to customise learning resources to match each learner's cognitive abilities and learning style. Sinha et al. (2021) declared that this advanced technology is anticipated to facilitate a deeper understanding of online learning processes among learners, fostering a sense of satisfaction and engagement. Sinha et al. (2021) stated the advantages of VLE as *"Seamless delivery, Time management, Flexibility, Communication and connection and Financial advantages"* (p. 118). As a result, employees will have access to the study materials, ensuring simultaneous communication of any modifications, and maintaining consistency across all users. Also, new members entering the group do not have to wait, as the VLE promptly provides access to the training program. The adaptability aspect of VLE provides autonomy to both learners and facilitators, to choose their preferred timing for activities independently. In addition, interaction and connectivity occurs through forums and message boards, allowing learners with more experience to offer comments, mentorship, and guidance to new employees.

2.3.5.2. Improved student evaluation

Throughout the pandemic (COVID-19), customising healthcare professionals' learning plans became crucial due to the inaccessibility of offline workshops. *"In person/offline sessions are quite expensive, require coordination in terms of time and availability and are almost impossible during pandemic"* (Sharma and Mohan, 2021, p. 14). Rizvi and Zaheer (2022) emphasised that, given the dire situation, healthcare systems needed to adapt and scale up AI-based medical practices, as they might have helped alleviate the shortage of human resources.

This urgency propelled the training modules of Virti into action for the NHS (National Health Service) (Sharma and Mohan, 2021). Leveraging AI made this training solution scalable, engaging, and cost-effective. Virti employed machine learning algorithms to develop predictive models by leveraging training data, enabling the translation of these models into real-world scenarios and personalised training programs. Furthermore, the system offers personalised assessments and instant feedback, creating a chance for doctors to enhance their skills. According to Sharma and Mohan (2021), this approach ultimately led to improved application and retention of learning. In addition; the study of Wolfe et al. (2016), introduced the BRCA Gist (BReast CAncer and Genetics Intelligent Semantic Tutoring), which offered an interactive learning experience, providing prompt system feedback, and allowed students to explore new concepts (Lomis et al., 2021).

2.3.5.3. Simulated patient scenarios

It is mentioned that AI can offer diverse scenarios to ensure a robust practice of clinical skills (Sharma and Mohan, 2021). Bohr and Memarzadeh (2020) suggested that AI-driven educational tools, such as "Augmented Reality" and "Virtual Reality" (AR and VR), offer a means to visually comprehend medical concepts for healthcare professionals. Virtual Reality (VR) referred to *"the immersion within a completely virtual environment",* this is frequently or most effectively accomplished by fully immersing a participant's surrounding field of view using a head-mounted display (Sutherland et al., 2019, p.39). In Augmented Reality (AR), *"virtual elements are overlapped onto the surrounding real-world environment, often using an HMD that does not occlude the wearer's vision"* (Sutherland et al., 2019, p.39). Bohr and Memarzadeh (2020) argued that complex subjects like human anatomy or intricate surgical procedures could be effectively taught using AI-based learning technologies, eliminating the need for direct involvement of actual patients. They stated the benefit to commence training earlier and reduce training costs in later stages (Bohr and Memarzadeh, 2020). Wolfe et al.

(2016) involved students interacting with the BRCA Gist (BReast CAncer and Genetics Intelligent Semantic Tutoring) as if they were patients, showcasing an increase in their declarative knowledge regarding genetic risk in breast cancer. Lomis et al. (2021) highlighted that integrating such technology in educational programs empowered educators to diversify the range of cases students encountered.

This section discussed the benefits of AI in healthcare in the landscape of learning and training. However, it's imperative to acknowledge the disadvantages that come with this technological advancement. The next section will delve into the disadvantages of AI in healthcare.

2.3.6. Artificial Intelligence – Disadvantages of AI in Healthcare training

While the integration of AI in healthcare has brought about numerous advancements and improvements, it also presents its own set of drawbacks. Despite its potential to revolutionise medical practices; AI in healthcare brings about disadvantages that warrant careful consideration. Understanding and addressing these downsides is crucial for harnessing the full potential of AI while mitigating its potential negative implications in healthcare.

Salomon et al. warned against tools and activities that diminish the human partner's intellectual involvement, emphasising the importance of understanding how individuals operate beyond the human-machine system (Salomon et al., 1991). They argued that cognition driven solely by instruction, without learner agency, and consideration of the process, might diminish non-cognitive processes and learner initiative.

2.3.6.1. Ethical concerns & Bias in Algorithms

Employing AI for adult learning can lead to significant ethical concerns arising from potentially biased data that fuels the algorithms (Verhagen, 2021; Khan et al., 2023). Verhagen (2021) suggested that adults who currently have limited representation in training participation will be offered fewer or lower-quality AI-driven training recommendations compared to those who

participate more frequently, consequently widening the existing participation gap. Obradović et al. (2015) explored methods to provide creative and instructional assistance to students with dyslexia, aiming to enhance student engagement and foster collaborative learning. Therefore, individuals with specific learning disabilities might encounter challenges in accessing or benefiting from AI-generated training recommendations. This situation can further widen the gap in participation and access to suitable learning resources for individuals with specific learning disabilities compared to those without such challenges.

2.3.6.2. User Trust and Acceptance

In addition, the absence of clarity and transparency may deter participants from engaging in AI-powered training methods (Verhagen, 2021). It is believed that individuals are less inclined to adopt AI tools for training if they lack trust in; the tool's usability, the delivery of unbiased and easily understandable outcomes, and assurance regarding ethical and fair usage of data (Verhagen, 2021).

2.3.6.3. Social concerns

There has always been a concern among humans that the introduction of AI in healthcare could lead to the elimination of their jobs (Khan et al., 2023; Rizvi and Zaheer, 2022). It was stated that *"Some people are skeptical about and even hostile to AI-based projects because of the threat of being replaced"* (Khan et al., 2023, p. 4). Bohr and Memarzadeh (2020) stated that *"It also seems increasingly clear that AI systems will not replace human clinicians on a large scale, but rather will augment their efforts to care for patients"* (p. 51). They believed that in the long run, healthcare providers who opt not to collaborate with AI may be the only ones risking their careers.

2.3.6.4. Dependency and Overreliance

AI can lead to technology addiction, a significant drawback. Sinha et al. (2021) expressed that while AI enhances daily tasks' efficiency, excessive reliance on machines can create a

dependence that fosters technology addiction among adults. They believed that although AI improves learning experiences, relying too heavily on it for grading and teaching may cause educational shortcomings, potentially harming learners instead of aiding them. Božić and Poola (2023) believed that relying too heavily on AI, without critical human judgement and expertise, can result in inaccurate diagnoses, inappropriate treatment plans, and compromised patient care. Finding an equilibrium between AI utilisation and human judgement is vital within healthcare settings (Božić and Poola, 2023).

Therefore, while AI offers immense potential to revolutionise healthcare, it comes with a set of notable disadvantages. Ethical concerns, biases in algorithms, social concerns, user trust and acceptance, dependency issues, and potential job displacement are among the potential drawbacks that necessitate careful consideration and mitigation strategies. Balancing the benefits of AI with its limitations is crucial for responsible integration into healthcare systems. Moving forward, the challenges associated with AI in healthcare will be discussed in the next section.

2.3.7. Artificial Intelligence – Challenges and complexities

Karabacak et al. (2023) expressed: *"quality of AI-generated content, bias in AI system, ethical and legal concerns and academic dishonesty"* as the challenges and ethical considerations of generative AI in the field of medicine. In navigating the integration of AI in healthcare; several critical challenges emerged that necessitate careful consideration.

2.3.7.1. Personalisation and adaptability

Personalising e-learning content to suit individual learning styles and needs within healthcare can be complex and challenging. Murtaza et al. (2022) emphasised the necessity of a proficient mechanism for continuously assessing learners and determining their level of comprehension within a personalised content delivery system. Also, challenges intensify for the adaptable learning components of the system (Murtaza et al., 2022). This system operates on the

fundamental principle of delivering content according to each learner's preferred mode of learning. For instance, while one learner may grasp concepts better through reading texts, another might favour learning through watching videos. As these preferences are implicitly assessed, an effective mechanism must be integrated into the recommendation system (Christudas et al., 2018; Alshmrany, 2022).

2.3.7.2. Integration complexity

Chen and Decary (2020) highlighted that the lack of compatibility between AI technologies and older, existing infrastructure; poses a challenge within healthcare organisations. The Academic Health Science Network (AHSN) Network (2018) reported that *"The underlying IT infrastructure in the NHS is poor and not AI ready"* (p. 18). The inadequate compatibility of foundational data infrastructure within the NHS posed a significant hurdle in integrating prospective AI technologies into healthcare sectors.

2.3.7.3. Continuous Updates and Validation

Insufficient access to high-quality and varied medical data for training Machine Learning (ML) algorithms was identified as a challenge crucial for maintaining relevance and precision (Chen and Decary, 2020). Effective machine learning (ML) heavily depends on accessing extensive volumes of high-quality data. Chen and Decary (2020) believed that *"the source, size, and quality of data"* significantly influence the development of ML models (p. 17). Acquiring vast and comprehensive data that is both accurate, current, and reflective of typical demographics; poses a significant challenge for professionals in analytics (Househ et al., 2019). It is declared that the bias present in AI systems partly stems from the limited availability of diverse data used to train the algorithms (Chen and Decary, 2020).

Given the challenges outlined above, the researcher can summarise and conclude that there are other possible challenges and ethical concerns associated with the utilisation of AI in healthcare, shown in Figure 14.

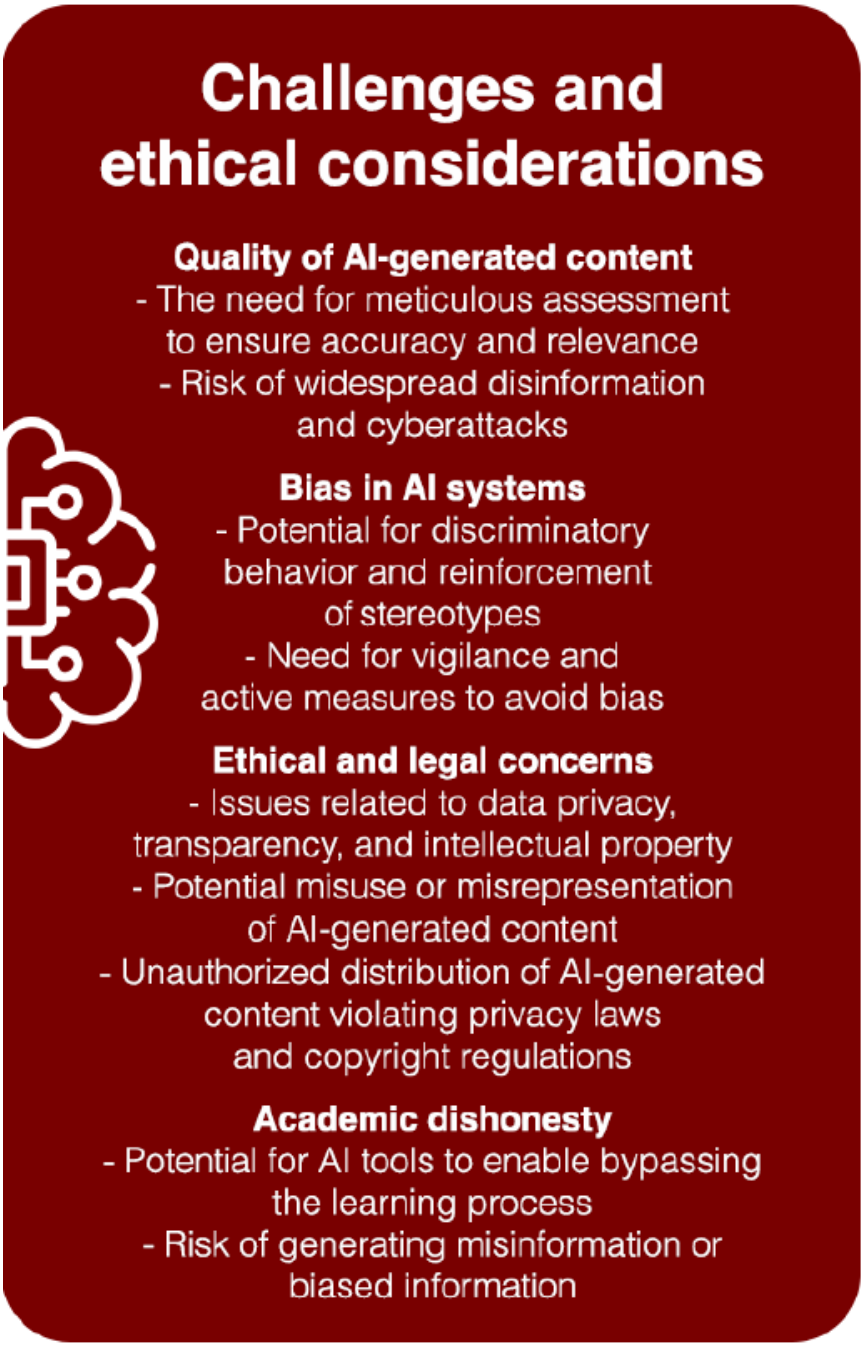

Figure 14: Possible challenges and ethical issues related to the application of generative AI in the field of medicine (Karabacak et al., 2023).

Overcoming these challenges necessitates collaboration and strategic solutions for AI integration in healthcare. The following section will delve into how AI has reshaped healthcare staff competency, redefining skills, and capabilities.

2.3.8. Artificial Intelligence – Impacts on Healthcare Staff Competency

The integration of AI technologies within healthcare settings has brought forth transformative changes, significantly influencing the competency and skills development among healthcare staff. This section will discuss the impacts of AI in healthcare staff training and development.

2.3.8.1. Positive Impacts

2.3.8.1.1. Continuous Learning Opportunities

AI-driven educational platforms and simulations offer healthcare staff ongoing opportunities for learning and skill development, ensuring they stay updated with the latest advancements in medical knowledge and technology. Sinha et al. (2021) believed that AI will continue to have a positive impact in training and development of learners. AI facilitates learners by employing various adaptive technologies to address uncertainties, identify learner weaknesses, and offer tailored learning solutions. Adaptive learning recognises that the pace of learning varies among individuals, emphasising the importance of ensuring educational resources align with each learner's needs to preserve their effectiveness (Sinha et al., 2021). Hence, e-learning enables learners to; maintain their progress, study at their convenience, and do so more cost-effectively, and efficiently.

2.3.8.1.2. Decision Support Systems

AI systems provide real-time information and recommendations to healthcare professionals, assisting them in making well-informed decisions during patient care. Shankar (2022) stated that employing a machine conversation system, which engages human users using natural, conversational language, can elevate interactions with virtual patients beyond mere computer-based text exchanges. This advancement has the potential to significantly enhance learner competencies through more authentic conversational experiences. Additionally, Božić and Poola (2023) have emphasised the importance of empowering employees by offering opportunities to utilise AI for decision-making and problem-solving in their roles. Granting

autonomy and ownership over AI tools; fosters experimentation and exploration, leading to increased motivation and engagement. Moreover, the integration of AI has demonstrated its ability to assist healthcare workers in making well-informed, data-driven decisions. Utilising artificial intelligence (AI) for tasks such as data analysis and pattern recognition facilitates, enhanced precision in diagnostic processes, the formulation of personalised treatment plans, and the optimization of strategies for patient care. Furthermore, Rizvi and Zaheer (2022) stated that *"AI can help physicians and caregivers integrate electronic medical records with other patients' data, such as radiological images and diagnostic test results"*, enhancing efficiency in patient care and simplifying the delivery of appropriate therapies (p. 122). Additionally, a decision support system developed by Moore et al. (2022) for healthcare professionals involved in wound assessment and management at the point of care has proven to reduce time spent and enhance healthcare staff confidence in wound assessment and decision-making.

2.3.8.1.3. Personalised Treatment Plans

AI algorithms can analyse large datasets to tailor treatment plans based on individual patient characteristics, optimising care, and improving outcomes. Božić and Poola (2023) asserted that the utilisation of artificial intelligence in the healthcare sector holds the potential to enhance patient outcomes. By employing AI-driven tools for tasks such as *"early disease detection, treatment planning, and monitoring",* can help healthcare professionals to offer more precise and individualised care, leading to improved patient satisfaction and results (p. 12). Furthermore, Bohr and Memarzadeh (2020) elucidated that precision medicine opens the opportunity to customise healthcare interventions for individuals or specific patient groups based on factors such as *"their disease profile, diagnostic or prognostic information, or their treatment response"* (p. 28). The groundbreaking personalised treatment strategy within precision medicine is anticipated to bring significant benefits to patients, thereby revolutionising the delivery and assessment of healthcare services.

2.3.8.2. Negative Impacts

2.3.8.2.1. Over-Reliance on Technology

Excessive dependence on AI tools may lead to healthcare professionals relying too heavily on automated systems, potentially diminishing their hands-on skills and clinical judgement. Božić and Poola (2023) articulated the viewpoint that artificial intelligence technologies, grounded in algorithms and data patterns, may not consistently encompass the intricate and nuanced judgement requisite for healthcare decision-making. A reliance on AI, in the absence of critical human judgement and expertise, poses the risk of generating *"inaccurate diagnoses, inappropriate treatment plans, and compromised patient care"* (p. 13). In addition, Ilić et al. (2023) observed that, notwithstanding the apparent advantages; intelligent techniques may limit opportunities for learners to engage in exploration and discovery. Scholarly investigations indicated that learners may miss out on opportunities to acquire novel skills or derive insights from their errors. While intelligent methods excel in rapidly handling large volumes of data, they may face difficulties in navigating complex situations. This emphasises the importance of human qualities such as flexibility, creativity, and adaptability (Ilić et al., 2023). According to Banerjee et al. (2021) AI may also diminish the chances for doctors to enhance their clinical judgement, practical skills, and communication abilities. Existing training programs might not adequately provide clinicians with the technical, statistical, and analytical skills essential for proficiently applying AI in their practices and benefiting their patients. Furthermore, Salomon et al. (1991) cautioned against tools and activities that reduce the intellectual involvement of the human participant. They stressed the significance of understanding how individuals' function beyond the human-machine system. The scholars argued that cognition directed solely by instruction, without proper consideration for learner agency and procedural aspects, could diminish non-cognitive functions and learner initiative.

2.3.8.2.2. Resistance to Change

Some healthcare professionals may resist adopting AI technologies due to fear of job displacement, lack of familiarity, or concerns about the impact on traditional medical practices. Božić and Poola (2023) stated that the growing utilisation of AI in healthcare could give rise to concerns regarding potential job displacement for healthcare professionals. A study conducted by Frey and Osborne (2013) found that approximately 47% of all occupations could potentially face job displacement. Furthermore, Makridakis (2017) expressed concerns among experts, about whether the social structure could endure such a rapid and substantial reduction in employment opportunities.

2.3.8.2.3. Ethical Concerns

The utilisation of AI may raise ethical dilemmas, such as issues related to privacy, bias in algorithms, and the responsible use of sensitive data. Božić and Poola (2023) emphasised that the implementation of AI technologies in healthcare gives rise to ethical concerns, including issues related to *"bias in algorithms, fairness, transparency, and accountability" (p. 12)*. They underscored that algorithmic bias in AI can result in discriminatory results, especially in areas that are highly sensitive, such as healthcare (Božić and Poola, 2023). Furthermore, Rizvi and Zaheer (2022) raised questions about the quality and safety of AI algorithms in healthcare, stating that assigning liabilities to AI algorithms is a complex task. Additionally, Naik et al. (2022) delved into various ethical and legal dilemmas associated with the use of AI in healthcare, as illustrated in Figure 15.

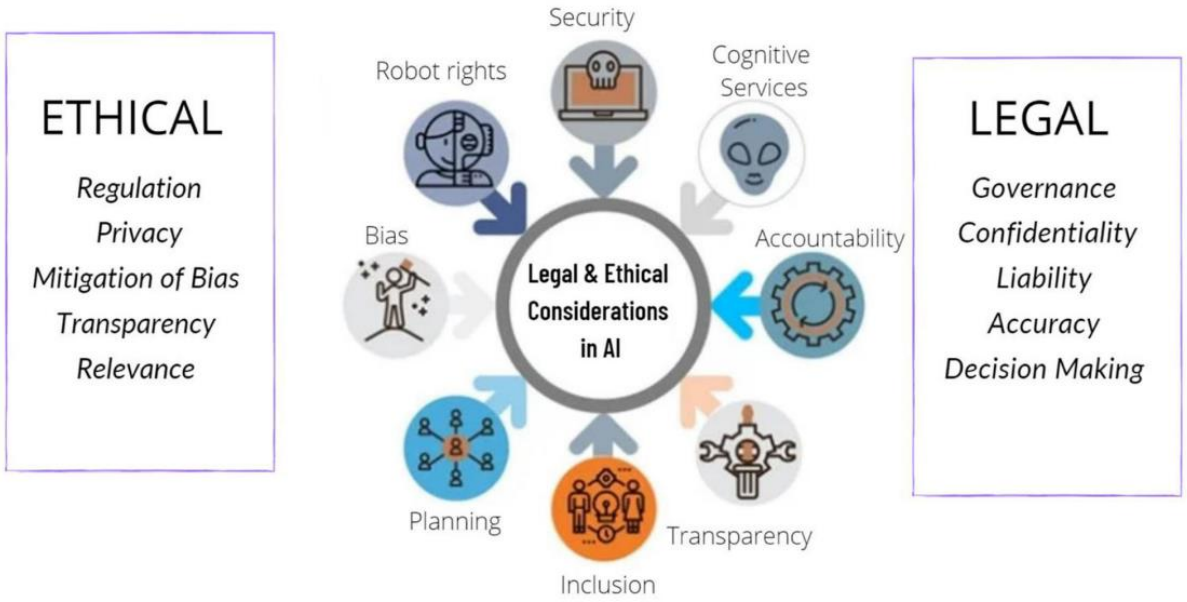

Figure 15: Ethical and legal concerns with utilising Artificial Intelligence in healthcare (Naik et al., 2022, p. 3).

This section has provided an overview of AI in healthcare, exploring its characteristics and importance. It delved into the advantages and disadvantages of AI-based training in healthcare and analysed the challenges and intricacies of AI-driven e-learning in healthcare organisations. Following this examination of the impact on healthcare staff competency; the subsequent section will explore various aspects of electronic learning (e-learning) in the realm of healthcare training and development.

2.4. Personalised AI based E-learning

Personalised learning, also known as individualised, or characteristic-based online learning, involves tailoring learning activities based on an individual's learning background and preferences (Xie et al., 2019). In addition, it was expressed that individuals possess distinct approaches to processing information, comprehending content, and solving problems (Wongwatkit et al., 2020). In essence, individuals each uniquely navigate information and experiences to acquire knowledge (Brock and Cameron, 1999). Artificial intelligence enables personalised e-learning through several advanced mechanisms such as adaptive learning systems where AI-driven platforms assess a learner’s progress and adjust the difficulty level,

pace, and type of instructional content accordingly. For instance, recent research by Rekha et al. (2024) highlights that AI-driven personalised learning systems can enhance student engagement and track performance by continuously analysing learner interactions and adjusting instructional materials accordingly. In addition, in the healthcare sector, personalised AI-based e-learning is particularly valuable for enhancing training and professional development such as simulation-based training. Komasawa and Yokohira (2023) discuss how AI-driven virtual simulations provide realistic patient-care scenarios, allowing healthcare workers to practice decision-making and procedural skills in a safe environment. However, AI systems rely on vast amounts of personal learning data, raising concerns about data security, learner consent, and ethical AI use (Selwyn, 2022).

This section will initially explore AI's contributions to e-learning, followed by an examination of the contributions, advantages, and challenges associated with personalised AI-based learning, derived from an in-depth review of literature. Lastly, it will investigate the impact of implementing personalised AI-based e-learning, drawing insights from multiple previous studies.

2.4.1. AI contributions to e-learning

AI's advent in e-learning has brought forth transformative advancements, reshaping how individuals access, interact with, and benefit from educational content. From personalised learning experiences to adaptive assessments, AI-driven systems have tailored educational journeys to suit individual needs and learning styles. This convergence of AI and e-learning signifies a pivotal shift towards more efficient, engaging, and inclusive educational experiences. Some of the contributions are as follows:

2.4.1.1. Enhanced Interactivity and Engagement

AI technologies such as chatbots, virtual assistants, and augmented reality applications, enrich the e-learning experience by fostering greater interactivity and engagement. Shankar (2022) argued that employing role-playing scenarios involving an intelligent active agent could enrich students' computer interaction experiences and foster a greater sense of accountability. Pokrivcakova (2019) similarly emphasised the incorporation of AI within computer programs, advocating for the creation and deployment of chatbots: online computer-based entities equipped with conversational abilities, to address routine student inquiries, and occasionally distribute educational resources. Moreover, Shanker (2022) contended that chatbots have the potential to elevate engagements with virtual patients from text-based interactions to authentic conversations, potentially enhancing the development of learner competencies. Therefore, virtual mentors and assistants provide immediate support, answering queries, guiding learners through complex topics, and offering real-time assistance, thereby augmenting the learning process. Additionally, the integration of immersive technologies like Virtual Reality (VR), and Augmented Reality (AR) offers experiential learning opportunities, simulating realistic healthcare scenarios for hands-on practice, and skill development. Thus, technologies resembling games such as virtual reality (VR) and augmented reality (AR) have the potential to enhance and enrich learning experiences in forthcoming medical and health-related fields (Shi et al., 2019). Sinha et al. (2021) observed that incorporating actionable, symbolic, and sensory elements as design components; creates an immersive environment, leading users to perceive themselves as being 'inside' the simulated setting. It was believed that these immersive digital interfaces serve as valuable tools for fostering learning, engagement, and transitioning from classroom-based learning to real-world scenarios (Sinha et al., 2021). Additionally, Lange et al. (2020) contended that the visualisation of anatomy learning content can notably improve through integration, suggesting that VR can serve as a supplemental tool enhancing material

visualisation. Bohr and Memarzadeh (2020) proposed that AR could provide medical students with exposure to complex surgical procedures and anatomical learning without direct involvement with real patients, in the early stages of their education. They asserted that while students will ultimately interact with real patients in their careers, the aim is to initiate training earlier, and reduce later-stage training costs (Bohr and Memarzadeh, 2020).

2.4.1.2. Intelligent Content Delivery and Recommendations

AI-powered recommendation systems offer personalised content suggestions, aligning with learners' proficiency levels and specific learning objectives. This not only enhances engagement, but also ensures relevance and efficacy in knowledge acquisition, especially in the rapidly evolving healthcare domain. Hachoumi et al. (2023) highlighted that leveraging AI for lifelong learning among healthcare professionals enables them to stay abreast of current research and optimal practices; ultimately enhancing patient care. Therefore, a dynamic platform affords professionals continuous opportunities to augment their knowledge and skills, thereby elevating healthcare quality (Hachoumi et al., 2023). It is believed that AI's potential in e-learning development lies in refining content element classification, catering to digital learners' expectations for diverse content formats across various platforms (Sinha et al., 2021).

Fontaine et al. (2019) assessed the effectiveness of adaptive e-learning environments tailored for healthcare professionals and students, considering individual learner nuances to deliver personalised instruction. Their findings suggested that adaptive e-learning holds promise in enhancing learning efficiency and effectiveness, compared to traditional educational methods like large-group classroom settings. Moreover, integrating real-world scenarios into legal education can fulfil the demands for professional learning experiences (Sinha et al., 2021). Therefore, immersive learning shows promise in facilitating rapid knowledge acquisition and retention. However, the critical determinant of success for any course lies in delivering content

tailored to each learner's needs, while aligning with specific learning objectives (Sinha et al., 2021).

2.4.1.3. Real-time Feedback and Performance Assessment

The integration of AI facilitates real-time assessment and feedback mechanisms. AI algorithms continuously monitor learner progress, identifying strengths, weaknesses, and learning patterns (Petit et al., 2018; Shankar, 2022). This data-driven approach allows for instant feedback, enabling timely interventions and targeted support to address knowledge gaps. Furthermore, AI-enhanced assessment tools offer sophisticated evaluation methods, moving beyond traditional assessments, to more comprehensive and adaptive evaluation techniques, enhancing the accuracy and depth of performance assessment. Shankar (2022) highlighted the potential of intelligent tutoring systems in aiding student learning through tailored feedback and customised learning routes. Engaging in role-plays, facilitated by an intelligent active agent was identified to augment students' computer interaction skills and inspire a sense of accountability. According to Chan and Zary (2019); machine learning's application in healthcare demonstrates promise in automating, managing, and integrating extensive clinical and educational data, to support the training, learning, and evaluation of healthcare professionals. Furthermore, multiple studies outlined how machine learning (ML) algorithms could enhance the assessment of surgical skills, by replacing subjective rater-based evaluations, with predictions based on ML (Khalid et al., 2020; Winkler-Schwartz et al., 2019; Bissonnette et al., 2019; Ismail Fawaz et al., 2019; Shankar, 2022).

In addition, Sinha et al. (2021) stated that AI's evolution has significantly transformed the landscape of the teaching and online learning sector. It has shifted from monotonous lectures to innovative and highly effective teaching approaches. AI introduces techniques and methodologies that enhance productivity and facilitate optimal learning for both educators and learners. Improved visual and audio elements contribute to a deeper comprehension of subjects,

leading to enhanced retention of information for longer periods. Sinha et al. (2021) illustrated the advantages of AI in e-learning as follows in Figure 16:

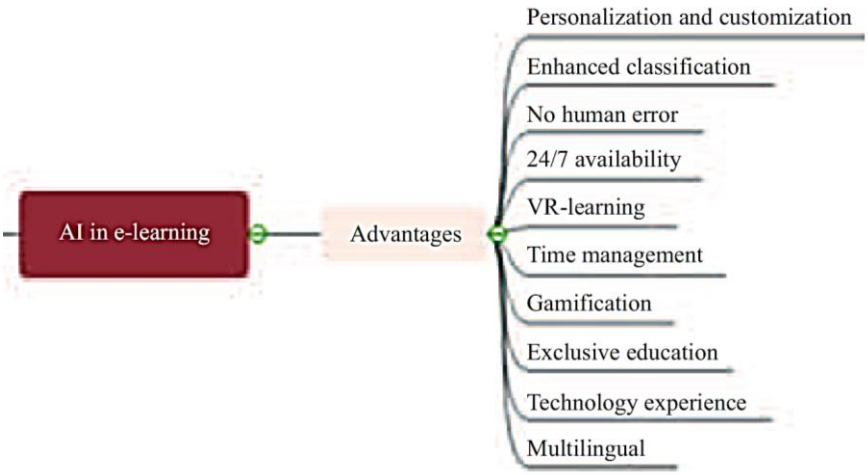

Figure 16: The advantages of AI in e-learning (modified version) (Sinha et al., 2021)

This segment outlines the primary trio of AI contributions to e-learning: Augmented Interactivity and Engagement, Intelligent Dispensation of Content and Recommendations, and Immediate Feedback and Performance Evaluation. Nonetheless, within the scope of this study, it is imperative to delve into the impacts and contributions of the personalised dimension of AI in e-learning.

2.4.2. Personalised AI Contributions to e-learning

One of AI's pivotal contributions lies in its ability to personalise learning experiences (Nazempour and Darabi, 2023). Abbasi et al. (2021) articulated the aim of new e-learning solutions as creating tailored and flexible settings to meet the requirements of individual learners; *"personal needs, learning speed, interests, and particularly their own learning approach"* (p. 2). In addition, Sanjabi and Montazer (2020) stated that customising the learning setting allows tailoring of educational content and resources based on individual learners' abilities and preferences. This approach boosts motivation and effectiveness while also

recognizing learning styles and preferences, crucial for ensuring personalised e-learning environments (Sanjabi and Montazer, 2020). Through sophisticated algorithms and machine learning models, AI analyses learner data, including performance, preferences, and pace of learning. This analysis enables the creation of adaptive learning paths tailored to individual needs, fostering more effective comprehension and skill acquisition among healthcare professionals.

Prior investigations have employed diverse online learning style theories, including those proposed by Felder & Silverman, Honey & Mumford, and Kolb, to discern learners' style preferences in order to construct adaptable and personalised systems (Malek et al., 2023; Abbasi et al., 2021; Chen et al., 2020). Malek et al.'s (2023) findings underscored the capacity of AI systems to provide individualised support to learners, thereby augmenting their learning progress by catering to their specific needs and preferences, such as devising tailored learning pathways. Consequently, the integration of AI-based personalised learning environments presents a significant opportunity to enhance learner performance and cater to individualised needs and interests. Notably, research outcomes corroborate the positive impact of personalised and tailored training on learning success, particularly within the domain of dementia care (Malek et al., 2023).

Earlier studies have posited that adapting to individual needs enhances the overall learning landscape, improves learning experiences, and fosters acceptance (Chen et al., 2020; Capuano and Caballé, 2020). Furthermore, it has been asserted that AI-based personalised learning; fosters the creation of customised learning programs, and bolsters learner motivation (Malek et al., 2023), resulting in the maximisation of learners' potential and success (Capuano and Caballé, 2020). Nazempour and Darabi (2023) have indicated that by identifying students' learning styles through observations in virtual learning environments, student performance can be significantly enhanced.

Consequently, adaptive learning platforms powered by AI; dynamically adjust content delivery, offering tailored modules and targeted interventions, thereby optimising the learning experience for each participant. Chen et al. (2020) emphasised that the advancement of AI technologies, such as virtual reality, expands the scope of the learning process beyond physical confines, creating a global classroom by virtually connecting students to learning environments.

2.4.3. Advantages of personalised AI based e-learning for healthcare staff

This study considers some of the advantages that personalised AI-based e-learning can offer, including the following:

2.4.3.1. Accessibility and Flexibility

AI-based e-learning allows healthcare professionals to access training materials anytime, anywhere; accommodating busy schedules and shift work common in the healthcare sector. Lamya et al. (2020) highlighted that personalised learning allows for adaptability in what, how, when, and where learners acquire and demonstrate knowledge. Specifically, these adaptable elements encompass *"pedagogical approaches, content, activities, objectives and learning outcomes"* (Lamya et al., 2020, p. 100). They presented a comprehensive method for tailoring teaching approaches across various activities, considering learners' diverse styles of learning based on the Kolb model. Meanwhile, Singh and Alshammari (2021) proposed a framework in their research indicating that technology-enabled personalised and adaptive learning, can furnish learners with the necessary customisation, flexibility, and responsiveness to cater to their learning requirements, and enhance their academic performance.

2.4.3.2. Tailored Learning Paths and Adaptive learning

AI can assess individual strengths and weaknesses, offering personalised learning paths. Healthcare staff can focus on areas where they need improvement, optimising their time and

making learning more efficient. Sanjabi and Montazer (2020) emphasised the importance of customising e-learning environments as a crucial element, contributing to effective learning, which elevates satisfaction, accelerates learning pace, and improves the quality and efficiency of the learning process. Their utilisation of Kolb's learning style model in personalising e-learning environments revealed that learners exposed to personalised experiences exhibited higher academic success and satisfaction compared to those who did not receive such personalised approaches. Consequently, these strategies hold promise for effectively designing e-learning environments to enhance the overall learning quality for students (Sanjabi and Montazer, 2020). Additionally, Wongwatkit et al. (2020) highlighted the potential of systems analysing and comprehending individual learning patterns, to facilitate an easier learning experience. Their findings indicated improved learning performance among students, when they perceived learning materials as facilitating their understanding, thereby enhancing their grasp of the subject matter (Soflano et al., 2015).

Also, AI can adapt content difficulty based on user performance, ensuring that the material matches the learner's pace and comprehension level. This personalised approach can enhance understanding and retention. Furthermore, Nazempour and Darabi (2023) introduced a framework aimed at identifying students' learning styles based on their behaviours within virtual learning environments, intending to bolster their academic performance. Employing the Felder–Silverman Learning Style Model; considered highly effective in online learning literature, they mapped learning resources to specific learning style characteristics (Nazempour and Darabi, 2023). They statistically demonstrated that students whose identified learning style characteristics closely aligned with those calculated by the approach, achieved better grades. Their research underscored the potential for significant performance enhancements, by tailoring educational interventions according to individual learning styles (Nazempour and Darabi, 2023).

2.4.3.3. Engagement and Motivation

Personalisation and interactive elements in AI-based learning can increase engagement and motivation among healthcare professionals, leading to better knowledge retention, and application. Earlier research has asserted that tailoring the learning environment allows educational content and materials to align with learners' abilities and preferences, fostering motivation and heightened efficacy (Peng et al., 2019; Bernard et al., 2017). Moreover, personalised approaches to individual learners were highlighted as, enhancing learner engagement, overall learning experiences, and effectiveness (Sweta and Lal, 2017). Ilić et al. (2023) conveyed that employing a personalised learning pathway, rather than a uniform approach for all learners, can mitigate learner disorientation and confusion; facilitating smoother reaching of curriculum objectives, while fostering increased learner motivation and dedication to the learning process.

2.4.3.4. Real-time Feedback and Assessment

AI can provide instant feedback on assessments, allowing learners to gauge their progress immediately. This facilitates a quicker understanding of strengths, and areas needing improvement. One formative assessment technique known as the "mastery learning approach" has been employed to assess and oversee students' continuous advancement toward meeting learning objectives, while providing personalised feedback (Wongwatkit et al., 2020). This approach is acknowledged as a key element within personalised e-learning environments, that influences students' learning performance (Wongwatkit et al., 2017). Literature exploring the application of the mastery learning approach suggests that successful learning outcomes are associated with its integration into online personalised learning support systems (Wongwatkit et al., 2020; Khan and Masood, 2013; Shafie et al., 2010; Furo , 2014).

In addition to above advantages, Maghsudi et al. (2021) presented the foundational framework of online personalised education, encompassing all involved stakeholders, along with essential elements and performance indicators, Figure 17.

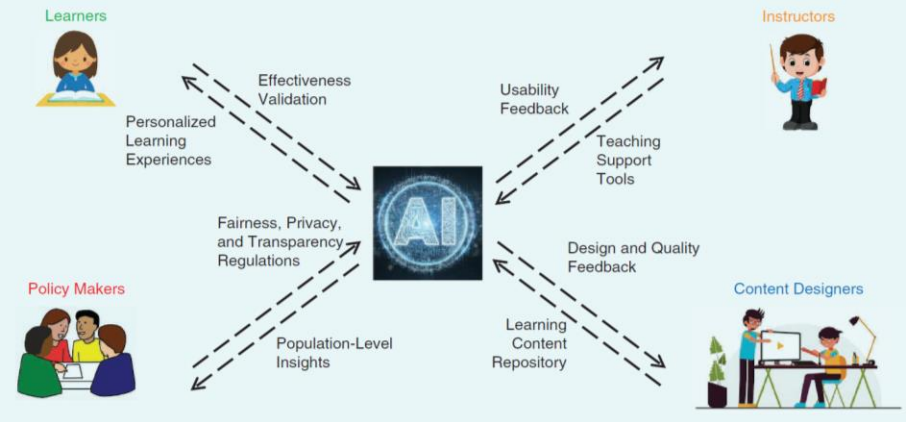

Figure 17: "The baseline ecosystem of AI-empowered personalized education" (Maghsudi et al., 2021, p. 38)

Overall, personalised AI-based e-learning can significantly enhance the efficiency, effectiveness, and relevance of training for healthcare staff, ultimately improving patient care and outcomes. Certainly, while personalised AI-based e-learning offers numerous advantages, it also presents some challenges for learners, these challenges will be discussed in the following section.

2.4.4. Challenges of Implementation of Personalised AI based e-learning:

Personalised AI-based e-learning, while beneficial, does come with its set of challenges. This section will discuss some of the challenges identified by previous research.

2.4.4.1. Learner Adoption and Resistance

Some learners might be resistant to adopting new technology or prefer traditional learning methods, leading to slower adoption rates, or reduced engagement with AI-based e-learning.

The attitude of users, which influences how modern technology is embraced, plays a crucial role in the utilisation of technological tools by individuals (Baniasadi et al., 2020). People unfamiliar with IT might resist using new technologies and lack trust in IT-based tools, especially without the necessary IT skills (Garrett et al., 2018). Ilić et al. (2023) highlighted that employing computer-based adaptive assessments can improve learners' experiences by tailoring questions to their actual ability level. This prevents overwhelming, discouraging, or boring questions, leading to a more user-friendly assessment experience and potentially increasing learners' acceptance (Hariyanto and Köhler, 2020).

2.4.4.2. Privacy and Data Security

Healthcare data is sensitive, and personalised learning relies on collecting and analysing individual data. Ensuring compliance with privacy regulations, while safeguarding this data from breaches or misuse is crucial but challenging. AI holds promise in enhancing learning abilities. However, these systems necessitate vast amounts of data, including confidential learner information, posing significant concerns about privacy and data security (Zawacki-Richter et al., 2019). There are apprehensions regarding learner privacy due to the monitoring and recording of their activities, including the measurement of unconscious behaviours. In addition, the World Health Organization (WHO) (2016) reported from 125 countries: The obstacles to the global implementation of big data for healthcare, shown in Figure 18. This indicates; information sharing (61%; n=70), and privacy and security (68%; n=78), as very or extremely important barriers in healthcare (World Health Organization, 2016; Wolff et al., 2021).

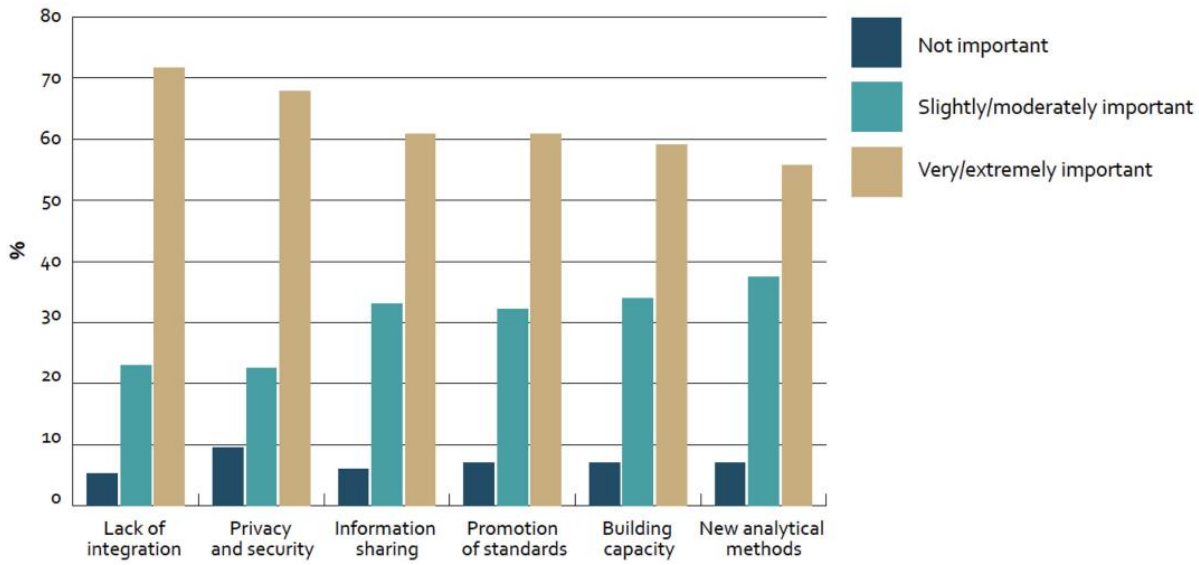

Figure 18: "Barriers to adoption of big data for health globally—survey of 125 countries" (World Health Organization, 2016).

2.4.4.3. Bias introduced by data and AI Algorithms

AI algorithms might inadvertently perpetuate biases in personalised content, affecting the learning experience or reinforcing existing disparities. Maghsudi et al. (2021) emphasised the significance of fairness in education, whether in traditional classrooms, or modern personalised learning platforms. This is due to factors such as uneven access to learning platforms, biases in training data, and flaws in algorithm design. Research indicates that certain student subgroups, often already privileged in conventional education systems, might benefit more from personalised education than their peers (Maghsudi et al., 2021). Concerns have been raised about generative AI potentially producing biased content, or lacking representation of all demographics in previous studies (Kung et al., 2023; Karabacak et al., 2023; Ellaway and Tolsgaard, 2023; Abd-Alrazaq et al., 2023). Preiksaitis and Rose (2023) highlighted the necessity for curricula that educates learners on the ethical and responsible use of this technology. However, raising awareness about these issues is just the initial step toward addressing them.

Addressing these challenges involves a multi-faceted approach, including robust data security measures, continuous system improvements, user training, ethical guidelines, and ensuring equitable access to technology and training opportunities for all healthcare staff.

2.4.5. Impact of adopting personalised AI based e-learning in the healthcare sector

Integrating personalised AI-based e-learning solutions within healthcare environments initiates a transformative wave, reshaping the landscape of professional development and the delivery of care. The far-reaching impacts span from redefining how healthcare staff acquire and retain knowledge, to fundamentally altering the quality and efficacy of patient outcomes. This section aims to explore existing literature, uncovering insights from prior studies that have elucidated the impacts resulting from the integration of personalised AI-driven e-learning in various business contexts.

2.4.5.1. Positive Impact

2.4.5.1.1. Enhanced Learning Efficiency

Personalised content and adaptive learning paths optimise time and effort, allowing staff to focus on areas that need improvement. Sweta and Lal (2017) utilised the Felder–Silverman Learning Style Model (FSLSM) within their Personalised Adaptive Learning Model (PALM), introducing novel adaptivity dimensions such as automatic, real-time detection of learning styles to tailor personalisation accordingly. They concluded that personalised adaptive e-learning systems outperform non-adaptive systems, benefiting learners and significantly enhancing the overall learning process. Therefore, catering adaptivity to individual learner needs, stands as a crucial factor in improving the efficiency and effectiveness of learning (Sweta and Lal, 2017). However, their study lacks consideration for two vital elements in personalization: learners' motivations and emotions. This suggests that a qualitative approach could enable learners to express their emotions and feelings about their e-learning journey, aiding in adapting e-learning systems toward a more motivational and user-friendly approach.

Earlier research examined the impact of the mastery learning approach, used for assessing ongoing learning progress, and providing individualised feedback on learner performance. Students' perceptions of this approach were found to directly influence their learning outcomes (Guskey, 2007; Wongwatkit et al., 2020), as they perceived the system as reliable for their learning, ultimately affecting their performance (Furo , 2014). Moreover, AI applications in the education sector, spanning curriculum development, and leveraging technologies such as; virtual reality, web-based platforms, robotics, and others, have notably enhanced students' learning experiences (Chen et al., 2020). This technological integration has empowered teachers, fostering more effective instruction and providing students with a personalised and enriched educational journey. In essence, Malek et al. (2023) asserted that utilising AI-based personalised learning environments presents a valuable prospect for enhancing learner performance and catering to individual needs and interests. Their findings affirmed that customised and personalised training significantly benefits learning outcomes within the realm of providing assistance to individuals affected by dementia (Malek et al., 2023). Mahdavi Ardestani et al. (2023) suggested that integrating elements such as: *"concepts like feedback from experts, personalized learning, instructional material quality, course organization, effective methodologies, multimodal delivery formats"* in e-learning can elevate learning achievements and adhere to the most effective approaches in both e-learning and healthcare education (p. 12).

2.4.5.1.2. Increased Engagement and Motivation

Personalisation and interactive elements enhance engagement, motivating staff to actively participate and apply learned skills in their practice. A pattern observed across several studies showed that when learners recognise a system's value for their learning, they are more inclined to repeatedly use it for achieving learning success, a pattern observed across several studies (Ghaleb et al., 2021; Park, 2009; Yi and Hwang, 2003). This aligns with the overarching aim

of online learning: the more engagement learners have, the greater their acceptance of learning, ultimately leading to enhanced learning performance (Wongwatkit et al., 2020). This occurs because online learning support systems facilitate better learning in preferred styles, strengthening learners' intentions to utilise the system, consequently improving their learning outcomes (Wongwatkit et al., 2020; Al-Azawei and Lundqvist, 2015; Joo et al., 2014; Chen, 2011). In addition, Malek et al. (2023) described the connection between AI technology and adaptive learning systems, which involves technologies that dynamically adapt to an individual's skill level and overall knowledge. They stated that these learning systems facilitated the creation of tailored learning programs and enhanced learner motivation, potential, and success (Capuano and Caballé, 2020; Malek et al., 2023).

2.4.5.1.3. Enhanced Patient Care and Safety

Healthcare professionals equipped with thorough training and updated knowledge through personalised learning; significantly influence patient care, ensuring enhanced safety protocols and superior outcomes. Additionally, Malek et al. (2023) emphasised the essential nature of ongoing, specialised training to ensure the delivery of top-tier care for individuals with dementia. They laid the groundwork for technical consortium partners to develop a tailored digital educational program, driven by AI, catering to healthcare practitioners engaged in daily dementia care. Malek et al. (2023) emphasised the importance of creating a lasting educational structure as a crucial step in maintaining the delivery of outstanding dementia care.

Furthermore, Božić and Poola (2023) highlighted the potential of AI in aiding healthcare professionals to remain abreast of the latest medical research and guidelines, through personalised content recommendations. They illustrated that AI-powered systems can assess healthcare professionals' browsing behaviours and preferences, to furnish them with customised learning resources and opportunities. Consequently, by offering immediate support, automated aid, and tailored guidance; AI has the capacity to equip healthcare workers with the

digital competencies essential for delivering high quality care in the digital age (Božić and Poola, 2023).

2.4.5.2. Negative Impact

2.4.5.2.1. Privacy Concerns

The use of AI in personalised e-learning involves collecting and analysing data about individual learners. This raises concerns about the privacy and security of sensitive healthcare information. Abd-alrazaq et al. (2023) argued the integration of Large Language Models, exemplified by the Generative Pre-trained Transformers (GPT) series, within medical education holds promise for reshaping student learning experiences, thereby enhancing their knowledge, skills, and proficiency. However, they expressed concern that OpenAI's potential use, or sharing of users' personal information with third parties, could lead to unintentional privacy breaches (Abd-Alrazaq et al., 2023; Schade, 2024). In addition, the efficacy of Personalized Recommendation Systems (PRS) in efficiently gathering valuable user information from healthcare professionals is considered an optimal solution for delivering personalised content and services (Javeed et al., 2023). However, according to Javeed et al. (2023), *"the entire process of collecting, storing, and analyzing consumers' data increases the probability of malicious activities and makes Personalized Recommendation Systems (PRS) a favorite target for attackers"* (p. 4).

2.4.5.2.2. Limited Interpersonal Skills Development, Isolation and Lack of Peer Interaction

Personalised AI-driven e-learning, especially if overly automated, may lack the human touch, and personalised guidance that traditional mentorship or face-to-face training provides. This could impact the development of soft skills, empathy, and the ability to navigate complex interpersonal situations. Leinster et al. (2021) criticised the solitary nature of e-learning when students interact individually with computers, and the absence of peer interaction. According to Abd-alrazaq et al. (2023*), "the absence of human interaction can negatively affect students*

who prefer a personal connection with their educator" (p. 5). Additionally, Sutoi et al. (2023) asserted that the absence of patient interaction during online classes hindered medical students from acquiring essential qualities for future doctors, such as effective communication and empathy with patients. Furthermore, they reported that *"11.3% of students stated that due to the COVID-19 pandemic and the lack of human interaction, not only with patients but also with their teachers and colleagues, they had moments when they thought of the possibility of quitting medical school. In 2.9% of evaluated cases decided to give up on studying in the medical field"* (Sutoi et al., 2023, p. 1082)

In summary, personalised AI-based e-learning not only elevates the skills and knowledge of healthcare staff but also enhances their efficiency, engagement, and ultimately, the quality of patient care they deliver.

2.5. Theories and Models – An Insight

This research believes that the evolution of e-learning is a convergence of two fundamental dimensions: the adoption of technology, and the diverse spectrum of individual learning styles. Technology adoption models, such as (Technology-Organization-Environment (TOE), Technology Acceptance Model (TAM) and DeLone and McLean Information System Success Model (D&M), offer a lens into how users embrace digital tools within educational contexts. These frameworks offer a lens into the multifaceted landscape surrounding the integration of technology within educational spheres; exploring elements like organisational readiness, technological infrastructure, and external environments that influence technology adoption dynamics. Understanding these adoption patterns, paves the way for seamless integration and utilisation of e-learning platforms.

However, the efficacy of these technological tools is intimately tied to the mosaic of learners' cognitive preferences and learning styles. Models like the Felder-Silverman, Honey &

Mumford, and Kolb's Experiential Learning Theory provide invaluable insights into the diversity of how individuals process information and engage with educational content. By recognising and leveraging these learning style models, e-learning platforms gain the ability to personalise experiences, catering to distinct learning profiles.

The intersection of technology adoption models and learning style frameworks opens up a spectrum of opportunities in e-learning. This convergence facilitates the development of adaptable platforms that not just prioritise user-friendly interfaces, but also harmonise content delivery, teaching methods, and evaluation approaches, with individual learning preferences. By integrating perspectives from these models within the healthcare sector, healthcare staff and developers have the capacity to shape comprehensive learning journeys that go beyond technology, nurturing active engagement, deeper understanding, and improved knowledge retention among learners.

Firstly, this section will explore the widely used technology adoption models across a diverse business context: Technology-Organization-Environment (TOE), Technology Acceptance Model (TAM), and DeLone and McLean Information System Success Model (D&M). Subsequently, it will explore Kolb's, Honey and Mumford, and Filder-Silverman learning style models. Following this, the research will provide rationale for integrating the most suitable technology adoption model with learning style model in the healthcare domain.

2.5.1. Technology Adoption Models

Personalising e-learning within the health and social care sector is currently in its early stages of implementation, necessitating a meticulous consideration of the adoption process. This adoption process is crucial as it aids staff and organisations in identifying and mitigating challenges associated with personalising e-learning for healthcare professionals. Researchers in diverse business sectors have outlined pivotal elements influencing the adoption of advanced

technologies, such as personalisation. Several theories and frameworks, including the Technology Acceptance Model (TAM), Technology-Organization-Environment (TOE), Diffusion of Innovation (DOI), and DeLone and McLean Information System Success Model (D&M), have been introduced to assess issues linked with the adoption of advanced technologies.

Among these theories, the Diffusion of Innovation (DOI) stands as the most frequently utilised theory, explaining modernisation acceptance based on technological features and consumer perceptions. However, DOI focuses solely on technology-related aspects and overlooks non-technical constructs like organisational and environmental factors, especially environmental concerns. On the other hand, the Technology-Organization-Environment (TOE) theory doesn't solely focus on technological aspects; it also encompasses organisational and environmental factors, thus addressing the limitations of the DOI theory. Unlike the DOI framework, which lacks a resolution strategy for breakdowns or errors in the adoption process, TOE is geared toward identifying the influential or impacting issues related to technology adoption.

This section aims to build upon relevant studies and theoretical literature to develop a conceptual framework for the adoption of personalised e-learning in the UK's health and social care sector. This framework will explore the issues affecting healthcare organisations in adopting personalisation within e-learning systems. Furthermore, the section will discuss commonly used technology adoption theories, shedding light on the efficacy of adopting personalised e-learning in healthcare settings.

2.5.1.1. Technology-Organization-Environment (TOE)

The TOE framework serves as an analytical tool utilised to explore adoption within a firm; concerning various Information Systems (IS), information technology (IT) products, and services (Singh and Alshammari, 2021). Originating from the field of organisational

psychology, this theory was conceptualised by Tornatzky and Fleischer in 1990 (Eze et al., 2018). It discerns the components within an enterprise that influence the adoption and implementation of technological innovations (Singh and Alshammari, 2021). By considering technological, organisational, and environmental contexts, the TOE framework offers a distinct perspective on IT adoption (Pan et al., 2022), shown in Figure 19.

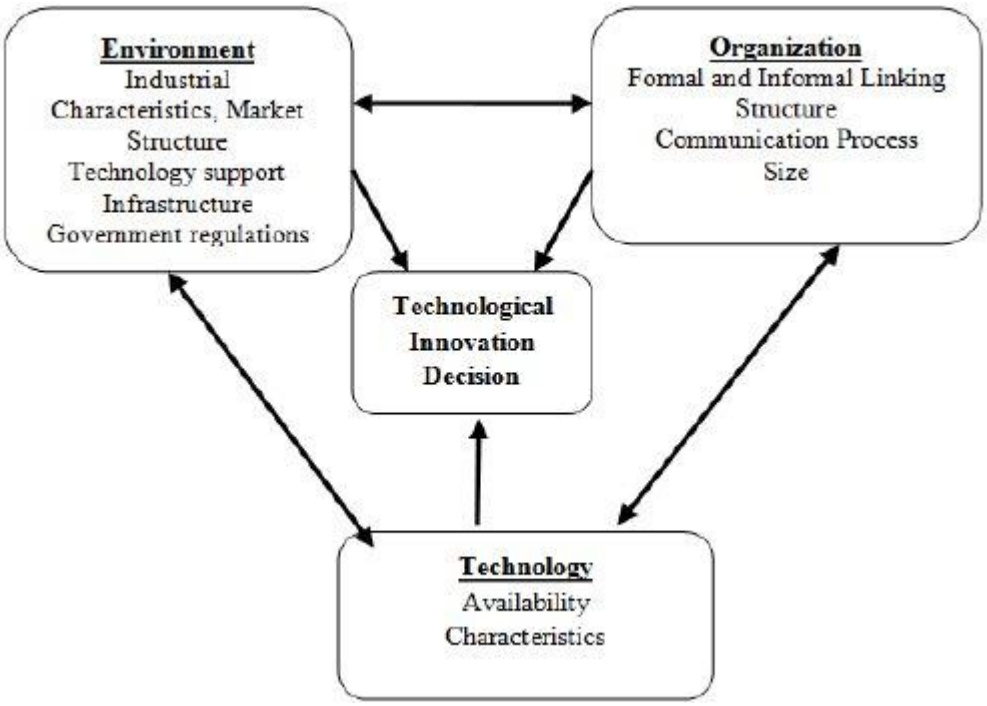

Figure 19: TOE framework (Tornatzky and Fleischer, 1990).

The technological viewpoint encompasses both the internal and external advantages of technology, aiming to enhance an organisation's productivity and operational efficiency (Eze et al., 2018). This includes aspects like information technology infrastructure, software, and hardware (Singh and Alshammari, 2021). When referring to an organisation; it encapsulates both the formal and informal structures, and communication processes within an organisation. Moreover, it denotes organisational traits that can either facilitate or impede the adoption process (Singh and Alshammari, 2021). The characteristics of an organisation are embodied in its organisational context, which involves factors like *"organization size, degree of complexity*

of management or organization structure, and human resources" (Ghaleb et al., 2021, p. 6). The environment perspective relates to elements such competition, business practices, government influence on the organisation, relationships with trading partners, industry structure, business location, and globalisation (Tornatzky and Fleischer, 1990; Chau and Tam, 1997; Nguyen et al., 2015; Yang et al., 2022; Eze et al., 2018).

Singh and Alshammari (2021) utilised the TOE model to devise a framework for Digital Technology-enabled Personalised and Adaptive Learning (DT-PAL) at an institutional level, specifically tailored for enhancing student learning in Saudi Arabia (p. 1). Within this framework, factors like COVID-19 impacts, and national cultural aspects were examined as environmental factors, while personalised and adaptive learning were categorised under the organisational factors within the TOE model. They proposed the subsequent framework based on the TOE model, Figure 20:

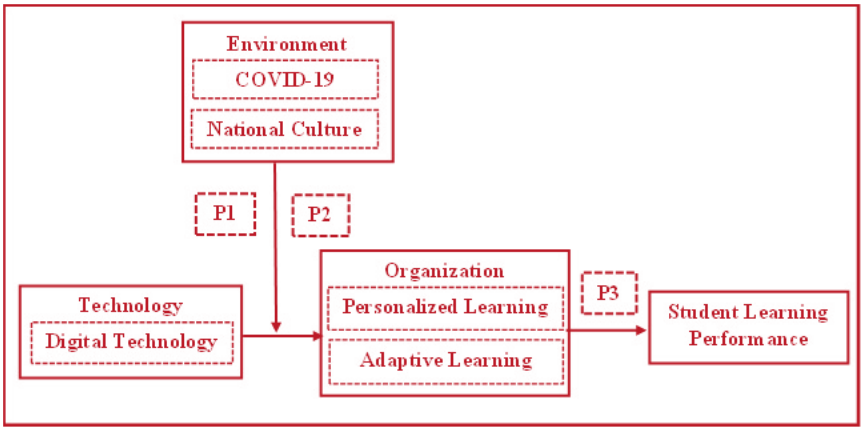

Figure 20: Digital Technology-enabled Personalised and Adaptive Learning (DT-PAL) Student Learning Framework (Singh and Alshammari, 2021, p. 8).

An earlier study employed the TOE framework to ascertain the elements influencing decisions regarding the adoption of AI healthcare service resources within integrated medical and healthcare organisations (Yang et al., 2022). The study revealed that the adoption of AI healthcare services was notably impacted by technological factors such as a "*lack of awareness*

of value and benefits of AI" and "*high risk of data leakage"*. Furthermore, within organisational aspects, *"lack of management leadership support"* stood as a foundational factor influencing the adoption of AI healthcare resources in medical institutions. Moreover, they highlighted environmental factors like "*government policies", "Competitive pressures"*, "*lack of patient trust"*, "*lack of excellent partnerships"* (Yang et al., 2022, p. 38).

Hence, the findings indicated that healthcare providers prioritise technological and environmental considerations when determining the adoption of AI service resources (Yang et al., 2022). This aligns with Ahmadi et al.'s (2015) discoveries, which also underscored the significance of environmental and technological factors as primary concerns in the adoption of Hospital Information Systems.

This research will use the Technology-Organization-Environment (TOE) framework as an analytical instrument to investigate the adoption of personalised AI-based e-learning within healthcare organisations. One prominent reason for selecting the TOE framework is that it encompasses the environmental context; an aspect often overlooked by the Innovation Diffusion Theory (IDT) (Oliveira and Martins, 2011; Maduku et al., 2016). Also, another compelling reason for employing the TOE framework is that in terms of the adoption, utilisation, and value creation of technological innovations, the TOE framework surpasses other adoption models (Oliveira and Martins, 2010). Moreover, its applicability is not limited to specific industries or firms (Wen and Chen, 2010). Extensive studies conducted across diverse technological, industrial, and national contexts have emphasised the pivotal role played by technological, organisational, and environmental variables. This emphasis establishes the TOE framework as invaluable in understanding innovation appropriation, utilisation, and value creation in innovation development (Zhu et al., 2003; Xu, 2017; Awa et al., 2012; Ramdani et al., 2009; Oliveira and Martins, 2011; Oliveira and Martins, 2010). Thus, Singh and Alshammari (2021) stated that *"the TOE framework provides an in-depth examination of*

consumer technology adoption, technology implementation, technological challenges, impact on activities along the value chain, diffusion of technology within firms the following adoption, and the factors affecting business and innovation adoption" (p. 4).

Furthermore, Low et al. (2011) and Ansong et al. (2017) emphasised that the TOE framework uniquely integrates the three crucial determinants influencing technology adoption: technological, organisational, and environmental perspectives. They highlighted TOE as the primary model that emphasises various individual factors to underscore the distinctiveness of decision-makers, while acknowledging the impact of technology development and organisational conditions, necessitating essential business and organisational adjustments shaped by the industry environment (Ansong et al., 2017).

Ghaleb et al. (2021) attested to the substantial empirical support in literature for examining the adoption of new technologies using the TOE framework. Literature from the early years highlights the validation and applicability of the TOE model across European, American, and Asian contexts, spanning both developed and developing countries (Zhu et al., 2003; Zhu et al., 2006; Xu et al., 2004; Schillewaert et al., 2005; Eze et al., 2018; Maduku et al., 2016). Consequently, this positions TOE as a reliable and trusted framework for application, especially within complex industries such as healthcare.

As a result, "*the technology acceptance model (TAM), the theory of planned behavior (TPB), and the unified theory of acceptance and use of technology (UTAUT) apply at the level of individuals, whereas the diffusion of innovation DOI and TOE apply at the level of firms*" (Singh and Alshammari, 2021, p. 3). Given this research's aim to establish a framework for implementing personalised AI-based e-learning within an institution; firm-level theories (DOI and TOE) are relevant (Singh and Alshammari, 2021). The TOE framework, which is considered an extension of the DOI model, assesses the likelihood of a specific organisation

adopting and integrating innovations comprehensively, accounting for technological, organisational, and environmental elements. Therefore, this study will employ the TOE model to construct a conceptual framework.

2.5.1.2. Technology Acceptance Model (TAM)

Davis (1986) introduced the Technology Acceptance Model (TAM) (Figure 21) as a means to forecast users' inclination toward accepting technologies. The model was Initially designed to elucidate user behaviour in relation to *"computer-usage and Information Technology (IT)"* (Al-Azawei and Lundqvist, 2015, p. 410). The theory asserts that *"a person's intent to use (acceptance of technology) and usage behavior (actual use) of a technology is predicated by the person's perceptions of the specific technology's usefulness (benefit from using the technology) and ease of use"* (Portz et al., 2019, p. 2). Additionally, the TAM suggests that these perceptions of usefulness and ease of use are shaped by external variables such as *"individual differences, system characteristics, social influences, and facilitating conditions"* (Portz et al., 2019, p. 2).

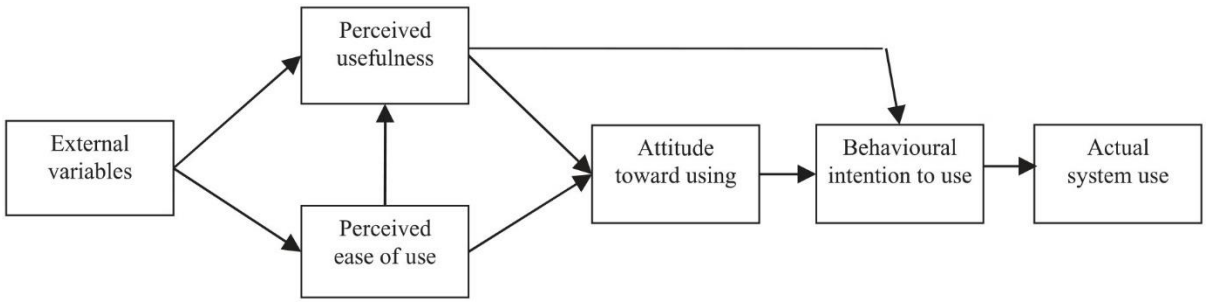

Figure 21: Technology Acceptance Model (TAM) (Davis et al., 1989)

Aeni Hidayah et al. (2020) integrated the TAM model with the Delone and McLean Information System Success Model to assess user acceptance levels of the Mobile Academic Information System application. They adapted the framework as illustrated in Figure 22:

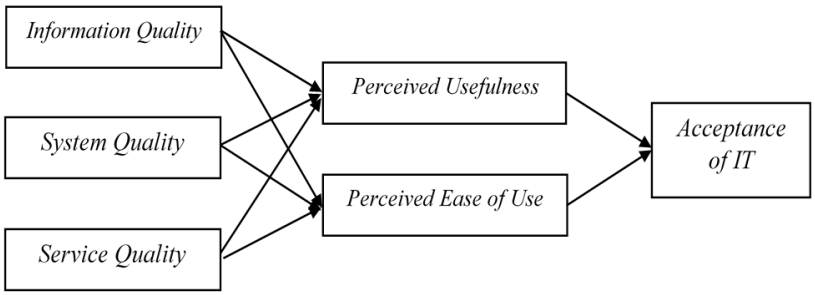

Figure 22: Integrated TAM model with Delone and McLean Information System Success Model (Aeni Hidayah et al., 2020).

Aeni Hidayah et al.'s (2020) findings revealed that Information Quality (IQ) and System Quality (SQ) indirectly influenced Acceptance of IT, while Perceived Usefulness (PU) and Perceived Ease of Use (PEU) had a direct impact on Acceptance of IT. Meanwhile, in a recent investigation into e-learning acceptance, and perceptions among medical and health students in Saudi Arabia amid the COVID-19 lockdown; Alhur et al. (2023) found a distinct preference for blended learning over traditional and pure e-learning methods. The TAM model effectively measured acceptance, where usefulness and ease of use emerged as crucial predictors for adoption (Alhur et al., 2023). Notably, the study highlighted a commendable level of acceptance among medical and health students towards E-Learning, indicative of the evolving educational trends in our time. However, it's important to note persistent challenges, particularly regarding perceived ease of use, emerged as a recurring concern (Alhur et al., 2023).

2.5.1.3. DeLone and McLean Information System Success Model (D&M)

The DeLone and McLean (D&M) information systems (IS) success model aims to provide a comprehensive understanding of IS triumph by elucidating the relationships among its pivotal success dimensions (Sabeh et al., 2021). Initially introduced in 1992, the original model encompassed six interconnected and interdependent success factors: "*system quality, information quality, use, user satisfaction, individual impact, and organizational impact"*

(DeLone and McLean, 1992). Several scholars have critiqued the model, prompting DeLone and McLean to review these criticisms and evaluate contributions from the field, leading to a revised model (Sabeh et al., 2021). In their original framework, "*system quality"* denoted the desirable attributes of the system itself, while "*information quality"* pertained to the excellence of system outputs (i.e., the quality of provided information). "*Service quality"* referred to the support quality users received from the system's service provider (DeLone and McLean, 2003). *"Use"* represented users' perceived actual utilisation of the system across various tasks (DeLone and McLean, 1992). "*Intention to use"* signified users' intentions to employ the system (DeLone and McLean, 2003). "*User satisfaction"* reflected users' contentment levels when utilising the system (DeLone and McLean, 1992). "*Net benefits"* gauged the degree to which IS contributed to the success of individuals, organisations, and groups (DeLone and McLean, 2003). Figure 23 illustrates the updated version of DeLone and McLean IS success model.

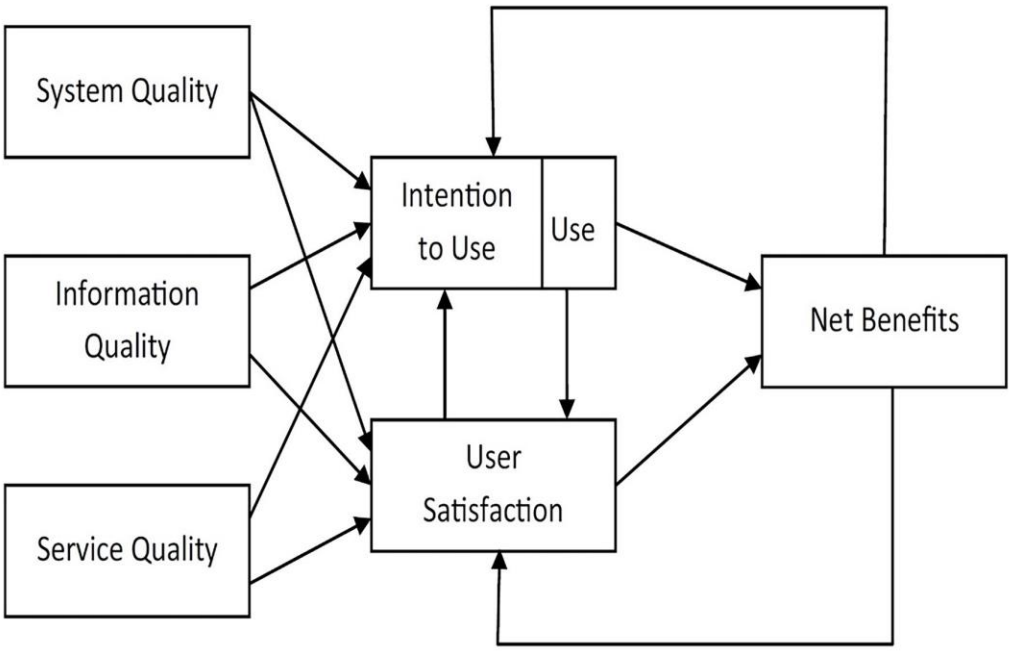

Figure 23: Updated version of DeLone and McLean information systems (IS) success model (DeLone and McLean, 2003).

A prior investigation utilised the Updated DeLone-McClean IS Success Model to identify the direct and indirect factors influencing the effectiveness of learning management systems integrated into the Ministry of Education's "Sekolah Penggerak" training initiative (Yudiawan et al., 2022), as illustrated in Figure 24:

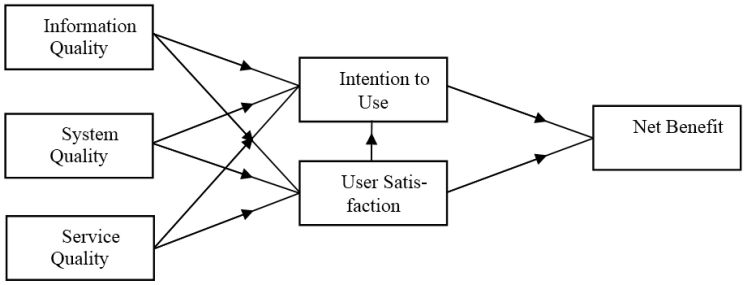

Figure 24: Adapted DeLone and McLean model used in Yudiawan et al. (2022).

They discovered direct and indirect connections among the seven factors, and the twenty-two hypotheses investigated to validate the efficiency and triumph of learning management system services. Nevertheless, Yudiawan et al. (2022) asserted that solely the intention to use variable did not mediate between service quality and net benefits. In separate research among Malaysian undergraduate nursing students, Ching et al. (2021) aimed to explore the impact of student satisfaction on learning quality and outcomes. The study constructed a conceptual framework based on the DeLone and McLean Information Systems Success Model, shown in Figure 25.

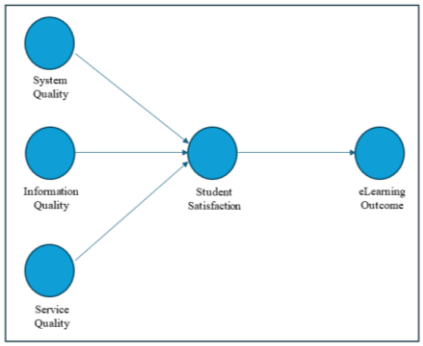

Figure 25: Conceptual framework based on "DeLone and McLean Information Systems Success Model to examine any mediation effect of student satisfaction on elearning quality and learning outcome among nursing undergraduates in a local elearning program" (Ching et al., 2021).

The results indicated notable connections between system quality and service quality dimensions, with both student satisfaction, and learning outcomes (Ching et al., 2021). Moreover, there existed a mediating influence of student satisfaction on the correlation between e-learning quality and learning outcomes. Ching et al. (2021) highlighted the crucial need for an initial comprehension of learners' environmental requirements in the learning process. This understanding is essential for delivering a credible and meaningful learning experience, especially for working nurses participating in e-learning nursing programs.

2.5.2. Learning Style Models

Understanding how individuals learn is an intricate puzzle, and learning style models serve as key pieces in deciphering this. These models offer lenses through which we explore the diverse ways individuals perceive, process, and retain information. By delving into these models, healthcare organisations can gain insights into tailoring instructional strategies that resonate with individual learners' preferences, thereby fostering more effective and engaging learning experiences. Learning style models explore a rich landscape, with varied theories such as Kolb's Experiential Learning Theory, Honey & Mumford's Learning Styles, and Felder-Silverman's Model offering nuanced perspectives. What makes learning style models

compelling is their capacity to capture the multifaceted nature of human cognition. They acknowledge that learners are not uniform in their approaches; instead, they embrace diversity by recognising various preferences. However, these models are not without debate or criticism. Some scholars question their empirical foundations or argue that oversimplification might limit their applicability in complex learning scenarios. Yet, their role in shaping educational practices remains crucial; guiding organisations and providers in crafting adaptable strategies that cater to various learning preferences.

In essence, learning style models constitute a rich tapestry of insights into how individuals engage with, and internalise information. By incorporating these models thoughtfully, healthcare organisations and providers can navigate the intricacies of learner diversity, paving the way for more personalised and effective learning journeys.

2.5.2.1. Kolb's Learning Style Model

Kolb emerged as a pioneering theorist, introducing the concept of Learning Style (LS) theory in the early 1970s (Kolb, 1984). He pioneered the development of an experiential learning style model, significantly influencing the construction of subsequent models. In his 1984 work titled "Experiential Learning", Kolb outlines the principle that learning transpires through discovery and firsthand experience (Kolb, 1984). Central to his theory is the notion that a person comprehends and internalises knowledge by cycling through four modes of learning, aiming to gain a comprehensive understanding of a subject (Lamya et al., 2020). The learning cycle includes Concrete Experience (CE), Abstract Conceptualization (AC) constituting the Grasping Experience mode, along with Reflective Observation (RO), and Active Experimentation (AE); forming the Transforming Experience mode, shown in Figure 26 (Huang et al., 2012; Kolb and Kolb, 2005). Kolb's theory revolves around four distinct learning styles derived from combinations of four adaptation modes, reflective of a learner's preferred

style (Lamya et al., 2020). To operationalise this theory, Kolb introduced the Learning Style Inventory (LSI) questionnaire, designed to discern an individual's predominant learning style.

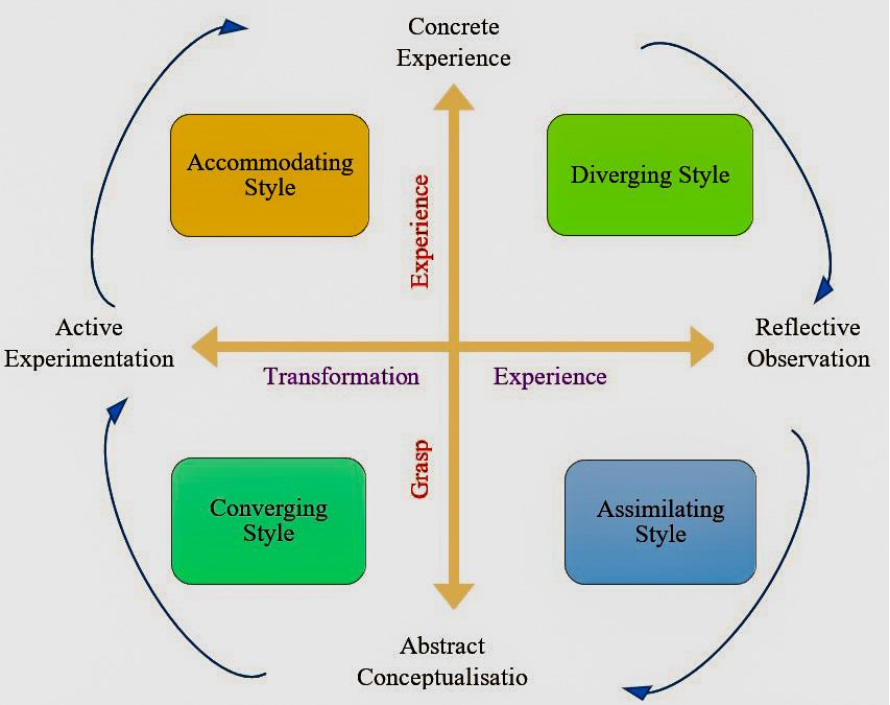

Figure 26: Kolb's Experimental Learning Model (Manolis et al., 2013). The figure shows the cycle of the experimental learning (Kolb and Kolb, 2005).

Kolb described various attributes specific to individual learners, categorizing them into four distinct styles: *"The divergent style, The assimilator style, The convergent style, The accommodator style"* (Lamya et al., 2020, pp. 102-103). This classification is detailed in Table 1:

Learning Styles (Kolb's LS Theory)	Characteristics
Converger (The Convergent Style)	*"They are abstract conceptualisation and active experimentation. Thus they will be able to make practical application of ideas by deductive reasoning. They are also good problem solvers"* (Sarabdeen, 2013, p. 3).
Diverger (The Divergent Style)	*"They are good at concrete experience and reflective observation. Therefore they tend to be imaginative and provide innovative ideas"* (Sarabdeen, 2013, p. 3).
Assimilator (The Assimilator Style)	*"This group uses abstract conceptualisation and reflective observation. They are good at using inductive reasoning"* (Sarabdeen, 2013, p. 3). They learn better alone.
Accommodator (The Accommodator Style)	*"This group of learners tends to use concrete experience and active experimentation. They are good at actually doing the things"* (Sarabdeen, 2013, p. 3).

Table 1: Characteristics of different learning styles, introduced by Kolb's Learning Styles Theory (Sarabdeen, 2013, p. 3).

2.5.2.1.1. The Convergent Style

Sarabdeen (2013) outlined that individuals demonstrating a converging style favour engagement in small group discussions and classroom settings while avoiding lectures. A *"Converger"* exhibits a preference for *"data-based programs" and "computer-based learning"*, typically characterised as someone averse to taking risks (Sarabdeen, 2013, p. 3).

2.5.2.1.2. The Divergent Style

"Diverger" prefers *"traditional classroom based delivery that comprises of brainstorming sessions, reflective activities, lectures and rhetorical questions"* (Sarabdeen, 2013, p. 3).

The Assimilator Style:

Individuals exhibiting an Assimilating Style are often referred to as "private learners". Delahaya (2005) cited in Sarabdeen (2013) suggests that their most effective training delivery method is through "print-based delivery" (p. 3).

2.5.2.1.3. The Accommodator Style

Individuals characterised by an Accommodator Style, display a preference for hands-on experimentation, engaging actively in activities such as *"computer-based simulation games, online group work, role-playing games, and observations"* (Sarabdeen, 2013, p. 3). As a result, the most effective training delivery method for an "Accommodator" is through computer-based modes (ibid).

2.5.2.1.4. Challenges of Kolb's LSI

Two concerns have been raised regarding Kolb's LSI. Firstly, the use of the "forced-choice method" and secondly, its nature as "ipsative" (Coffield et al., 2004; Kolb and Kolb, 2021). The forced-choice method is deliberately employed across all three versions of the LSI by Kolb to enhance the instrument's ecological validity; compelling learners to select between different learning modes in line with Kolb's theory. This method also aims to mitigate the influence of the "social desirability response" (Kolb and Kolb, 2021). Kolb addressed this by using four words considered "equally positive in social desirability" (Kolb and Kolb, 2021) although the success of this objective is debated (Coffield et al., 2004).

Secondly, the LSI operates as what is termed 'ipsative,' inherently intertwining the four learning modes into the test (Kolb and Kolb, 2021). This means learners are required to assign a score

(1, 2, 3, or 4) to four different endings to a sentence, ensuring a constant total score of 10 for each learner for each sentence (Coffield et al., 2004). Doherty (2022) has expressed concerns that the choices imposed on learners by the Kolb questionnaire may not truly reflect their genuine opinions. Learners might perceive two statements as equal but are unable to score them equivalently. Similarly, learners may consider certain statements unworthy of any score, but the questionnaire doesn't allow for this, potentially affecting result accuracy (Doherty, 2022). Table 2 detailed the strength and weaknesses of Kolb's LSI:

	Strength	Weakness
General	• Learning styles are not fixed personality traits, but relatively stable patterns pf behaviour. • 30 years of critique have helped to improve the LSI, which can be used as an introduction to how people learn.	Should not be used for individual selection.
Design of the model	• Learning styles are both flexible and stable. • Based on the theory of experiential learning which incorporates growth and development.	Three elements need to be separated: • Process=the four stages of the learning cycle • Level=how well one performs at any of the four stages • Style=how each stage is approached.
Reliability	Changes to the instrument have increased its reliability.	Long, public dispute over reliability of LSI. Third version is still undergoing examination.
Validity		• The contrast validity of the LSI has been challenged and matter is not yet settled. • It has low predictive validity, but it was developed for another purpose-as a self-assessment exercise.
Implications for pedagogy	• In general, the theory claims to provide a framework for the design and management of all learning experiences. • Teachers and students may be stimulated to examine and refine their theories of learning: through dialogue, teachers may become more empathetic with students. • All students to become competent in all four learning styles (active, reflective, abstract and concrete) to produce balanced, integrated learners. • Instruction to be individualised with help of IT.	• The notion of learning cycle may be seriously flawed. • The implications for teaching have been drawn logically from the theory rather than from research findings.
Evidence of pedagogical impact		• There is no evidence that 'matching' improves academic performance in further education. • The findings are contradictory and inclusive. No large body of unequivocal evidence on which to base firm recommendations about pedagogy.
Overall assessment	One of the first learning styles, based on an explicit theory. Problems about reliability, validity and learning cycle continue to dog this model.	
Key source	Kolb 1999	

Table 2: Strength and weaknesses of Kolb's Learning Style Inventory (LSI) (Coffield et al., 2004, p. 70).

2.5.2.2. Honey and Mumford learning Style Model

Honey and Mumford (1986 cited in (Kolb and Kolb, 2005, p. 29)) acknowledged Kolb's model as "academically respectable". However, they recognized the necessity for a practical instrument applicable in the business sphere. Hence, Honey and Mumford (1982, 1992) adapted Kolb's model based on Experiential Learning Theory (ELT) to create a model tailored for middle and senior managers in the business realm (Sarabdeen, 2013). This adaptation resulted in two changes from the original model to suit the business environment, culminating in the development of the Learning Styles Questionnaire (LSQ) (Honey and Mumford (1986) cited in (Sarabdeen, 2013, p. 3)).

Huang et al. (2012) indicated that the LSQ explores general behavioural tendencies instead of directly inquiring about individuals' learning processes, a departure from the LSI's approach. The LSQ aims to investigate how managers learn most effectively, and the environments in which managers thrive (Manolis et al., 2013). Consequently, Manolis et al. (2013) argued that the LSQ lacks consideration of the "*psychology behind the behavior,*" focusing solely on "*observable behavior*" (p. 47). Huang et al. (2012) suggested that Honey and Mumford adopted this approach because, *"people have never consciously considered how they really learn"* (p. 340). Prior studies debated the validity and reliability of the LSQ. Allinson and Hayes (1988) cited in Manolis et al. (2013) argued that the LSQ can differentiate between similar independent samples, presenting an advantage over the LSI. However, critiques by Allinson and Hayes (1988), Duff (2001), and Duff and Duffy (2002) cited in Manolis et al. (2013) contended that the LSQ, including its modified version, inadequately assesses individual learning styles, lacking predictive ability and evidential support for validity. Duff (2001) raised concerns about the validity of the LSQ scale, citing insufficient evidence. Duff and Duffy (2002) and Duff (2011) expressed doubts about the reliability and validity of LSQ, including issues with its variable structure. Swailes and Senior (1999) noted LSQ's popularity in the UK but highlighted

a lack of evidence demonstrating its contrasting validity. Their study on 329 managers in Britain using LSQ indicated, through factor analysis, that the LSQ did not distinctly align with the four-stage Learning Cycle underpinning its theoretical foundation (Swailes and Senior, 1999). Consequently, Swailes and Senior recommended a redesign for LSQ due to identified weaknesses (Coffield et al., 2004).

Table 3 shows the strengths and weaknesses of LSQ:

	Strength	**Weakness**
General	LSQ probes the attitudes and behaviours which determine preferences with regard to learning. To be used for personal/organisational development and not for assessment/selection. Not a psychometric instrument, but a checklist about how people learn.	Danger of labelling people as 'theorists' or 'pragmatists', when most people exhibit more than one strong preference.
Design of the model	Based on Kolb's model, with new terms for style preferences which are aligned to the four stages in the learning cycle.	Evaluation by researchers has become increasingly critical, eg percentage of variance explained by personality and learning style put at 8% (Jackson and Lawty-Jones 1996).
Reliability		Only moderate internal consistency has been found.
Validity	Face validity is claimed by authors.	Validity not assessed by authors. More evidence is needed before LSQ is acceptable.
Implications for pedagogy	• To help managers/ employees to devise personal development plans. • To show managers how to help their staff learn. • To be used as a starting point for discussion and improvement with a knowledgeable tutor.	All the suggestions are derived logically or from practice with using the LSQ; they have not been rigorously tested to see if they work.

	• Suggestions made to help people strengthen an under-utilised style.	
Evidence of pedagogical impact	No evidence quoted by authors.	No evidence found by researchers.
Overall assessment	Has been widely used in business, but needs to be redesigned to overcome weaknesses identified by researchers.	
Key source	Honey and Mumford 2000	

Table 3: Strength and weaknesses of Honey and Mumford's Learning Style Questionnaire (LSQ) (Coffield et al., 2004, p. 76).

2.5.2.3. Felder-Silverman Learning Style Model (FSLSM)

The Felder-Silverman Learning Style Model (FSLSM) was introduced by Felder and Silverman in 1988, leading to the development of the Felder-Soloman's Index of Learning Styles (ILS) based on FSLSM (Zywno, 2003). The ILS is a psychometrically validated assessment tool (Zywno, 2003; Dung and Florea, 2012). FSLSM has been linked to students' performance in online courses, demonstrating a correlation between a person's learning style and their course performance (Graf et al., 2007). Multiple studies by Zywno (2003), Peña, Marzo and Rosa (2005), Dung and Florea (2012), and Huang and Lin (2012) have corroborated the effectiveness and comprehensiveness of FSLSM across various adaptive systems. Campbell et al. (1996) cited in (Sarabdeen, 2013, p. 4) noted the popularity of the Learning Style Inventory (LSI) by Kolb and the Learning Style Questionnaire by Honey and Mumford in the UK. Kolb's LSI comprises of 80 items, while ILS consists of 44 items across four scales to assess learning styles (Huang et al., 2012). Zywno (2003) conducted research to validate learning style instruments, primarily comparing Kolb's LSI and Felder-Soloman's Index of Learning Styles. The study found that students faced difficulties in understanding the wording in Kolb's LSI questionnaire, leading to confusion in responses (Zywno, 2003). Also, it is declared that Kolb's questionnaire took more than 10 minutes to complete (Zywno, 2003).

Additionally, because Kolb's questionnaire took over 10 minutes to complete; Zywno (2003) argued that if a voluntary survey takes this long, it's less likely to be completed and returned by students or faculty.

Both instruments have been effectively applied in various research contexts. Past studies indicate that FSLSM is a suitable model for e-learning systems, while Kolb's LSI questionnaire can offer a more personalised approach compared to LSQ. Moreover, ILS emerges as a better instrument, due to fewer questions, shorter completion time, and clearer survey structure compared to LSI.

Figure 27 illustrates the Felder-Silverman learning style model (FSLSM):

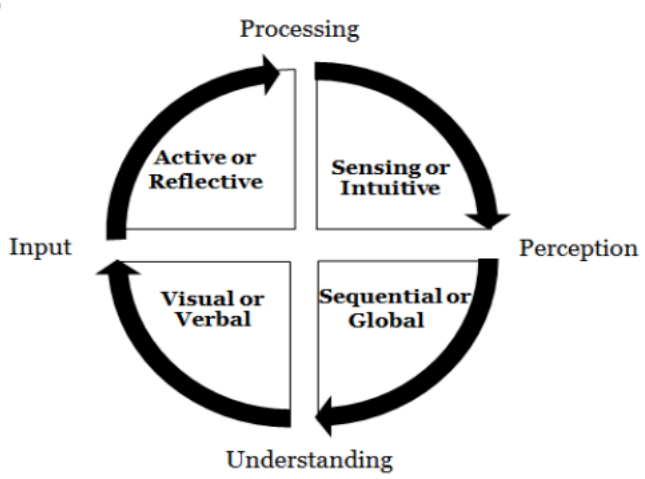

Figure 27: Felder-Silverman learning style model (FSLSM) (Felder and Silverman, 1988).

The following table illustrates a summary of learning styles:

Dimensions of FSLSM	Similar concepts or scales	Authors
Active/Reflective	Active/Reflective in ILS	Felder and Soloman (1997)
	Activist/ Reflector in LSQ	Honey and Mumford (1992)

	Active Experimentation (AE)/Reflective Observation in LS (RO)	Kolb (1984)
Sensory/Intuitive	Sensory/Intuitive dimension in ILS	Felder and Soloman (1997)
	Sensation-Intuition in MBTI	Myers (1962)
Visual/Verbal	Visual/Verbal dimension in ILS	Felder and Soloman (1997)
	Verbal/Imagery style dimension in CSA	Riding (1991)
Sequential/Global	Sequential/Global dimension in ILS	Felder and Soloman (1997)
	Holistic/Analytic style dimension in CSA	Riding (1991)
	Field dependence-independence	Witkin (1949)

Table 4:"Summary of Learning Style Dimensions" (Huang et al., 2012, p. 341).

Initially, the FSLSM stands out as the most commonly utilised model for assessing individual learning styles on a broad scale (Becher, 1994). It has maintained popularity over the years across diverse disciplines within healthcare and beyond. Additionally, it has been advocated as the most suitable model for a technology-enhanced learning environment due to its incorporation of crucial theories of cognitive learning behaviours (Graf et al., 2007; Kuljis and Liu, 2005). Consequently, numerous scholars have grounded their investigations of learners' learning styles in e-learning and technology-supported learning environments; on the FSLSM (Abdullah et al., 2015; Azzi et al., 2020; García et al., 2007; Hmedna et al., 2020; Kolekar et al., 2017).

Secondly, the FSLSM, built upon earlier learning style models, combines their strengths, and offers a more comprehensive understanding of learners' learning styles (Crockett et al., 2011;

Latham et al., 2012). In contrast to many other learning style models that categorise learners into a few groups, the FSLSM delves into details, describing learners' preferences across four dimensions (Fakoya et al., 2020). The four dimensions consist of eight paired styles, namely: sequential/global, sensing/intuitive, active/reflective and visual/verbal, with each learner being assigned to one pair at a time (El-Bishouty et al., 2019; Huang et al., 2012).

Thirdly, the FSLSM exhibits robust predictive prowess when tested with independent sets (i.e., learning style objects unknown to the model) (Curry (2987) cited in (Hu et al., 2021)), consistently validated as more accurate, reliable, and valid in forecasting learners' performance when contrasted with numerous other models (Felder and Spurlin, 2005; Latham et al., 2012).

Finally, the ILS, originating from the FSLSM, is an openly accessible tool accessible on the internet and extensively applied in research settings (Jing et al., 2015; Coffield et al., 2004). It proves to be a valuable instrument for identifying learning techniques, showcasing reliability and validity across diverse studies (Zlatkovic et al., 2020).

This study sought to introduce a conceptual framework to address identified barriers to the adoption of personalised AI-based e-learning within the healthcare sector. The conceptual framework derived from this study integrated Felder-Silverman Learning Style Model (FSLSM) with a technology adoption framework, TOE.

2.5.3. Integration of TOE and FSLSM

This research aims to utilise the Technology-Organization-Environment (TOE) framework as an analytical instrument to investigate the adoption of personalised AI-based e-learning within healthcare organisations. Additionally, the amalgamation of the TOE framework with the Felder-Silverman Learning Style model in the healthcare context seeks to provide a comprehensive perspective on how learning styles intersect with technology adoption within organisational settings. This combined framework is anticipated to establish the foundational

structure for comprehending the adoption of personalised e-learning in health and social care institutions.

2.5.3.1. Justification of applying TOE and FSLAM

The Technology-Organization-Environment (TOE) model primarily focuses on understanding the factors that influence the adoption and assimilation of personalised AI based e-learning within healthcare organisations. The Felder-Silverman Learning Style Model (FSLSM), on the other hand, centres around individual learning preferences. Integrating the TOE model with the FSLSM, can provide several benefits, enhancing the depth and breadth of researcher understanding in research or practical applications.

2.5.3.1.1. Holistic Perspective

It is believed that combining TOE and FSLSM offers a more holistic view by considering both organisational/technological factors and individual learning preferences. Therefore, it can analyse not only how the technology is adopted within an organisation, but also how individual learning styles interact with, and influence this adoption process.

2.5.3.1.2. Individual-Centric Design

FSLSM helps in understanding how to tailor technology interfaces and educational content to individual learning styles. As a result, this integration allows for the development of personalised e-learning platforms that cater to diverse learning preferences, promoting individual-centric design for a more effective learning experience.

2.5.3.1.3. Improved E-learning Programs

It is believed that integration helps healthcare organisations to develop more effective online training programs that consider diverse learning styles for healthcare staff. So, training initiatives aligned with individual learning preferences identified through the FSLSM, can lead to improved engagement, comprehension, and retention of knowledge among healthcare staff.

2.5.3.1.4. Inclusive Organisational Culture

The integration promotes an inclusive organisational culture that recognises and accommodates diverse learning styles. Therefore, by acknowledging and accommodating various learning preferences, healthcare organisations can foster a more inclusive environment, leading to higher employee satisfaction and performance.

2.5.3.1.5. Better Learning Outcome

Another reason to integrate the FSLSM with TOE, is to enhance the effectiveness of e-learning platforms within healthcare organisations. Tailoring e-learning to individual learning styles can result in improved learning outcomes, as staff are more likely to engage with, and benefit from, content that aligns with their preferred learning methods.

It is important to mention that this integration can provide a more nuanced understanding of the complex interplay between technology adoption, and individual learning styles within a healthcare context. In addition, the research can investigate the intricacies of how organisational, technological, and environmental factors interact with, and are influenced by individual learning preferences. In summary, integrating TOE with the FSLSM allows for a more comprehensive exploration of the factors influencing technology adoption, resulting in better-designed e-learning systems and organisational practices that accommodate a diverse range of learning styles.

2.6. Summary of the Chapter

This chapter extensively examined the literature pertaining to personalised AI-based e-learning in a healthcare context. The chapter begins by establishing the context and significance of Artificial intelligence, e-learning, and personalised AI based e-learning within a broader field. An overview of key studies is presented, highlighting the evolution of AI and e-learning in the healthcare sector and beyond. The review encompasses various technology adoption models,

learning style models, and empirical studies that contribute to the understanding of the research problem. Models such as Technology-Organization-Environment (TOE) and the Felder-Silverman Learning style Model have been explored to provide a conceptual foundation for this research. Additionally, the literature review identifies gaps, debates, and inconsistencies in the existing body of knowledge, laying the groundwork for the current research. The following chapter will outline the methodology employed for this research.

Chapter 3.0: Research Methodology

3.1. Introduction

The term 'methodology' denotes the research rationale employed by a researcher in a specific project, encapsulating; foundational knowledge relevant to the subject, the utilised research methods, and the framework implemented within a specified context (Sarantakos, 2005). Following a systematic literature review, and the subsequent development of a conceptual framework, the next phase of this research study is to offer a comprehensive explanation of the research procedures and processes. Therefore, the aim of this chapter is to provide the reader with insights into the methodology adopted in this research study, and to elucidate how the conceptual framework is utilised to investigate the factors influencing the adoption of personalised AI-based e-learning within the healthcare sector.

The chapter begins by examining the chosen research philosophy, paradigms, approaches, methods, and strategies, along with the rationale for their selection. Subsequently, the chapter outlines the proposed research design implemented in the current study, covering research phases and processes, and includes a discussion on data collection instruments and analysis. Lastly, the chapter concludes with an exploration of ethical considerations and research limitations associated with data collection.

3.2. Adopted Research Philosophy

This research is anchored in a constructivist epistemological framework, which posits that knowledge is actively constructed by individuals within specific social and cultural contexts. Epistemology pertains to beliefs about knowledge, defining what is considered acceptable, valid, and legitimate knowledge, as well as exploring the ways in which we can convey knowledge to others (Burrell and Morgan, 2016; Saunders et al., 2019). The study recognises that reality is subjective, and meanings are not fixed, but are shaped through the interactions of

individuals with their environment (Saunders et al., 2016; Burrell and Morgan, 1979). This perspective aligns with the qualitative nature of the research, emphasising the exploration and interpretation of individuals' lived experiences. Therefore, the AI-driven personalisation features, aim to cater to individual learning styles, preferences, and contextual needs, contributing to the co-construction of knowledge between the learner and the technology.

I believe that the epistemological stance acknowledges the subjective nature of knowledge within the realm of personalised AI-based e-learning in healthcare, and rejects the notion of an objective, independent reality, that can be entirely detached from the observer (Saunders et al., 2016). Instead, this study assumes that myself (the researcher) and participants co-create knowledge through an interactive and interpretative process. This perspective allows for a deeper understanding of the intricacies and nuances inherent in the phenomena under investigation (Alliger and Janak, 1989).

The epistemological stance of this study emphasises the importance of contextual understanding within the domain of personalised e-learning for healthcare staff. Healthcare knowledge is viewed as context-dependent, situated within the specific social, cultural, and organisational contexts of healthcare professionals (Silverman, 2000). The epistemological framework emphasises the importance of understanding the context in which knowledge is produced and the impact of that context on the interpretation of findings. By recognising the influence of context, the study aims to provide a more relevant and impactful learning experience, by aligning the educational content within the specific context of healthcare staff.

In the context of personalised e-learning for healthcare staff, the research acknowledges and values the existence of multiple, valid realities. Each healthcare professional brings a unique set of experiences, clinical challenges, and learning preferences. An AI system, designed to

adapt and personalise content delivery, respects the diversity of perspectives within the healthcare workforce, rather than imposing a one-size-fits-all approach for all learners.

The epistemological approach emphasises reflexivity as a fundamental aspect of the research process. The research actively reflects on its assumptions, biases, and preconceptions throughout the study; recognising that its positionality may influence the interpretation of data. By engaging in continuous reflexivity, the research aims to enhance the transparency, reliability, and validity of the knowledge generated.

Therefore, the epistemology of this research, situated in the context of personalised AI based e-learning for healthcare staff, is grounded in a constructivist perspective, emphasising the subjective nature of knowledge, the importance of context, the existence of multiple realities, and the ongoing reflexivity of the researcher.

I opted for epistemology and determined that ontology, which pertains to the "nature of reality" (Saunders et al. 2016, p. 127), would not be suitable for this study. Ontology is described as how world can be observed, in other word, ontological assumption shapes the way the objectives of a research can be seen (Saunders et al. 2016). I believe that studying human and their social worlds (social sciences) requires different ways of studying to physical phenomena (natural sciences); new and richer understanding of social world will be lost in studies if social sciences try to emulate natural sciences philosophical position (ibid). This research implies that the potential participants involved in this study will have different experience and perspective of their e-learning system, which it can result in valuable knowledge to assess and identify the opportunities for AI training systems to improve the effectiveness of their training.

3.3. Adopted Research Paradigms

This research is firmly grounded in an interpretive epistemological stance. Interpretivism, as the guiding philosophy, asserts that knowledge is subjective, context-dependent, and

constructed through the interpretations of individuals within their social and cultural milieu. The study recognises that healthcare professionals actively contribute to the construction of knowledge through their unique perspectives on the adoption of personalised AI-based e-learning within the UK healthcare sector. Saunders et al. (2019) expressed that *"interpretivism emphasises that humans are different from physical phenomena because they create meanings"* (p. 148). Thus, as articulated by Saunders et al. (2019), the objective of interpretive research is to cultivate novel, and more intricate understanding and interpretations of social worlds and contexts.

Within this epistemological framework, the research recognises that knowledge is not objective or universal, but rather a product of the subjective interpretations of healthcare staff. The assertion is that the study of human beings, and their social environments, necessitates a distinct approach compared to the examination of physical phenomena. Therefore, researchers in the social sciences argue for a departure from attempting to replicate the methods of the natural sciences (Saunders et al., 2019). Additionally, interpretivists highlight the significance of language, culture, and history (Crotty, 1998) in influencing how researchers interpret and experience organisational and social realms (Saunders et al., 2019). Consequently, the fundamental element for the success of an online training program lies in comprehending learners' experiences throughout their learning and training processes. This involves actively engaging individuals to cultivate a deeper understanding of their perceptions, experiences, and thoughts (Alliger and Janak, 1989). It is posited that these subjective values of learners' perceptions, experiences, and thoughts, can be explored and evaluated through dialogical interviews (ibid). Advocating for an interpretivist stance in understanding the nature of staff learning and training processes, leads to the generation of subjective, comprehensive, and valuable knowledge (Saunders et al., 2019). The aim is to delve into the diverse and contextualised ways in which healthcare professionals make sense of, and contribute to, the

discourse surrounding personalised AI-based e-learning. The study values the richness inherent in individual experiences, emphasising the dynamic nature of knowledge acquisition within the healthcare domain.

Interpretivism posits that knowledge is co-constructed through interactions between the researcher and participants. Saunders et al. (2019) expressed that interpretive researchers aim to gather information that holds significance for their research participants. Furthermore, various branches of interpretivism slightly emphasise different methods to achieve this in practice. In this investigation, the approach aligns with phenomenology, where researchers, like phenomenologists, concentrate on the participants' lived experiences; specifically, their recollections and interpretations of those experiences (Crotty, 1998). In this study, the researcher actively engages with healthcare staff, recognising that the insights gained are a result of collaborative sense-making. The research process is iterative, allowing for the emergence of new perspectives and understanding, as the study progresses. This co-construction of knowledge aligns with the interpretive epistemological stance, emphasising the importance of dialogue and shared meaning.

The study embraces the idea that multiple realities exist within the healthcare sector, and each member of healthcare staff's perspective; contributes to a mosaic of interpretations. The interpretive epistemology encourages an exploration of the diversity of meanings attributed to the adoption of personalised AI-based e-learning. Saunders et al. (2019) asserted that understanding of seemingly identical phenomena may vary across historical or geographical contexts. For example, employees of different genders, or ethnic/cultural backgrounds, might perceive workplaces, services, or events differently. Through this lens, the research seeks to uncover the varied ways in which healthcare staff understand and navigate the challenges and impacts of integrating technological advancements into their professional practices.

Concluding this section on the epistemological stance within the interpretive paradigm, the chosen approach lays the groundwork for a nuanced exploration of subjective meanings. The subsequent section will involve the exploration of the specific research approach employed to capture and interpret these subjective insights, thereby advancing the understanding of the research questions.

3.4. Research Approaches

The choice of the research approach holds significant importance as it not only guides the research design, but also empowers researchers to thoughtfully assess how each approach can enhance or constrain their study. It enables them to align with the stated objectives, and craft an approach that best fulfils the specific requirements of the research (Creswell, 2003). In addition, the inquiry into whether the research focuses on testing existing theories, or constructing new ones; poses a crucial question regarding the formulation of the research project. This is commonly presented as two contrasting methodological approaches reflective of the researcher's reasoning: either deductive or inductive; shown in Table 5 (Saunders et al., 2019). Sachdeva (2007) stated that these two modes of reasoning evoke distinct approaches in the research process. Inductive reasoning, characterised by its openness and exploratory nature, is particularly prominent in the initial stages. On the other hand, deductive reasoning is more constrained and revolves around the testing or affirmation of hypotheses (Sachdeva, 2009).

	Deduction	Induction
Logic	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive inference, known premises are used to generate untested conclusions
Generalisability	Generalising from the general to the specific	Generalising from the specific to the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework
Theory	Theory falsification or verification	Theory generation and building

Table 5: Understanding Logic, Generalisability, Use of date and Theory within Deduction and Induction approaches, adapted from (Saunders et al., 2019, p. 153)

In the following discussion, these approaches will be elucidated, referencing the chosen research approach for this study. Additionally, the rationale behind the adoption of this approach will be provided.

3.4.1. Deductive Approach

Deductive reasoning *"involves the development of a theory that is then subjected to a rigorous test through a series of propositions"* (Saunders et al., 2019, p. 153). In addition, Sachdeva (2009) elucidated that deductive reasoning operates in a "top-down" manner, progressing from the more general, to the more specific. In this approach, researchers typically start by conceptualising a theory related to the topic of interest. They then refine this theory into more specific hypotheses that are subject to testing. As observations are collected, the focus narrows further to address these hypotheses, allowing researchers to empirically test the hypotheses with specific data—a process that either confirms or refutes the original theories (Sachdeva, 2009). Consequently, *"as a scientific approach that emphasises structure, quantification,*

generalisability and testable hypotheses," the deductive approach is inherently associated with the positivist research philosophy (Saunders et al., 2019, p. 154).

3.4.2. Inductive Approach

Inductive approach is an alternative approach to develop theory. Sachdeva (2009) elucidated that inductive reasoning progresses *"from specific observations to broader generalizations and theories"* (p. 24); referred to as a "bottom up" approach. Affirming this perspective, Saunders et al. (2019) stated that the primary aim of the inductive approach is to gain insight into the nature of the problem by comprehensively understanding the observed phenomena. Consequently, researchers are tasked with making sense of the collected interview data through rigorous analysis; leading to the formulation of a theory often expressed as a conceptual framework.

It is emphasised that researchers employing the inductive approach, may arrive at similar theories, but the distinctive feature lies in the reasoning process: *"theory follows data rather than vice versa, as with deduction"* (Saunders et al., 2019, p. 155). Additionally, Sachdeva (2009) highlighted that in inductive reasoning; researchers commence with specific observations and measures, identify patterns and regularities, formulate tentative hypotheses for exploration, and ultimately develop general conclusions or theories. Consequently, due to its affiliation with the humanities, and its emphasis on the significance of subjective interpretations, the inductive approach is likely to be aligned with interpretivist philosophy (Saunders et al., 2019).

As previously mentioned, deduction traces its origins to research in the natural sciences. Saunders et al. (2019) noted that social science researchers have criticised this deductive reasoning approach since the inception of the social sciences, as it enables the establishment of cause-and-effect relationships between variables, without a comprehensive understanding of

how humans interpret their social world. The strength of an inductive approach lies in its ability to develop such an understanding. Moreover, one of the notable strengths of the inductive approach is its flexibility, as it allows for considerations, such as sample size and data types (Crowther and Lancaster , 2008). However, Saunders et al. (2009) have highlighted that the inductive approach is time-consuming, requiring an extended period for data collection, interpretation, and analysis. Furthermore, it was indicated that within an inductive framework, there exists a considerable likelihood that collected data may not yield meaningful, or useful information (Saunders et al., 2009; Mazumdar, 2018).

3.4.3. Adopted Research Approach:

This study decided to adopt an inductive approach, as the researcher would argue that it is more realistic to treat healthcare staff as humans, whose attendance behaviour is a consequence of the way in which they perceive their work experience, rather than as if they were unthinking research objects who respond in a mechanistic way to certain circumstances (Saunders et al., 2019). The inductive approach allows for a flexible and exploratory examination of the phenomenon under investigation. Grounded in qualitative methods, the inductive approach begins with data collection and analysis, patterns and themes emerge organically, guiding the development of conceptual frameworks. Consequently, this will contribute to a deeper understanding of the complex realities healthcare organisations face in adopting personalised AI based e-learning.

As the researcher emphasises on valuing subjective interpretations, the inductive approach has been chosen. This choice aligns with the interpretivist philosophy guiding this research. The next section will explore various research methods, ultimately selecting and discussing the most suitable method for this study, in accordance with its objectives and research questions.

3.5. Research Method

Research methodologies can be categorised into two main approaches: qualitative and quantitative methods. At a superficial level, both qualitative and quantitative approaches share common steps, such as identifying a research problem, reviewing relevant literature, and collecting and analysing data. However, they are fundamentally suited for different types of data. Quantitative studies involve numerical data, while qualitative studies predominantly rely on nonnumerical data, such as verbal information and visual displays. Additionally, quantitative and qualitative research designs are, to some extent, suitable for addressing distinct types of questions (Leedy and Ormrod, 2015). The fundamental differences between quantitative and qualitative research are shown in Table 6. The following sections will discuss qualitative and quantitative research methods, along with the selected approach for this study.

Research Agenda	Qualitative	Quantitative
Focus	Understand and interpret	Describe, explain and predict
Involvement	High as researcher is participant and catalyst	Researcher keeps himself away to reduce bias
Purpose	In-depth understanding, theory building	Describe, predict and test theory
Sample design	Non-probability, purposive	Probability

Table 6: fundamental differences between qualitative and quantitative research (Sachdeva, 2009, p. 182).

3.5.1. Qualitative Research Method

Qualitative research is crafted to elucidate the process (how) and meaning (why) behind occurrences. It encompasses a variety of interpretive techniques aimed at describing, decoding, translating, and grappling with the significance, rather than the frequency, of naturally unfolding phenomena in the social realm (Sachdeva, 2009). Bryman and Bell (2003)

emphasised that qualitative research leans towards words rather than numbers. According to Saunders et al. (2019), a key differentiation between quantitative and qualitative research lies in the type of data — *"numeric data (numbers) and non-numeric data (words, images, audio recordings, video clips and other similar material)"* (p. 175). However, Cornford and Smithson (1996) challenged this distinction, suggesting that basing it solely on the use of numbers may be flawed. Furthermore, Strauss and Corbin (1990) asserted that qualitative research essentially refers to any research producing findings not derived from statistical procedures, or quantification methods. Therefore, qualitative research aims to explore, understand, and interpret, social phenomena, human behaviour, and the subjective aspects of experiences. This method allows the researcher to delve into the richness and complexity of the social world, emphasising context, meaning, and the perspectives of the participants (Sachdeva, 2009).

Qualitative research is frequently linked with an interpretive philosophy (Denzin and Lincoln, 2018). This interpretive nature stems from the necessity for researchers to comprehend the subjective, and socially constructed meanings conveyed regarding the phenomenon under investigation (Saunders et al., 2019). These scholars note that numerous forms of qualitative research often initiate with an inductive approach to theory development. This involves employing a naturalistic and emergent research design to construct theory or cultivate a more comprehensive theoretical perspective than what is already present in the existing literature. Therefore, theories and hypotheses emerge from the data rather than being imposed beforehand. Researchers analyse the collected information to identify patterns, themes, and categories, which then contribute to the development of theories. Furthermore, according to Saunders et al. (2019), qualitative research involves studying the meanings attributed by participants to their experiences and interactions, as well as examining the relationships between these meanings. This is achieved through diverse data collection methods and

analytical procedures, with the aim of constructing a conceptual framework and contributing to theory development.

As per Yin (2009); the typical aim of a qualitative research method, is to provide a thorough comprehension of phenomena that have received minimal attention or study, especially in cases where limited information is available. Additionally, Leedy and Ormrod (2015) asserted that when there is scarce information about a topic, uncertainties about variables, or a lack of relevant theoretical groundwork, a qualitative study becomes valuable in delineating crucial aspects that warrant investigation. Therefore, qualitative research with open-ended questions, will allow participants to express their thoughts and experiences in their own words. This approach enables researchers to uncover unexpected insights and understand the diversity of perspectives within a given context.

3.5.2. Quantitative Research Method

Quantitative research investigates *"relationships between variables, which are measured numerically and analysed using a range of statistical and graphical techniques"* (Saunders et al., 2019, p. 178). In the context of Business Research, Sachdeva (2009) expressed that "quantitative methodologies usually measure individual behaviour, knowledge, opinions, or attitudes" (p. 182). These approaches address inquiries concerning *"how much, how often, how many, when, and who"* (Sachdeva, 2009, p. 182). Quantitative research is a systematic, empirical investigation that uses statistical, mathematical, or computational methods to collect, analyse, and interpret numerical data. Unlike qualitative research, which explores the depth and richness of human experiences, quantitative research aims to measure, quantify, and generalise findings to a larger population. Furthermore, Leedy and Ormrod (2015) noted that researchers employing quantitative methods often aim to discover explanations and predictions that can be applied to broader populations and different locations. Also, this method is often associated with positivist or deductive research approaches, seeking to establish patterns,

relationships, and causal connections. Saunders et al. (2019) also highlighted that quantitative research designs are commonly linked to positivism, particularly when paired with pre-established and highly structured data collection methods. Additionally, quantitative research typically aligns with a deductive approach, involving the collection and analysis of data to test existing theories (Saunders et al., 2019; Leedy and Ormrod, 2015). Quantitative research relies on structured data collection methods, such as surveys, experiments, or structured observations. These methods use standardised instruments and closed-ended questions to ensure consistency in responses. Moreover, Saunder et al. (2019) asserted that due to the standardised nature of data collection, it is crucial to ensure that questions are articulated clearly, to guarantee uniform understanding among all participants.

Quantitative research typically involves testing hypotheses derived from theories or existing knowledge. The goal is to discover connections among two or more variables, and subsequently, based on the findings, either confirm or adjust existing theories or practices (Leedy and Ormrod, 2015). Since quantitative studies have traditionally been the predominant approach to research, well-defined guidelines exist for their execution (Leedy and Ormrod, 2015). Leedy and Ormrod (2015) stated that *"concepts, variables, hypotheses, and methods of measurement tend to be defined before the study begins and to remain the same throughout"* (p. 99). As a result, researchers employing quantitative approaches, choose methodologies that facilitate an objective measurement of the variable(s) under consideration (Leedy and Ormrod, 2015). Researchers strive for objectivity and neutrality in quantitative research. The focus is on minimising bias and subjectivity, and data analysis often involves statistical techniques that aim to eliminate, or control for potential confounding variables. Furthermore, Leedy and Ormrod (2015) clarified that quantitative researchers aim to maintain objectivity by staying detached from the phenomena and participants, thereby reducing the likelihood of collecting biased data. Additionally, Sachdeva (2009) noted that quantitative research is frequently

employed for theory testing, necessitating researchers to uphold a level of distance from the research process, to avoid influencing the results.

In a general sense, quantitative research was defined as involving the gathering of numerical data and characterised by a deductive view of the relationship between theory and research. Bryman and Bell (2003) declared that it tends to favour a natural science approach, particularly aligning with positivism, and adopts an objectivist perspective on social reality.

3.5.3. Adopting Qualitative Research method for this study

The selection of a research method, as well as its specific type, is contingent upon the nature of the research question and objectives (Saunders et al., 2019). The crucial determinant for the success of this research lay in choosing a suitable method to yield meaningful results (Saunders et al., 2016). For this study, the researcher opted for a subjective approach and embraced the interpretivist paradigm, utilising a qualitative method; a recognised and dependable approach (Collis and Hussey, 2009). The decision to employ a qualitative approach is rooted in the research problem, aiming to unravel the complexity of the phenomena by adopting an epistemological position. Additionally, considering that questions related to "how" and "why" are central to the investigation; the qualitative research method was deemed more appropriate, underscoring its value in this research.

The researcher believed that the qualitative research method will be effective in capturing the perspectives of participants, in their own words, providing a voice to individuals and groups whose experiences may not be adequately represented through quantitative measures. Hence, the primary focus of this qualitative research lies in understanding the perspectives and experiences of healthcare staff regarding their online training system. According to David and David (2016), involving individuals who will be impacted by a change in decision-making and implementation, is crucial. Therefore, gaining a deeper understanding of staff members'

perceptions, experiences, emotions, thoughts, and interpretations regarding the adoption of personalised AI-based e-learning is considered valuable. Given this emphasis on subjective experiences, a positivist assumption is deemed inappropriate for this research. Instead, an interpretivism approach is chosen to facilitate a more comprehensive examination, and critical observation of the experiences, thoughts, and feelings of potential participants.

Choosing the qualitative research method for this study was motivated by the opportunity for allowing a thorough exploration of complex phenomena. It is well-suited for investigating in-depth details, meanings, and the context of personalising AI based e-learning, within healthcare organisations. Yet, it is perceived that there is a gap in the literature regarding the implementation of personalised AI based e-learning in healthcare organisations. Employing a qualitative approach is seen as a means to acquire valuable and comprehensive insights. In addition, this research is studying complex social realities within the healthcare context, which cannot be easily quantified, but qualitative methods are valuable. Therefore, a qualitative approach captures the richness, and nuances of human experiences and behaviours.

3.6. Adopted Research Strategy

Saunders et al. (2019) defined research strategy *"as a plan of how a researcher will go about answering her or his research question"* (Saunders et al., 2019). The research strategy serves as the methodological bridge connecting the research philosophy to the subsequent selection of methods for data collection and analysis (Denzin and Lincoln, 2018). In addition, Sachdeva (2009) characterised a research design as the organisation of conditions for gathering and analysing data and intending to align these with the research purpose efficiently. Sachdeva (2009) emphasised that *"research design provides the glue that holds the research project together"* (Sachdeva, 2009, p. 78). The critical factor influencing the choice of the research strategy in this study is ensuring a reasonable level of coherence throughout the research

design. This coherence is essential for enabling the researcher to address the research questions and achieve the research objectives effectively (Saunders, et al., 2019).

Saunders et al. (2019) stated some available research approaches: *"experiment", "survey", "archival and documentary research", "case study", "ethnography", "action research", "grounded theory", "narrative theory"*. In this research, a case study approach was utilised because the researcher is convinced that examining a case within its authentic, real-life setting, is crucial for providing context, distinguishing this research strategy from others. Understanding the context holds fundamental importance in the context of this case study research.

3.6.1. Case Study Research

Yin (2018) defined case study as *"to gain an in-depth (and up-close) examination of a "case" within its real-world context"* (p. 330). Case study research is a qualitative research method that involves an in-depth, comprehensive examination of a specific instance or phenomenon within its real-life context (Saunders et al., 2019). The utilisation of a case study strategy possesses the capability to yield insights through thorough, and in-depth research into the examination of a phenomenon, within its authentic real-life context. This process results in the formulation of rich empirical descriptions, and the advancement of theoretical frameworks (Dubois and Gadde, 2002; Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Ridder et al., 2014; Yin, 2018). Case study research is frequently employed when the delineation between the studied phenomenon, and the encompassing context is not consistently evident (Yin, 2018). Saunders et al. (2018) underscored the fundamental importance of comprehending the context, within the realm of case study research.

Flyvbjerg (2010) asserted that, while the study of human affairs does not yield predictive theories and universals; context-dependent, or practical knowledge, can offer valuable insights.

Case study methodology provides a profound understanding of the highest level of human learning processes, emphasising the significance of cultivating a nuanced view of reality that cannot be fully apprehended through theoretical frameworks (Flyvbjerg, 2010). Consequently, this underscores the value of the proximity of case studies to real-life situations and their wealth of details (ibid). The case study method is considered an illuminating approach that contributes more to the process of learning, than merely substantiating claims. It is posited that in-depth case studies have the potential to unveil more discoveries, compared to statistical studies involving large groups (Beveridge, 1957). Moreover, the knowledge derived from case studies holds significance in the acquisition of knowledge, and the role of formal generalisation should not be excessively emphasised as the sole source of scientific development.

Yin (2018) discussed four different case study strategies: “single case versus multiple cases” and “holistic case versus embedded case” (p.83), shown in Figure 28.

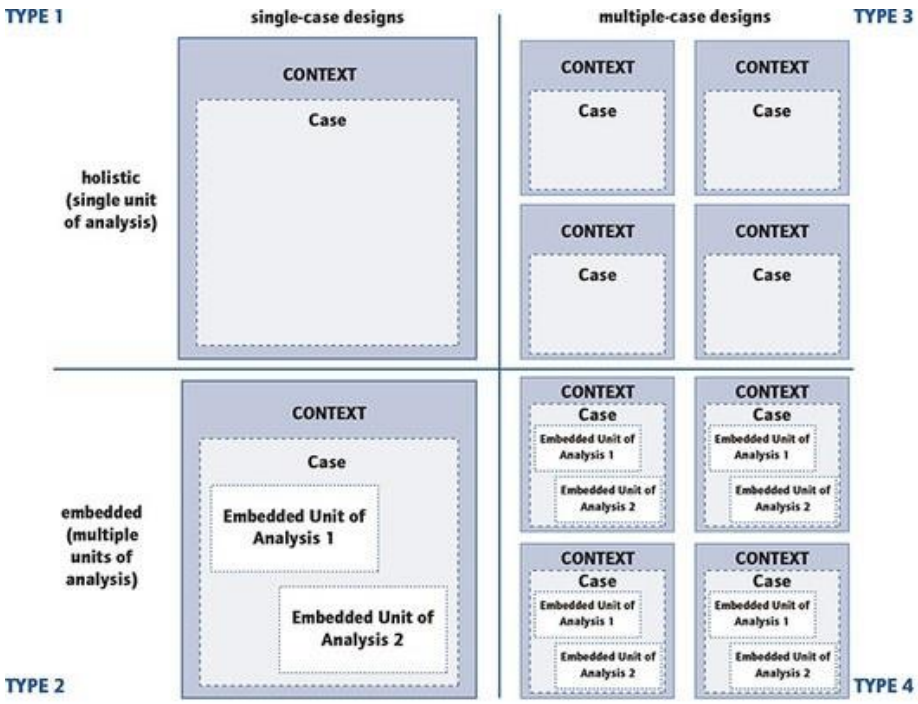

Figure 28:"Basic Types of Designs for Case Studies” (Yin, 2018, p. 84). This research selected Type 1, single case with a holistic design.

3.6.2. Justification of Employing Case Study Research

This research opted for the case study research approach to offer insightful responses to the research question and achieve the research objectives. The decision to utilise the case study strategy was motivated by the researcher's aim to acquire comprehensive insights into healthcare staff's perspectives, thoughts, and feelings regarding the adoption of personalised AI-based e-learning. Brocki and Wearden (2006) suggest that to produce" *a deeper, more personal, individualised analysis*" (p. 99), qualitative idiographic studies are the most suitable approach in single case studies. Smith (2004) proposes that using single case studies is *'an important area for development ... the very detail of the individual also brings us closer to significant aspects of a shared humanity'* (p. 43). In addition, Smith (2004) believes that single case study *"is important in clearly marking a place for the significant contribution of the case in its own right, which has been sorely neglected in psychology"* (p. 42). I believe that when analysing a particularly rich and compelling case, it is important to focus on it thoroughly and do it justice, rather than hastily moving on to examine additional cases; supported by Smith (2004). Therefore, I gathered the data from a single care home situated in the UK, it is recommended to prioritise the depth and richness of the data over the size of the sample in qualitative research (Patton, 1990; Morrow, 2005).

Healthcare is a complex field with diverse stakeholders, regulatory frameworks, and patient-centric considerations. An in-depth case study will allow the researcher to explore how personalised AI-based e-learning interacts with the intricate web of healthcare practices, regulations, and cultural nuances within the UK. It is acknowledged that *"understanding context is fundamental to case study research"* (Saunders et al., 2019, p. 197). A thorough examination of the existing literature reveals a gap in comprehending the adoption of personalised AI-based e-learning, from the perspective of staff within healthcare organisations

in the UK. Consequently, it is asserted that the most effective way to comprehend this phenomenon is through in-depth case study analysis (Dubois and Gadde, 2002, p. 554).

Moreover, the integration of AI-based e-learning may necessitate organisational changes within healthcare institutions. A case study can illuminate how healthcare organisations adapt to, and integrate these technologies, considering various factors with broader organisational goals. Hence, gaining insight into the viewpoints of healthcare staff is crucial when implementing advanced technologies, such as personalised AI-based e-learning in healthcare organisations within the UK.

3.7. Research Design

Saunders et al. (2019) elucidated that the research design serves as the overarching blueprint detailing how research endeavours to address the research questions. Similarly, Babbie (2010) defined research design as the conceptual framework, guiding researchers in the execution of their study. In addition, research design contains well-defined objectives, derived from the research questions, specifies the data collection sources, outlines the methodology for data collection and analysis, and addresses ethical considerations and inevitable constraints, such as access to data, time, location, and financial resources (Saunders et al., 2019). This underscores the notion that a profound understanding of the research design enhances the overall quality of the research. The primary purpose of the research design is to assist the researcher in minimising uncertainty and ambiguity, to the greatest extent possible (Apulu, 2012).

The presented research design in this study is adopted from Mazumdar's (2018) research, containing three phases as follow:

1- Development phase

2- Implementation phase

3- Analysis/validation phase

To comprehend each of these stages in the research design, a flow chart detailing the developed research design is provided in Figure 29.

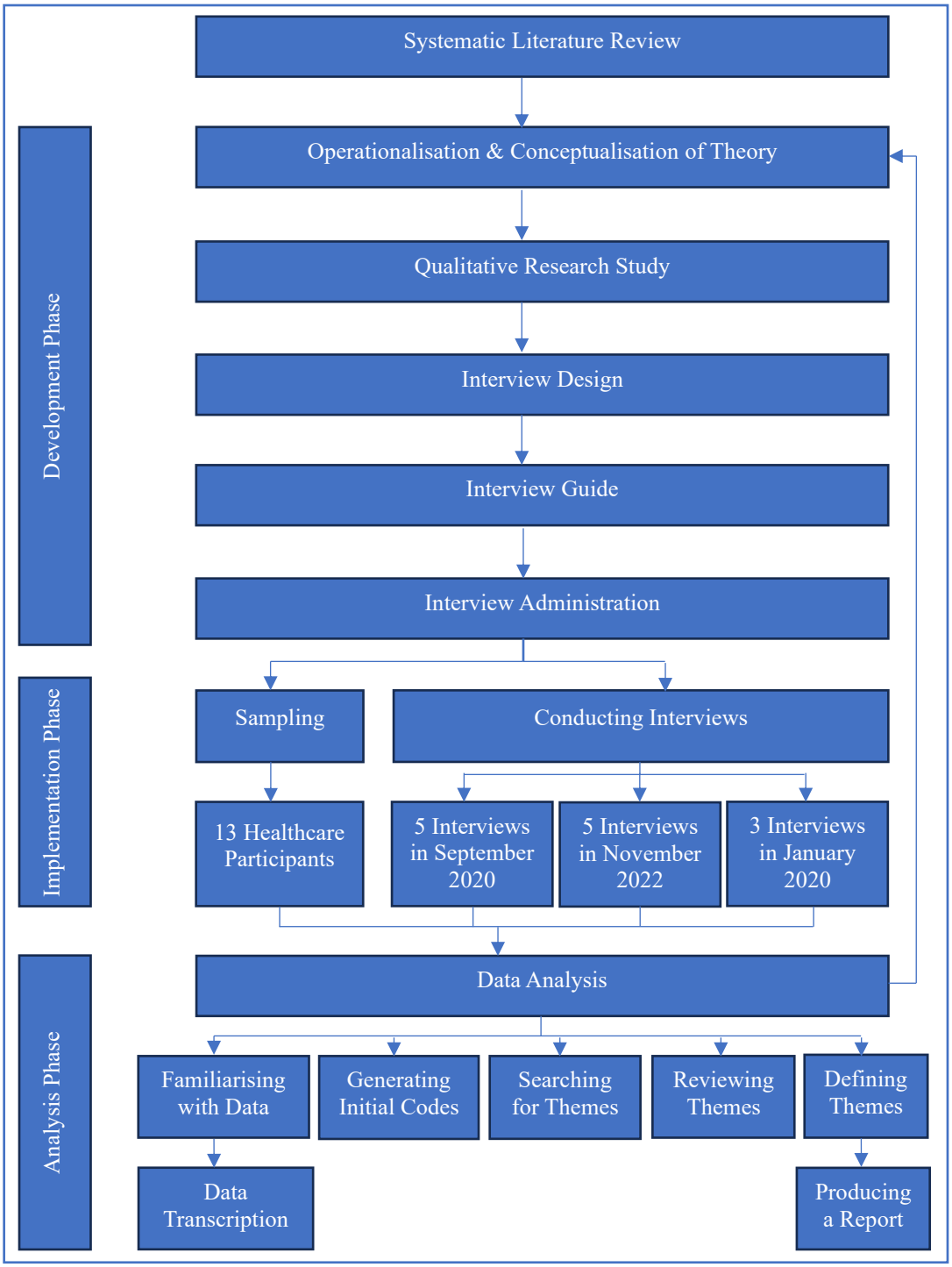

Figure 29:Research Design Flowchart (Adapted from (Mazumdar, 2018)).

3.7.1. Development Phase

The developmental phase encompasses the conceptualisation and operationalisation of research constructs, along with the development of the instrument utilised for assessing these constructs (Sefiani, 2013). To commence research design, scholars initiate the process with a systematic literature review, aiming to acquire a thorough comprehension of existing literature, and the insights necessary for shaping their research approach. In the following sections, first, conceptualisation and operationalisation, and then instrument development will be discussed.

3.7.1.1. Conceptualization and Operationalization

The initial stage in the development phase of research design, involves the operationalisation and conceptualisation of the research theory. As outlined by Cohen et al. (2007), theory conceptualisation involves defining the theory, and its representations. The operationalisation of the theory entails translating the identified theory into specific, tangible, and measurable items. Table 7 illustrates constructs used in this study in terms of its conceptualisation and operationalisation.

Constructs	**Construct Conceptualisation**	**Construct Operationalization**
Technology (T)	This component focuses on the technological characteristics that can influence the adoption of personalised AI based e-learning in healthcare organisations.	Measured technological characteristics through interviews with healthcare staff.
Organization (O)	This component focuses on the internal factors within an organisation that can influence the adoption of personalised AI based e-learning in healthcare organisations.	Assess organisational factors through interviews with healthcare assistants, head of care and co-ordinators focusing on factors such as leadership support, training programs, and organisational policies regarding technology adoption.
Environment (E)	This component focuses on the external factors outside the organisation may impact the personalised AI based e-	Explore the external factors that affect personalised AI based e-learning adoption, such as patient's needs, CQC and government policies.

	learning adoption in healthcare organisations.	
Learning Style (LS)	The individual preferences and tendencies of healthcare professionals regarding how they prefer to learn and process information, as defined by the Felder-Silverman Learning Style Model dimensions (e.g., active/reflective, sensing/intuitive, visual/verbal, sequential/global).	Through interviewing healthcare staff, participants' perceptions and preferences are used to understand the drivers towards adopting a personalised AI based e-learning.

Table 7: Description of the research theory.

3.7.1.2. Instrument Development

The second component of the development phase in research design is instrument development. This stage begins with the design of interview questions and concludes with the finalisation of the interview design. In the following sections, the researcher will outline the steps taken to create the instrument design for this research.

3.7.1.2.1. Interview Design

Saunders et al. (2019) expressed that a research interview entails purposeful dialogue between two or more individuals, where the interviewer poses clear and concise questions, and attentively listens to the interviewee's responses. Building rapport between the interviewer and interviewee is crucial for the success of such interviews (Saunders et al., 2019). Bryman (2008) defines interview questions as a systematic exploration involving participants responding individually to a set of predetermined questions. Saunders et al. (2007) contend that the data quality significantly relies on both the interview's structure, and the design of each specific question.

Consequently, a set of self-designed, semi-structured interview questions was formulated based on a thorough review of existing literature and analysis. These semi-structured questions serve as an "interview guide," allowing interviewees the freedom to decide how to respond (Bryman

and Bell, 2003, p. 343). The interview questions were adapted and refined from various prior research studies (Song et al., 2004; Havens et al., 2006; Lockyer et al., 2007; Riley, 2011; Pawlyn, 2012; Riley and Schmidt, 2016; Bell et al., 2019), to gain valuable insights into healthcare staff perceptions, and opinions regarding their e-learning journey. The interview questions used in this research can be found in Appendix C.

3.7.1.2.2. Question Phrasing and Content

The interview questions were formulated with the intention of being clear, specific, and easily understandable, while avoiding ambiguity, oversimplification, disrespect, and less meaningful inquiries. Moreover, prior to presenting the questions, the reasons for asking each particular question were explicitly stated to participants.

3.7.1.2.3. Structure of Response

To acquire a thorough comprehension of participants' perspectives, thoughts, experiences, and insights regarding the adoption of personalised AI-based e-learning; the researcher employed open-ended questions. Furthermore; 'why' and 'how' questions were occasionally posed following the participants' answers, to extract maximum information, thereby enhancing the richness of the data obtained.

3.7.1.2.4. Categorisation of the Interview Questions

The interview questions contain three main sections: Section 1- demographic questions; Section 2- section asked about effectiveness of the current e-learning system for staff, and the advantages and disadvantages of online, and face-to-face training. Section 3- asked participants' suggestions for adopting personalised AI based e-learning. Each section contains open-ended questions discussed in more details as follows:

Section 1- the researcher asked demographic questions from participants, including age, role and years of experience. Participants occasionally talked about their personal life, such as being

a single parent, or married with kids. This section also addressed inquiries regarding the participants' IT skills, and their ability to access and use electronic devices.

Section 2- this section primarily focused on participants' experiences with electronic devices for accessing e-learning, and the online course materials. This section played a crucial role in understanding how e-learning influenced participants' decision-making in the workplace, from their perspectives. In addition, participants were queried about their perceived advantages and disadvantages of both e-learning, and face-to-face training. The researcher also posed additional questions to uncover the perceived challenges and barriers associated with adopting personalised AI based e-learning.

Section 3- The inquiries in this section aimed to explore participants' involvement in their e-learning. In addition, participants were asked about their learning style, and their preferences for acquiring new knowledge. At the end, participants were asked about their recommendations and feedback for personalised AI based e-learning that can enhance their engagement.

Furthermore, this study started before COVID-19, and after an interruption in the interview process, the process resumed after COVID-19. In response to the global health crisis, the researcher decided to incorporate a question regarding the impact of the pandemic on participants' training experiences into Section 2 of the interview.

3.7.1.2.5. Testing the Interview Questions

As per Sarantakos' (2005) study; researchers typically embark on a study, only when they are thoroughly assured that the selected research method is appropriate, valid, reliable, effective, and devoid of issues or errors. Alternatively, they ensure that they have undertaken all necessary precautions to mitigate any potential problems during the preparatory phases of the research. Consequently, the pre-designed interview questions were subjected to examination for clarity, comprehension, ambiguity, and response bias. The researcher employed two types

of testing styles, pre-testing and field-testing to evaluate the effectiveness of the interview questions.

3.7.1.2.5.1. Pre-testing

Polit and Hungler (1999) emphasise that when using interview questions as a data collection method, it is essential to ensure that the questions are clear enough to effectively explore the research topic and that participants fully understand what is expected of them. Therefore, after formulating the initial interview questions for this study, I conducted a pre-test to assess their clarity and ensure that their intended meaning was comprehensible. The initial interview questions were reviewed in person with a healthcare professional whom I personally know, though this individual was not included in the study sample. During the discussion, the main issue identified was that some questions lacked clarity and were too vague for the participant to answer effectively. To improve comprehension, I rephrased those questions for better clarity. Additionally, I noticed that some questions were repetitive, so I revised and restructured them accordingly.

3.7.1.2.5.2. Field-testing

To conduct the field test, a pilot study was undertaken by the researcher, utilising the initially formulated questions. The researcher conducted the interview with healthcare staff to assess the meaningfulness, clarity, and absence of technical jargon in all the questions. During the pilot study, it became evident that a modification was necessary for the question addressing the advantages and disadvantages of online versus face-to-face training (Section 2). As a refinement, the question was subdivided to enhance simplicity, reduce complexity, and improve ease of recall.

3.7.1.2.6. Design of the Interview

Saunders et al. (2007) argued that the quality of data is contingent upon both the structure of the interview, and the formulation of the questions. This is of paramount importance as maintaining participant focus on the topic, requires a well-organised interview structure, along with adept control during the interview process. Moreover, recognising the variability in participants' level of understanding regarding question meaning, the researcher developed an interview guide that included explanations for certain intricate questions. The interview guide encompassed essential questions, follow-up inquiries, and, notably, clarifying questions; interview questions can be found in Appendix C in this research. The overarching aim was to comprehensively address the research subject, and extract as much information as possible during the interview.

3.7.2. Implementation Phase

The implementation phase, constituting the second phase in the research design of this study, focused on sample selection, and conducting data collection. This phase involved the development of interview questions to facilitate primary data collection. The subsequent section delineates the procedures entailed in sample selection and data collection.

3.7.2.1. Population and selecting participants

While it is feasible to gather data from an entire population for certain research questions, this does not inherently ensure more valuable outcomes (Saunders et al., 2019). The authors posit that even obtaining information from a smaller number of cases, can result in more intricate and higher-quality data from participants (ibid). According to Saunders et al. (2019), it is imperative to establish a coherent link between the chosen sampling technique, and the research objective. The selected sample should either shed light on a specific aspect, or enable generalisations to theory, rather than encompassing the entire population.

Yin (2018) contends that a case should be perceived as an opportunity to empirically elucidate theoretical concepts or principles, rather than serving merely as a sample. This mitigates the risk of mistakenly assuming that the case is representative of a larger universe, or population of similar cases, thereby avoiding the unnecessary revival of statistical generalisation concerns. In the context of this single case study conducted in a UK care home, both the data collection, and sample size were contingent upon the research questions and objectives (Yin, 2018). Saunders et al. (2009) proposed that sample size could be determined by continuously collecting data until data saturation is achieved. Mason (2010) advised that if consistent stories, issues, topics, contexts, and themes emerge from the discussions, the researcher should consider the sample size sufficient. Bryman and Bell (2011) referred to this approach as 'theoretical sampling'. The researcher emphasises that the study's value lies in the comprehensive information gathered from healthcare staff, and the subsequent analysis, rather than fixating on the sample size (Patton (2015) cited in (Saunders et al., 2019)). Therefore, the researcher acknowledges that an adequate sample size is attained when no new insights emerge from the collected data within the constraints of the available time for data collection and analysis.

To ensure a sufficient number of interviews for addressing the research questions, the study employed purposive sampling, a non-probability sampling technique. Merriam (1998) identified purposive sampling as the most commonly used method for sample selection in qualitative research. Also, qualitative samples are typically purposive rather than random, this is partly because the initial scope of the study is more narrowly defined and partly because social processes follow a logical and coherent pattern that random sampling may disrupt, making findings difficult to interpret (Miles and Huberman, 1994). Additionally, when working with a small number of cases, random sampling can lead to a significantly skewed selection (ibid). Denscombe (2007) provided a detailed explanation, defining purposive sampling as the

intentional selection of individuals or events known to the researcher, based on prior knowledge, with the objective of acquiring the most valuable data. The author underscored that in purposive sampling, participants are chosen with a specific purpose, aiming to reproduce certain qualities applicable to the subject of investigation.

Maxwell (2005) emphasised purposive sampling as a strategic choice that intentionally selects specific settings, individuals, or activities, to gather information not as easily accessible through alternative options. Therefore, I considered purposeful sampling to be the most appropriate technique, as it would offer valuable insights into the challenges faced by healthcare staff in a selected care home when adopting a personalised AI based e-learning. In the realm of case study research, purposive sampling is frequently utilised due to its appropriateness for small yet highly informative samples. Stake (1995) advocated for the application of purposive sampling techniques to introduce the greatest diversity in responses whenever feasible. In this study, my focus was on individuals and their personal experiences and insights regarding e-learning. As a result, methods such as convenience, snowball, self-selection, or quota sampling were not the most appropriate for my research, as these approaches use non-selective techniques for sample selection.

Saunders et al. (2019) illustrated different sampling techniques as shown in Figure 30:

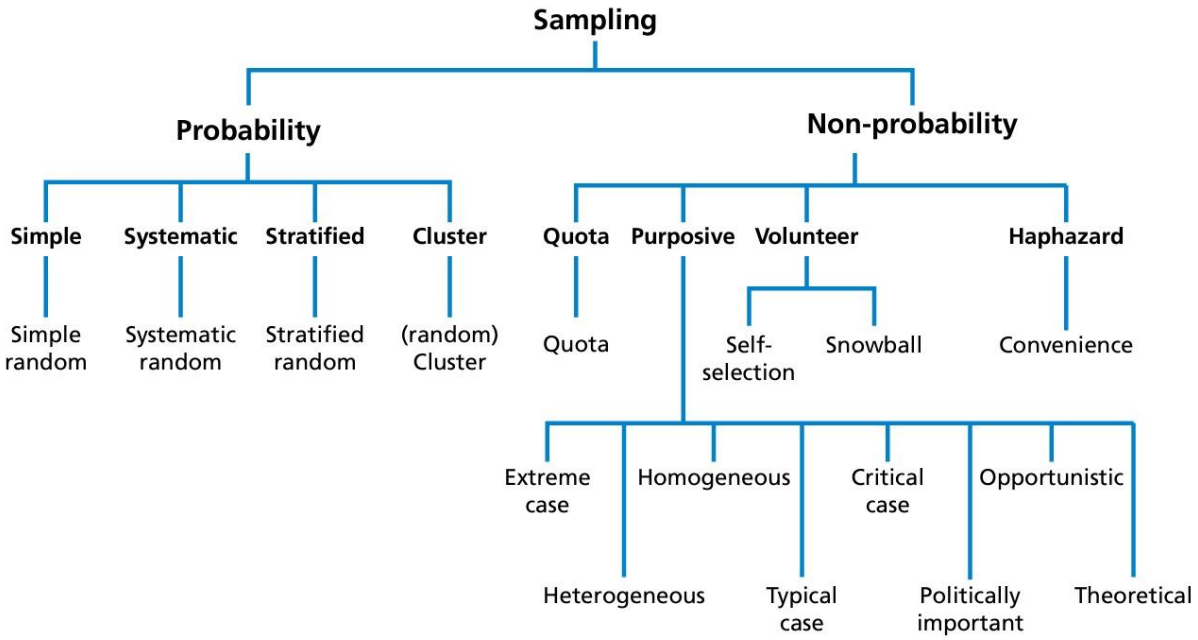

Figure 30: "sampling techniques" (Saunders et al., 2019, p. 297).

The primary objective of collecting data in the chosen care home is to gain a comprehensive understanding of the perspectives, emotions, obstacles, and expectations of each potential participant, regarding the adoption of personalised AI based e-learning. Those who agreed to take part in the study were invited for interviews. The researcher transcribed each interview and conducted an initial analysis of the transcripts. Subsequently, the emerged themes from each interview were examined, revealing sufficient similarity to establish an agreement. This iterative process aided the research in identifying codes or indexes to construct common themes in the data (all elaborated in Chapter 4). The decision to include the next participant in the sample was contingent upon this analysis, and this process continued until the collected data exhibited recurring themes and achieved data saturation.

The researcher arranged the interview time and date at the care home with the Head of Care. Due to the human factors considered when conducting research within a care home environment; the Head of Care dictated the order of the interviews with staff to ensure that safety and high levels of care were maintained. Additionally, due to the lockdown measures

imposed during the COVID-19 pandemic, the researcher faced restricted access to the care home. When the interview process resumed, new challenges arose in securing available staff for interviews, as elaborated in further detail in the Research Limitations section. Nevertheless, the researcher persisted in conducting interviews with staff until data saturation was attained, ensuring the accurate and comprehensive achievement of the research objectives.

3.7.2.2. Data Collection

In conducting research, it is crucial for a researcher to address the research inquiries, making it essential to gather sufficient, and meaningful data through an appropriate research process (Apulu, 2012). As per Bell (2005), an effective research approach is necessary to address the research problem. Among the various methods of data collection in qualitative research, interviews stand out as one of the most popular. Interviews can be categorised into three types: "structured interviews", "semi-structured interviews" and "unstructured interviews"; shown in Figure 31 (Saunders et al., 2019, p. 437).

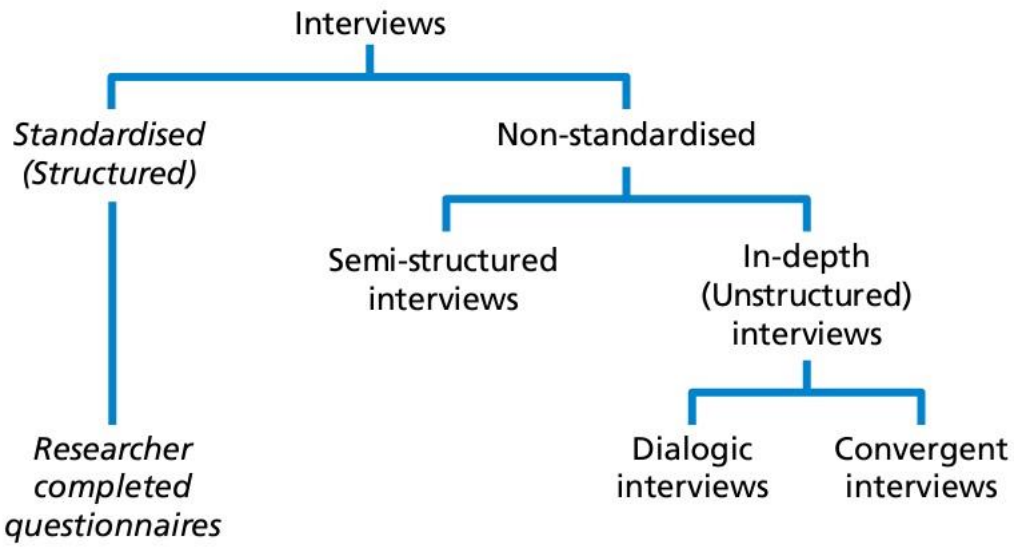

Figure 31: "interview structures" (Saunders et al., 2019, p. 437).

Conducting interviews and analysing the transcribed content can be time-consuming; however, the insights gained from the interviewees' perspectives are valuable for understanding a phenomenon (Bryman and Bell, 2003). In this qualitative research, the primary investigation necessitated a data collection method that would enable the researcher to focus specifically on the phenomena under consideration, given the constraints of a small sample size and a cross-sectional time frame. The use of open-ended semi-structured interviews was implemented to achieve a comprehensive understanding of the research subject. Maxwell (2005) stated that employing structured methods for collecting data, helps maintain uniformity across various data sources, whereas unstructured approaches prove especially valuable in uncovering the processes that result in specific outcomes. An inductive research approach was employed to provide an in-depth understanding of personalised AI based e-learning. According to Gill et al. (2008), dialogue typically offers a 'greater' depth of insight into social facts, than might be obtained through methods such as more rigidly structured interview questions.

Maxwell (2005) supports the utilisation of open-ended, semi-structured interviews as a research instrument, emphasising their effectiveness in gaining access to actions that occurred previously, or those that are otherwise inaccessible. Furthermore, an open question is crafted to prompt the interviewee to offer a comprehensive and evolving response, serving to uncover attitudes, or gather factual information (Saunders et al., 2019). Gill et al. (2008) additionally highlights the use of open-ended semi-structured interviews in situations, where access to areas is unsuitable for quantitative research methods, or when a thorough exploration, insights, and understanding of specific phenomena are essential.

Given the various interview methods: unstructured, semi-structured, and structured, making an appropriate selection of the interview approach is crucial to produce high-quality data. Mack et al. (2005) further stressed that the chosen interview method should offer an opportunity to gain insights into how research participants organise their understanding of the world and

provide explanations for their experiences and beliefs. Gillham (2005) also highlighted the effectiveness of semi-structured, open-ended interview questions, utilising a sequence of questions for structure, while maintaining flexibility to encourage discovery and focus. This format ensures consistency in the questions posed to participants and allows for a similar duration of interview time.

In this study, semi-structured interviews were carried out with healthcare staff at a UK care home. The semi-structured interview questions served as an "interview guide," allowing interviewees the flexibility of how to respond (Bryman and Bell, 2003, p. 343). These interviews supported the researcher with a thorough understanding of the challenges, barriers, and advantages associated with personalised AI-based e-learning in the healthcare sector. Petticrew and Roberts (2006) acknowledged that interviews play a vital role in successful case studies, as they offer the best access to participants' interpretations and perspectives on actions and events that have transpired. To collect data, semi-structured interviews were conducted with thirteen healthcare staff at a UK care home between 2019 and 2022, utilising an interview procedure as a guide.

At the beginning of each interview, the researcher provided an introduction, accompanied by a detailed explanation of the research aims and objectives. In the initial segment of the interview, the researcher addressed demographic inquiries, in addition to assessing participants' IT skills, and their proficiency in accessing and utilising electronic devices. Subsequently, the interviews focused on gathering information about the effectiveness of the current e-learning system for staff and explored the perceived advantages and disadvantages of online versus face-to-face training. This section was particularly crucial to understand how e-learning influenced participants' decision-making in the workplace, from their own perspectives. Finally, the last phase of data collection aimed to elicit participants' perceptions and expectations regarding the adoption of personalised AI-based e-learning.

Moreover, through the employment of open-ended interview questions, participants were given the chance to express their opinions in their own words. Respondents were consistently encouraged to expand on their responses and provide examples where feasible. Yin (2009) pointed out that utilising semi-structured interviews not only helped to convey participants' viewpoints on the investigated issues but also allowed the interviewer an opportunity to request further clarification and elaboration of the responses. Similarly, Bell (1993) asserted that the use of semi-structured interviews enables the collection of rich data, as they are viewed as an effective method of prompting discussions on issues that may have otherwise gone unnoticed in surveys or questionnaires.

All interviews were carried out within a UK care home, with each potential participant dedicating at least 45 minutes to one hour. Adequate time was provided for all respondents to answer the questions without any interruption from the researcher. At the conclusion of each interview, participants were encouraged to engage in an open discussion, allowing them to pose questions and contribute any additional comments they wished to share. The interviews involved Healthcare Assistants (carers), the Head of Care, Lifestyle Coordinator, and Night Coordinator partners, to ensure a comprehensive perspective and achieve triangulation (Brun et al., 2006).

All interviews were recorded, and a transcript of each recording was generated to constitute the raw interview data. Recording the interviews serves to capture all participants' responses to the questions and enables the researcher to focus on the interview questions and subsequent probing queries. This ensures the optimisation of engagement between the participant and the researcher. Moreover, this approach is designed to maintain a consistent experience in the interview process and enhance the accuracy of the collected data. Miles and Huberman (1994) strongly endorsed the practice of tape-recording interviews as a means of providing a comprehensive account of interviews, responses, and comments. Each interview was

transcribed immediately after its completion, while the details were still fresh in the researcher's mind. This transcript played a crucial role in clarifying the obtained information and aiding the researcher in determining the relevant content for the script.

3.7.3. Analysis/ Validation Phase

According to Saunders et al. (2019), in qualitative research, the processes of data collection and analysis are interconnected and interactive. Analysis is conducted both during and after the collection of data, particularly influencing the direction of data collection, especially in approaches leaning towards induction (Saunders et al., 2019). The interactive nature of this relationship allows for the identification of crucial themes, patterns, and relationships throughout the data collection process—essentially enabling these to emerge organically from the integration of data collection and analysis (Saunders et al., 2019). Moreover, as stated in Mosby's Medical Dictionary (2009), data analysis represents a phase of a study involving the classification, coding, and tabulation of information required for quantitative or qualitative analyses based on the research design and aligned with the nature of the data. In this study, data collection was exclusively conducted through interviews, and a thematic method was applied to analyse the gathered data.

3.7.3.1. Thematic Analysis

Braun and Clarke (2006) considered Thematic Analysis as a fundamental method in qualitative analysis, describing it as a technique for identifying, analysing, and reporting patterns (themes) within data. According to Saunders et al. (2019), the primary objective of this approach is to explore themes or patterns that emerge across a dataset, which could encompass interviews, observations, documents, diaries, or websites. It is crucial that these themes cohesively fit together and effectively address the research questions (Braun and Clarke, 2006; Saunders et al., 2019).

Thematic analysis provides a systematic yet adaptable and accessible approach for examining qualitative data (Braun and Clarke, 2006). According to Saunders et al. (2019), the systematic nature of thematic analysis ensures an organised, and logical manner of analysing qualitative data. In an inductive approach, themes are derived from the data, where the exploration of themes is driven by research interests, without imposing a pre-existing framework on the dataset (Saunders et al., 2019). Boyatzis (1998) stated that thematic analysis serves various purposes, such as a method for gaining insights, making sense of seemingly unrelated material, analysing qualitative information, systematically observing individuals, interactions, groups, situations, organisations, or cultures, and converting qualitative information into quantitative data.

Thematic analysis is outlined as a procedure that entails familiarising ones-self with the data, coding it, seeking themes, and identifying relationships, refining those themes, and assessing propositions (Saunders et al., 2019). This method represents a flexible approach that can both mirror reality and elucidate various aspects of it. Braun and Clarke (2006) expressed the advantages of thematic analysis being, *"Flexibility; Relatively easy and quick method to learn, and do; Accessible to researchers with little or no experience of qualitative research; Results are generally accessible to educated general public; Useful method for working within participatory research paradigm, with participants as collaborators; Can usefully summarise key features of a large body of data, and/or offer a 'thick description' of the data set; Can highlight similarities and differences across the data set; Can generate unanticipated insights. Allows for social as well as psychological interpretations of data; Can be useful for producing qualitative analyses suited to informing policy development"* (Braun and Clarke, 2006, p. 37). In practice, this process does not follow a simple linear progression; instead, it often happens simultaneously and iteratively. This involves analysing data as it is collected, revisiting earlier

data, refining coding, categorisation for newly collected data, and searching for analytical themes (Saunders et al., 2019).

This study relies on qualitative methods, and the analysis of qualitative data primarily involves an inductive process of organising data into categories and identifying connections among these categories. Thematic coding practices aligned with the semi-structured interviews were employed to analyse the qualitative data. Thematic analysis was chosen for its flexibility and to mitigate researcher assumptions, fostering an approach driven by the data (Braun and Clarke, 2006). This research followed six phases of analysis presented in Table 8; the table has been sources from Braun and Clarke (2006):

Phase	Description of the process
1. Familiarizing yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

Table 8:Six phases of thematic analysis (Braun and Clarke, 2006, p. 87).

3.7.3.1.1. Familiarising with Data

Braun and Clarke (2006) emphasised the importance of immersing oneself in the data to gain a thorough understanding of its depth and breadth. Immersion typically involves 'repeated reading' of the data, actively searching for meanings and patterns (Braun and Clarke, 2006; Saunders et al., 2019). Braun and Clarke (2006) recommended going through the entire dataset at least once before coding, as ideas and potential patterns are likely to emerge during this process. Saunders et al. (2019) highlighted that producing transcripts and becoming familiar

with the data are crucial elements in data analysis. To achieve familiarity with the collected data, the recorded interviews were promptly transcribed into Microsoft Word after each interview. The transcriptions mirror the participants' exact words, providing an opportunity to immerse and engage with the interview conversations (Braun and Clarke, 2006). Throughout this phase, summaries, self-memos, ideas, and notes were generated for coding, serving as references in subsequent stages (Braun and Clarke, 2006; Saunders et al., 2019).

3.7.3.1.2. Generating Initial Codes

Coding is employed to group data with similar meanings. According to Saunders et al. (2019), coding entails assigning a label to each unit of data within a transcript that symbolises or summarises the meaning of that extract. In this phase, initial codes are generated from the data (Braun and Clarke, 2006). Codes highlight a facet of the data that captivates the analyst, and represent the most fundamental segment, or element of raw data that can be meaningfully assessed regarding the phenomenon (Boyatzis, 1998). Additionally, Bazeley and Richards (2000) suggested that coding is a method to manage data, and preserve knowledge acquired from documents or interpretations. Hence, the researcher identified initial codes by carefully examining each interview, pinpointing interesting aspects that might serve as the basis for recurring patterns (themes) across the collected interviews.

3.7.3.1.3. Searching for Themes

Braun and Clarke (2006) elucidated that the third phase of thematic analysis shifts the focus of the analysis to a broader level of themes rather than codes. This phase involves organising various codes into potential themes and compiling all relevant coded data extracts within the identified themes. Essentially, researchers begin to analyse the codes, considering how different codes might integrate to create a comprehensive theme. According to Saunders et al. (2019), a theme is defined as *"a broad category incorporating several codes that appear to be related to one another and which indicates an idea that is important to your research question"* (p.

657). Additionally, Braun and Clarke (2006) noted that some initial codes may evolve into main themes, while others may become sub-themes, and some may be discarded. Therefore, the researcher initiated an exploration of the relationships among the extensive list of different codes, initially collated across the transcripts, leading to the generation of themes and sub-themes.

3.7.3.1.4. Reviewing Themes

As per Braun and Clarke (2006), the examination of themes should occur at two levels. Initially, the themes should be examined in connection with the coded extracts, and subsequently, they should be assessed for their compatibility with the entire dataset. In this study, the researcher re-examined all the extracted data associated with each theme, to ensure a coherent fit. Additionally, every individual theme underwent a double-check in relation to the entire dataset. Furthermore, the connections between themes in an initial map were verified to confirm their accurate representation of the overall meaning of the data.

3.7.3.1.5. Defining and Naming Themes

Following Braun and Clarke's (2006) guidance, this phase encompasses a thorough exploration of the themes to refine the nuances of each theme, and improve the overall story conveyed through the analysis. By the end of this phase, a comprehensive definition, and distinct names for each theme were established. This iterative process continued, and after a thorough review of all the themes in connection with the data, a final set of themes and sub-themes was derived from the analysis.

3.7.3.1.6. Producing a Report

Concluding the thematic analysis, the presentation of a report marks the final phase, encompassing the ultimate analysis and documentation of the report. Braun and Clarke (2006) underscored the importance of the analysis, including data extracts, in delivering a *"concise,*

coherent, logical, non-repetitive", and engaging narrative that encapsulates the story revealed by the data, both within, and across themes. In this research, the investigator presented abundant evidence from the data to showcase the significance of the identified themes. Various vivid examples or extracts were included to effectively capture the essence of the research questions.

3.7.4. Trustworthiness of the Qualitative Research Findings

Trustworthiness in qualitative research, similar to the concepts of validity and reliability in quantitative research, is a critical measure of research quality (Marshall and Rossman, 2011). Graneheim and Lundman (2004), assert that research findings should strive for maximum trustworthiness, and the evaluation of every research study should consider the procedures employed to generate those findings. In the realm of qualitative research, several authors have proposed that concepts such as *"credibility; transferability; dependability, and confirmability (objectivity)"* serve as benchmarks for establishing trustworthiness in qualitative studies (Guba, 1981; Lincoln and Guba, 1985; Patton, 1987; Polit and Hungler, 1999; SchwandtThomas et al., 2007; Marshall and Rossman, 2011). This research utilised these four concepts to assess the trustworthiness of its findings.

3.7.4.1. Credibility

Credibility pertains to the research focus and involves having confidence in how well the data and analytical processes align with the intended focus (Polit and Hungler, 1999). In quantitative research, credibility is analogous to internal validity, reflecting the extent to which research findings align with reality. Conversely, in qualitative research, many rationalists argued that there is not a single reality to uncover, as each individual constructs their own personal reality (Smith and Ragan, 2005). To enhance the credibility of qualitative research studies, one approach is to incorporate member checking into the findings. Lincoln and Guba (1985) asserted that including member checking is a crucial technique for establishing credibility. In

this study, three doctors from the academic field reviewed the qualitative findings to obtain additional feedback and validate the results.

3.7.4.2. Transferability

Polit and Hungler (1999) define transferability as the degree to which research findings can be applied to different settings or groups. This concept mirrors the notion of external validity in quantitative research, which addresses the extent to which findings can be generalised. Seale (1999) asserts that achieving transferability requires providing a detailed, rich description of the studied settings to furnish readers with abundant information. Moreover, Seale (1999) elaborates that such information should empower readers to make judgments regarding the applicability of the findings to other known settings. This study includes a thorough description of the thematic analysis process, facilitating the identification of themes. Additionally, a comprehensive portrayal of the qualitative findings is presented, enabling readers to evaluate and assess their transferability. Chapter four of this study offers a detailed exploration of personalised AI-based e-learning in healthcare in the UK, aiming to inform readers about this context, and support the application of research findings in diverse contexts. Lewis and Ritchie (2003) argue that evaluating the transferability of findings to another setting is essential, and hinges on the understanding of the context and phenomena uncovered. Hence, the intricate nature of the transferability challenge in qualitative research requires the reader to determine a resolution based on how closely the context of the current study aligns with their own.

3.7.4.3. Dependability

According to Merriam (1998), dependability refers to the extent to which findings can be reliably replicated. This term is used in qualitative research instead of reliability, which is more commonly used in quantitative research. This implies that if the study were to be repeated under the same conditions, using the same methods, and involving the same participants, comparable results should be achieved. Lincoln and Guba (1985) emphasised a close connection between

credibility and dependability, asserting that demonstrating the former significantly contributes to ensuring the latter. To establish dependability, Lincoln and Guba (1985) highlighted the importance of auditing; allowing others to examine the researcher's documentation of data, methods, decisions, and the final outcome. Schwandt (2007) noted that researchers bear the responsibility of ensuring that the research process is logical, traceable, and well-documented. In this study, dependability was ensured by providing a comprehensive account of the processes involved. Moreover, to address the factor of change over time, interviews were conducted in different periods (5 interviews in September 2020, 5 interviews in November 2022, 3 interviews in January 2023), and consistent results were observed from the participants.

3.7.4.4. Conformability

Confirmability involves ensuring that interpretations of the findings are not products of the researcher's imagination but are clearly grounded in the data (Tobin and Begley, 2004). This concept is comparable to objectivity in quantitative research. Lincoln and Guba (1985) proposed that auditing could be employed to validate confirmability. In this research, a clear record of the research steps was maintained through the implementation of an audit trail, covering the entire process from project initiation to the development and presentation of findings. To further establish confirmability, this study utilised triangulation of data collection methods, incorporating not only interview transcripts, but also additional information obtained through field notes.

While this section has covered the overarching research design, it is crucial to specifically address the choice of research. Consequently, the following section will detail the chosen research approaches, and explore their practical application in this study.

3.8. Research Choice

Saunders et al. (2019) discussed various methodological choices in which researchers can combine techniques and procedures. As illustrated in the Figure 32, the research choices can be broadly categorised into two types: mono method, and multiple methods. Saunders et al. (2019) defined that the mono method normally includes a single data collection technique, with corresponding numerical or nonnumerical data analysis. On the other hand, the multi-method includes more than one data collection technique with a corresponding quantitative and qualitative research method, a single analytical procedure, and a numerical or non-numerical data analysis, leading to either multi-method quantitative research, or multi-method qualitative research (Saunders et al., 2019). The mixed method, falling under multiple methods, includes both quantitative and qualitative data collection methods with both mathematical and non-mathematical investigative processes (Saunders et al., 2019).

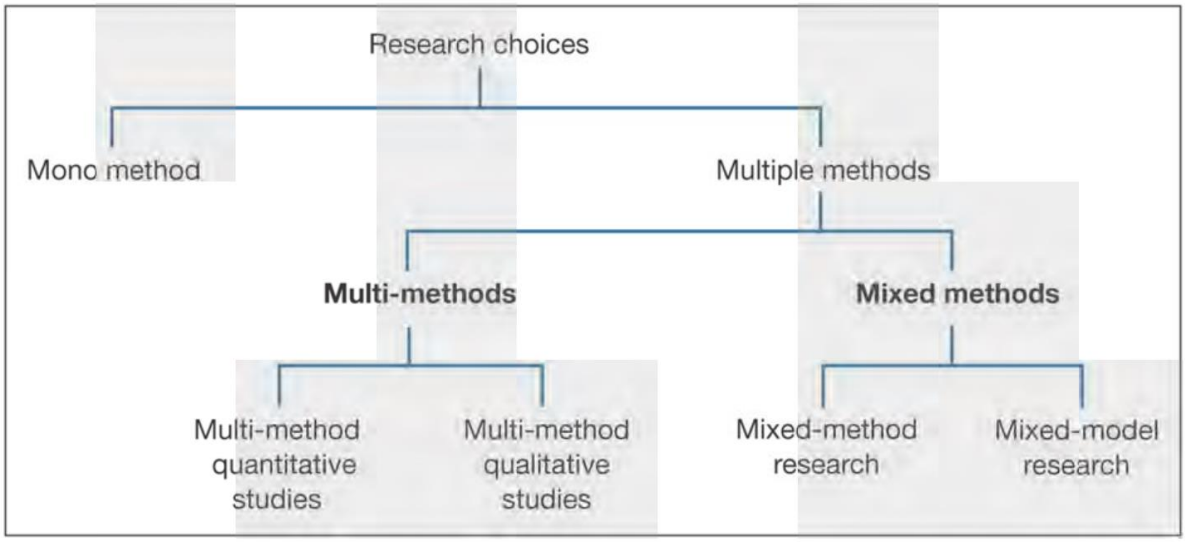

Figure 32: Research Choices (Saunders et al., 2009).

Considering only numerical and non-numerical data as the exclusive differentiator between qualitative and quantitative research was judged insufficient. Therefore, Saunder et al. (2019)

redefined research choices by linking them to philosophical assumptions, as well as approaches to theory development and strategies. Choosing an appropriate research approach for implementing personalised AI-based e-learning in a complex environment, such as healthcare, was a crucial decision for the researcher. This study involved interviews with both day and night shift staff (Healthcare Assistants), as well as the Head of Care and Co-ordinators, employing a one-time data collection practice. The researcher believed that, in order to address the research questions in this study, relying on hypotheses, or simple yes/no answers would not be suitable (Maxwell, 2005). Consequently, the researcher opted for a qualitative multi-method approach for this study, considering it the most appropriate method for addressing the research questions, and ensuring the fulfilment of research objectives within the study's limitations.

3.9. Time Prospects of the Research

Time prospects refers to the timeframe within which the research is conducted. Saunders et al. (2019) emphasised a critical query in research design: *"'Do I want my research to be a "snapshot" taken at a particular time or do I want it to be more akin to a diary or a series of snapshots and be a representation of events over a given period?'"* (p. 212). The term 'snapshot' corresponds to a cross-sectional time horizon, while the 'diary' perspective aligns with a longitudinal approach. A longitudinal investigation is suitable when exploring changes over the research lifecycle or part of the lifespan (Saunders et al., 2009). However, for this research, delving into past changes during the specified timeframe was not anticipated. Therefore, a cross-sectional time perspective was chosen because the impacts and effects of adopting e-learning have already been investigated, and occurred in the past, across various countries. The study aims to uncover respondents' in-depth understanding, perceptions, and viewpoints regarding personalised AI-based e-learning. Furthermore, the selection of a cross-sectional time horizon influences sample selection and data collection. Specifically, opting for a cross-sectional approach ensures that sample, and data collection procedures are precisely planned

to yield the depth and high-quality data necessary for addressing the research objectives and questions.

3.10. Research Ethics

Ethics constitutes a delicate dimension of any qualitative study, and the researcher took extensive measures to safeguard the individuals participating in this research. The guidelines outlined in the University of Wales Trinity St. David's Research Ethics and Integrity Code of Practice were adhered to. This section will discuss the ethical considerations within this research.

3.10.1. Debriefing

The researcher verbally presented detailed explanations to all participants regarding the research's goal and objectives, before conducting interviews. This precautionary step was taken to ensure a comprehensive understanding of the research's purpose and aim, thus reducing the possibility of any misconceptions among the participants.

3.10.2. Protection of care home Resident and Respondents

Prior to recruiting the potential participants in the selected care home, discussions regarding the purpose of this research were conducted with the Operations Director, and the Registered Manager. One of the concerns of conducting qualitative research in a care home was the residents of the home. The researcher clarified that the focus of this study is solely on the staff, and the residents will not be involved at any stage. Additionally, precautions were taken to ensure that the recruitment of potential participants (healthcare staff), did not disrupt the operations of the care home. Consequently, scheduled dates and times with staff were contingent upon factors such as rosters, staff holidays, and fulfilling the care needs of the residents. Every effort was made to minimise any disturbance to the number, and availability

of staff for the care home residents due to the researcher's presence. Therefore, the researcher attended the care home at times agreed with the Registered Manager.

3.10.3. Participants Consent & Withdrawal

Staff members were given a research information sheet detailing the study's purpose and the interview process. The sheet clarified that information would remain confidential, and individual identification of interviewees would not occur. It emphasised that participation in the study was voluntary. The information sheets were given to staff prior to interview, the interview took place if only the potential participant wished to contribute to the research. Also, the researcher explained and clarified all aspects of the information sheets at the start of the interview. If the potential participant was willing to participate in the research, a consent form was signed by the participant.

3.10.4. Confidentiality

The ethical concern of revealing participants' thoughts and emotions was thoroughly taken into account when devising a protocol for the collection, and storage of interviews. Interviews were recorded using a recorder, with participants being informed about the recording. Subsequently, the recorded interviews were transcribed as anonymous data. Each interviewee was assigned a number, ensuring anonymisation of their identity, such as "Participant 1". All records were securely stored following the university's procedures for safe data handling. Participants' names were exclusively mentioned on consent forms, and each participant's demographic information and consent form were securely stored in a locked cupboard when not in use.

3.11. Research Limitations

This study acknowledged the importance of the strengths and limitations of this qualitative study. As it has been stated; this study conducted a single case study approach in a care home in the UK. This approach involved some risks in executing the research project. For instance,

securing the single case was challenging, as healthcare organisations are responsible for residents' health and wellbeing; there is a huge pressure on business and staff to provide the best care. Considering the number of older patients is increasing (Randall, 2017; Gilbert-Johns et al., 2022), more complex care is required. Moreover, healthcare organisations are facing a lack of healthcare staff to respond to an increasing number of patients. Therefore, considering the challenges that healthcare organisations are facing, it raises significant difficulties to select a single case. However, the researcher expressed the benefits and advantages that the outcome of this research can bring to the future of e-learning for businesses and staff. It was crucial to emphasise the importance of the quality of training and learning for healthcare staff, as well as improving the patient's care, and using the organisation's resources effectively.

After selecting a care home as a single case, the research faced another major challenge; the COVID-19 pandemic in 2020. The researcher managed to interview some of the potential participants, however, the situation limited the access to the selected organisation. This challenge occurred due to the issue of spreading the virus to the very vulnerable people (the residents), and it was a governmental decision for a lock down in the UK from 2020. During this time healthcare organisations were in a most critical state, and researcher access was withheld. The research resumed data collection in 2022 with the permission of the selected care home. However, the care home was recovering from the challenges posed by the pandemic, and it was difficult to arrange more interviews, even though the organisation was keen to cooperate, the resources were limited in regard to providing care for residents.

Another challenge and risk was identifying and selecting potential participants for interviews. As it has been mentioned; due to the challenges that healthcare organisations faced as a result of the pandemic, the researcher had to ensure that the recruitment of potential participants was not interfering with the administration of the selected care home. Therefore, the assigned interview dates and times with staff, was dependent on; staffing, and resident's safety, rosters,

staff holidays, fulfilling the care required for residents of the care home etc. All efforts had to be made to minimise the disturbance to the number and availability of staff for residents of the care home as a result of the researcher's presence. Moreover, the data collection from potential participants took place in a longer period of time than expected.

It is expressed that the researcher is normally an employee in the organisation the data was collected (Saunders et al., 2019). However, the researcher believes that not knowing the participants prior to interviews can mitigate the major problem of bias in interviewing participants and analysing the data. Shopes (2002) declared that a significant concern of using interpretivist approach is that the researcher's interpretation and presumption dominates the output of interviews, meaning the interpretation and the outcome leans more towards being suitable to the research plan. Although this is a limitation of the inductive approach; it is believed that more discoveries can be developed from a case study, than from a statistical study of a large group (Beveridge, 1957). In order to mitigate the bias towards verification, the research applied a multi method of data collection.

In addition, it is apparent that the validity, particularly regarding the generalisation, of this study should not be overstated, given the size of the sample of collected data, and conducting interviews (known as a very subjective approach). This study acknowledged that the small sample size of interviewees, and uneven distribution of participants based on gender, posed limitations. However, it could be argued that the main focus of the study was to understand the participant's opinions, thoughts, perspectives, and expectations of their training and e-learning system in detail. Also, this study was limited to the staff specifically employed within a care home environment, therefore other professions (such as nurses, doctors etc.) can be investigated further in the future as they require different levels of training and skills related to their positions.

Despite the limitations in this research, the qualitative approach had an important contribution towards understanding healthcare staff's challenges and expectations for adopting personalised AI based e-learning. In addition, personalised AI based e-learning in healthcare in the UK is a new area, in which it is believed that qualitative research was the most appropriate approach.

3.12. Summary of the Chapter

Chapter three introduced the adopted research methodology and design that guided this study. The primary emphasis of this chapter was to establish a robust research methodology, particularly focusing on the selection of a subjective research approach. The researcher opted for the interpretivism paradigm, a choice supported, and affirmed through the explanation and implementation of interpretive repertoires. Furthermore, the epistemological stance was grounded in the subjective nature of this study, incorporating the researcher's reflexivity. In order to meet the objectives of this research, a qualitative research method was employed, providing greater authority. The rationale behind choosing the inductive research approach, along with a detailed explanation of the sample selection, and data collection for this study, was also elucidated. Finally, the chapter explored the specifics of the research design method, ethical considerations related to data collection, and the method employed for data analysis. Chapter four will subsequently present individual insights from participants, as extracted from interview transcripts.

Chapter 4.0: Analysis and Findings

4.1. Introduction

The preceding chapter outlined the research methodology employed in this study, with this chapter focuses on the thematic analysis of interview transcripts. Through this analysis, various overarching themes and sub-themes emerged, reflecting the perspectives, thoughts, and experiences of respondents, regarding the adoption of personalised AI-based e-learning in healthcare. The investigation primarily centres on elucidating the factors influencing the adoption of such technology within the healthcare sector. To illustrate these factors, this chapter incorporates examples drawn from audio recordings, and interview notes. Given the subjective nature of this study, emphasis is placed on valuing the perceptions and experiences of the respondents, which are integral to the research. consequently, the insights from the collected and analysed data shed light on the challenges and issues surrounding the adoption of personalised AI-based e-learning in healthcare. It is proposed that this subjective approach provided a comprehensive understanding of the issues and facilitated enhancements in the adoption process. Thus, this chapter will present the emergent themes and sub-themes derived from interviews conducted with healthcare staff at a UK care home. Before discussing and examining the themes and sub-themes; the profiles of the participants interviewed for this study will be provided below, Table 9. Moreover, participant names have been anonymised and each interviewee has been designated a numerical identifier to maintain confidentiality, such as "Participant 1".

Participants Demographic Information					
Participant Identification Number	**Gender**	**Age** (Years)	**Position**	**Experience**	**Marital Status**
Participant 1	Female	43	Head of Care	22 years	Married with kids
Participant 2	Female	45	Healthcare Assistant	9 years	Married
Participant 3	Female	48	Senior Healthcare Assistant	30 years	Married
Participant 4	Female	19	Healthcare Assistant	2 years	Single
Participant 5	Female	53	Senior Healthcare Assistant	40 years	Married
Participant 6	Female	19	Healthcare Assistant	8 months	Married with kids
Participant 7	Female	44	Healthcare Assistant	22 years	Single Mum
Participant 8	Female	38	Healthcare Assistant	9 years	Married with kids
Participant 9	Female	38	Lifestyle Co-Ordinator	3 years	Married with kids
Participant 10	Female	25	Head of Care	7 years	Unknown
Participant 11	Male	23	Night Co-ordinator	5 years	Living with Partner
Participant12	Female	37	Healthcare Assistant	16 years	Married with kids
Participant13	Male	67	Healthcare Assistant	5 years	Married with kids

Table 9: List of Participants and their Demographic Details (Created by the Researcher).

4.2. Representing Themes and Sub-themes Derived from Narratives

In qualitative research, thematic analysis holds significant advantages to generate profound insights in research. The researcher employed a systematic approach to present the content in

a manner that is easily comprehensible and relatable for audiences. To facilitate understanding, this presentation segment employs the use of captions, labelled as 'Themes', which encapsulate diverse outcomes and distinctive sub-themes that each contains, with interpretations. Sub-themes delve into discussions with respondents regarding the adoption of personalized AI-based e-learning within the healthcare sector, and its associated challenges. Furthermore, additional examples and commentary are added within the text and themes to enrich the descriptions. Sequential presentation was employed as the method for data collection conversations, to ensure consistency in this research. Consequently, each theme holds equal significance, whether designated as theme one, or theme five, with each including crucial sub-themes within its domain.

The research followed a structured approach, beginning with gathering basic participant information regarding their proficiency in using electronic devices and IT resources. Subsequently, it progressed to examining more intricate aspects, such as comprehending the challenges of e-learning, the pandemic's impact on staff training, factors influencing employee empowerment, and staff perceptions of personalised AI-based e-learning adoption in the healthcare sector. Each theme was illustrated with various examples to elucidate the topic comprehensively. This chapter aims to provide insight into respondents' understanding, feelings, perceptions, reactions, and opinions concerning personalised AI-based e-learning adoption in the UK healthcare sector. Building upon the arguments and methods outlined in Chapter 3; interviews were conducted in a semi-structured manner to maintain subjectivity control. The subsequent section presents all the themes derived from respondent transcripts, along with supporting sub-themes for each. Nevertheless, only the key interpretations of respondents will be summarised for each theme, given the variations in responses across interview agendas.

4.2.1. Emergence and Deployment of Themes and Citations

In this section, the process of developing all the themes used in this chapter will be outlined. The researcher conceptualised themes as abstract constructs that encompass not only textual expressions, but also visual representations, auditory cues, and tangible objects. Furthermore, the emerged themes represent significant excerpts aimed at addressing the research questions. Prior to the identification of emerging themes, transcripts underwent individual markup to detect potential keywords. Following this, the interview questions outlined in the interview guide were utilised as a set of pre-defined codes. Alongside these pre-defined codes, attention was paid to patterns and distinctive words, which were later incorporated through observational techniques. Additionally, observational and deployment techniques were employed to support the emergence of these themes in the study. Detailed explanations of both techniques will be provided in the following sections.

4.2.1.1. Observational Techniques

This technique helps in searching for elements within the text, sourced from Mazumdar (2018).

Step 1- Repetitions: The research detected all instances of recurring topics or words that appeared repeatedly.

Step 2- Clinical or General Terms: Participants employed clinical or general terminology, some of which might be unfamiliar to the researcher. Certain general terms may be specific to the chosen care home, such as designated terms for staff hierarchy, while clinical terms like "stoma care" or "resuscitation" were also used by participants.

Step 3- Metaphors and Analogies: The researcher observed respondents for any frequently expressed thoughts, behaviours, and experiences through their use of analogies and metaphors.

Step 4: Transitions: The researcher subsequently examined naturally occurring changes in content that could serve as indicators of themes. Given that the study involved written texts (in

the form of interview transcripts), the presence of new paragraphs may have signalled shifts in topics.

Step 5- Similarities and Differences: Next, a constant comparison was employed to determine the similarities or differences between each interview, and the previous or subsequent statements.

Step 6- language linkages: Subsequently, the researcher examined specific words and phrases such as 'because', 'since', and 'as a result', which frequently suggested causal connections. Additionally, words and phrases such as 'if/then', 'rather than', and 'instead of' were recognised as indicators of potential actions or alternatives.

Step 7- Missing Data: During this phase, a method of scrutiny was employed, which diverges from conventional theme identification approaches. In this instance, the focus was on identifying what was absent or overlooked, rather than what was present, to uncover additional keywords or patterns.

Step 8- Theory-related Material: In this final stage, the researcher analysed the environment and circumstances, the viewpoints of the participants, and their perspectives on individuals, objects, procedures, activities, occurrences, and connections. During this phase, the researcher paid close attention to the circumstances, actions/interactions, and outcomes of a phenomenon, and organised these factors and outcomes into theories.

4.2.1.2. Deployment Techniques

This research used four manipulation steps to process texts, sourced from Mazumdar (2018):

Step One - Following the initial process of examining and annotating the text, a comprehensive list of codes/themes was compiled. Subsequently, the text was divided and organised, with quotes or expressions identified as significant. These quotes/expressions were then grouped together based on their relevance or similarity.

Step Two - During the revision of the transcript, the identification of new codes/themes led to the immediate opening of older transcripts, to incorporate these new codes/themes.

Step Three - Upon completing the coding process for the first few transcripts, multiple revisions were conducted to finalise the list of codes. This involved the organisation of notes and passages from transcripts according to codes/themes.

Step Four - Finally, significant discoveries were derived from integrating similar codes, generating distinct codes through comprehensive analysis, and exploring contrasts and comparisons. Furthermore, these pivotal findings were correlated with the existing literature and theories used earlier.

Prior to the presentation of themes and sub-themes, it is necessary to elucidate the utilisation of citations under each theme. Upon gathering all the data, the actual words or statements of the respondents were transcribed into a single column. From these transcriptions, all potential codes, or indices, representing the sub-themes supporting the main theme, were compiled. This process was carried out following the principles of thematic analysis, as explained in Chapter 3. Throughout the analysis, the actual words of respondents were employed as citations. This approach was consistently applied across all main themes and interview transcripts, ensuring uniformity across respondents.

As detailed above; a thorough explanation has been provided regarding the processes involved in developing themes, sub-themes, and ultimately finalising all five main themes. Additionally, for interpretation purposes, all five main themes, along with their corresponding sub-themes, have been incorporated, and will be presented below.

4.3. Interpretation of Emerging Themes and Selected Sub-Themes Derived from Research Texts

In this section, the outline of the five themes developed through constructive thematic analysis of the research text will be presented. Each theme will be supported by various sub-themes.

4.3.1: Theme One: Knowledge and understanding of personalised AI based e-learning is not well understood amongst healthcare staff, during COVID-19 period

Sub-Theme 1: A - The majority of face-to-face training was cancelled and became available online

Sub-Theme 1: B – The number of people in group training was minimised

Sub-Theme 1: C - In house training was not affected by COVID-19

Sub-Theme 1: D – Government's lock down policy for attending care homes

Sub-Theme 1: E - Less involvement in hands-on activities in group sessions

4.3.1.1. Theme One Interpretation

It is evident that COVID-19 has had a significant impact on the training of healthcare staff. It is noteworthy that the enforcement of lockdown during pandemic (COVID-19) changed training strategies. In this section, theme one; participants shared their emotions and experiences during the pandemic and its effects on their training.

Participant 9 mentioned that all her face-to-face training stopped during COVID-19, with the exception of First Aid training, which remained face-to-face:

> *"…It was stopped… it all stopped literally…The only ones that we had face to face were the first aid one, even in COVID-19. We had that, because obviously that's extremely important. Obviously, they're all checked before they came in, everyone wore masks…" (Participant 9).*

In addition, Participant 9 articulated the impact of switching to online training instead of face-to-face sessions during the COVID-19 pandemic:

> *"...I found it harder, because obviously it would have been really nice to have been able to do the face to face and then teach you how to do the movements in a correct way and re-correct you. I did online, they showed you the movements…There's no way to correct you. They watched a video of me performing the exercises to the residents and it was all videoed and then they marked on the video. But realistically, it would have been really nice to say, well, actually, no, you're not moving it this way. You should be doing it that way, but they there was none of that…" (Participant 9).*

Furthermore, Participant 7 noted that she only participated in one face to face training session during the COVID-19 pandemic, with restrictions on face-to-face training when she was working with the NHS:

> *"...so I'd only just done mine before the pandemic started…And so I think we only had one face to face one during the pandemic for the NHS..." (Participant 7).*

Hence, participants declared that the majority of face-to-face training became accessible online during COVID-19 period. Participant 9 also expressed her emotions about participating in online learning rather than in a group setting:

> *"...but most other courses you know they did tend to go online or he did it as a zoom or. I mean I've just finished doing my online training. This year, for armchair exercises, I'd love to have gone and done one in a room with people and done it like that, but it was all online…" (Participant 9).*

In addition, Participant 10 mentioned that face-to-face training became available online in her previous job. She explained the benefits and drawbacks of e-learning compared to face-to-face sessions during COVID-19:

> *"…In my last employment. I guess it did change. It was obviously online or we did a zoom call. And things like that which. Online training is great. Don't get me wrong. It is good as you can go back and refer to it if you need a refresher or things like that where it's face to face. Obviously it's hard. To go back and refresh it, unless you ask manager. I'm just a very I love face to face training. Ask the questions you need to ask. Find out the answers straight away, whereas online, don't know has its perks, has its cons, but I do prefer face to face…" (Participant 10).*

However, participants asserted that 'in house' training was unaffected by COVID-19 and continued to be conducted face to face. With an 'in house' training, one of the staff was trained to lead face-to-face training for other colleagues in the care home. Participant 11 declared that 'in house' training proceeded as usual during COVID-19, and his training was not impacted:

> *"…trainers at my last home, they were in-house trainers so they worked for our company so we didn't need to get anyone in. We could just carry on our training as normal… So in COVID it didn't affect us at all, because they could just train us directly, but the trainer would then like send them little bits to teach us as well. If there's anything that's changed…" (Participant 11).*

Additionally, Participant 12 remarked that 'in-house' training was conducted more frequently, along with e-learning, in her previous position:

"…the training was done probably more frequently because we could do it like in house training for better effect…" (Participant 12).

Furthermore, participants indicated that the size of group training was reduced for face-to-face sessions. Participant 7 explained her experience attending a face-to-face course during the COVID-19 lockdown, where only two staff members were permitted in a ventilated room. Additionally, she notes that both staff members were seated apart during the course, and they were instructed not to handle devices to prevent contamination:

"…So literally one member of staff that was teaching us and they would sit one side of the room we would sit the other side of the room and they would demonstrate and we would just sit and watch. We weren't allowed to touch anything like we would have done before…" (Participant 7).

Furthermore, Participant 12 expressed her experience with face-to-face training during COVID-19:

"…Obviously we had to wear masks and we had to sit further apart from each other and do tests regularly…" (Participant 12).

Also, Participant 11 mentioned that the number of staff attending group sessions was minimised:

"…Well it was minimised. Groups like staffing levels… so four or five people in one sitting…" (Participant 11).

Additionally, participants noted reduced engagement and fewer practical activities in group sessions during face-to-face training amid the COVID-19 pandemic. Participant 7 underscored the significance of group interaction, and hands-on practice with physical devices during face-

to-face courses. However, her participation and engagement in the face-to-face course was limited due to pandemic restrictions:

> *"…We would have been involved and had got to try him out on a dummy and stuff, but it was proper quick. It wouldn't take very long..." (Participant 7).*

She added that people were able to participate and practice before COVID-19, but the process was different during COVID-19:

> *"…So before it would have been more intense, we would have been in a group and got to practise… But we didn't. It was just often a trainer and masks on big room ventilated windows… we just watched that…" (Participant 7).*

Due to the spread of COVID-19, and the vulnerability of the elderly (including care home residents), the government imposed a lockdown. Consequently, visits to care homes were either restricted or prohibited. Participant 6 offered her viewpoint on visiting care homes during COVID-19:

> *"…obviously during COVID time you're only allowed in certain groups…and there was probably a likelihood of them not being able to come in and teach you because of Certain reasons... also COVID when that first happened no one was really allowed to come in the home… so it kind of made it more difficult…" (Participant 6).*

In addition, Participant 7 detailed the process of attending the birth clinic in her previous job during COVID-19. She expressed her emotion as a very sad time:

> *"…In fact at the beginning of the COVID when it first came around, only the mums and the babies were allowed in. The dads had to stay outside, which*

was really sad. 'cause it's a massive thing isn't it? you know, birth, see baby so yeah... But it was really strict… was really hard…" (Participant 7).

4.3.1.2. Summary of Theme One

Through the interpretation of theme one, it becomes evident that the implementation of lockdown measures during the COVID-19 pandemic significantly influenced training strategies within healthcare organisations. Six sub-themes emerged from theme one, aimed at comprehending the repercussions of COVID-19 on healthcare organisations and staff training. Participants observed that most face-to-face training sessions were cancelled and transitioned to online platforms. While some "in-house" training persisted during COVID-19, the number of participants in group sessions was restricted. Furthermore, participants were unable to engage in practical activities during these group "in-house" training sessions, due to the risk of viral transmission. It was noted that, since the onset of the pandemic, the predominant mode of learning and training for healthcare staff has been online. Furthermore, participants described the emotional impact of government lockdown policies on visits to healthcare organisations. The analysis of theme one addresses the first objective of this research.

4.3.2. Theme Two: Healthcare staff perceptions of adopting personalised AI based e-learning reflects lack of clarity

Sub-Theme 2: A - The various learning styles of individuals in online courses is not considered

Sub-Theme 2: B - Face to face training is considered to be necessary along with e-learning

Sub-Theme 2: C – Lack of personalised online courses relevant to job description

Sub-Theme 2: D – Lack of required equipment and support for adopting new changes

Sub-Theme 2: E - Lack of human interaction with other learners and instructor.

Sub-Theme 2: F - Various attitudes towards adopting personalised AI based e-learning

Sub-Theme 2: G – Staff Learning style has not been considered resulting in a lack of staff engagement in e-learning

4.3.2.1. Theme Two Interpretation

Theme one expressed the knowledge and understanding of healthcare staff regarding personalised AI based e-learning during COVID-19 period. In this section, theme two delves into participants' perceptions of adopting personalised AI based e-learning. Theme two is supported by seven sub-themes articulated by participants.

Participants revealed valuable knowledge regarding their preferences and their learning style. Some participants acknowledged that they are aware of their learning style, Participant 4 expressed her learning style as follows:

> *"...my learning style is I think I read it or watch it. If I am listening to a video I would not concentrate..." (Participant 4).*

Participant 7 follows a ,different approach of learning to Participant 4, and she believed that she required various stimuli in order to learn and retrieve information:

> *"...my learning is definitely watching people in person as well as reading stuff. You know, watching. I think I'm an all-rounder for learn and I think I need a lot of different stimuli to help it go into my brain and stay there for sure and also writing stuff down. I find writing stuff down really useful. So, if I'm learning I will take notes so I can flip back to them because that's just the way I've always learned, you know, even when I was doing my GCSE's, I would always use a mixture of different things to learn..." (Participant 7).*

Moreover, Participant 11, with a learning disability, expressed his challenges with reading and writing as a means of learning:

> *"...I feel like I definitely have to be able to see it and do it myself... Hopefully be able to do it and learn from...I can't read it... And maybe sometimes visually like watching. Like a video, but yeah, I can't read and be able to do it. It's either visual and being hands on and doing it..." (Participant 11).*

In addition to the diverse learning styles among the participants, some participants believed that it is essential for e-learning to be supplemented with face-to-face training. Participant 7 shared her experience, and articulated her perspective on the adoption of personalised AI-based e-learning:

> *"...I think combined...definitely. I think you need both of those to be able to be alert. For me anyway, I need that combined to be able to pick up stuff properly. It's all very well just watching it online, but sometimes I do need that face to face things... For instance, I don't think you would need to do online and face to face one for fire, because I think it's very self-explanatory. You either deal with it or you don't deal with it...fire extinguisher, you either know how to use it and use it or you don't. It's quite basic, but I think for stuff to do with actual residents and behaviours and stuff like that it's got lots of grey areas. For me personally, I think a bit of online and a bit of face to face, and I think it's beneficial to me..." (Participant 7).*

On the other hand, Participant 13 expressed a preference for online training over attending face-to-face sessions:

> *"...face to face it's like there will be too much chatting. They won't take it serious the way they do it. So online training is straightforward. They give*

you a question and you've got to answer that question straight away…face to face and online, most of what they will be teaching is just the same. So, I don't see there's any point with that…" (Participant 13).

Moreover, participants' preference regarding the adoption of personalised AI-based e-learning, was to offer relevant and tailored e-learning courses specific to their job descriptions. For instance, Participant 1 mentioned that:

"...I think it is not personalised enough... I think it is very generic…" (Participant 1).

Participant 3 also elaborated on the relevance of e-learning courses as follows:

"...yes they are all related to what we do. It is relevant but not always relevant in everything you do every day because you are not doing it every day you are not gonna remember it…" (Participant 3).

However, Participant 7, and Participant 11 believed that all the online training was relevant to the residents' needs and to the care home environment:

"...I'd say everything I've actually learned from the online training here. I think personally is relevant to the residents I work with and for the environment I'm in…" (Participant 7).

Furthermore, regarding the use of personal electronic media devices at home, where participants frequently shared devices, or resorted to smaller screens like mobile phones, presented a perceived significant obstacle. Participants emphasised their need for a suitable electronic device for their online training. Participant 5, Senior Carer, discussed her challenges when using an iPad for her online training. She expressed a preference for e-learning on a computer over other devices, citing difficulties she encountered with her iPad:

"...you have to scroll up with your finger on the screen... you have to scroll up and you have to put the dot in the question where the answer you want and as I scrolled up, it jumped down and putting on wrong answer..." (Participant 5).

In addition, Participant 7 does her e-learning on her phone, and she struggled with the small screen:

"...I think I would probably prefer to do it on a bigger screen. My phone was just for convenience and because I haven't got the use of a laptop at home all the time...my kids use it for college and school. my daughter sometimes takes it to college so it is not always available. So it was just my phone." (Participant 7).

She also mentioned that in her previous job with the NHS, she had access to a separate office and computer:

"...when I worked for the NHS because we did it at work, we could take ourselves to a separate office. Sit on a computer and that's what we would do. We would just be doing online training... so there weren't any distractions..." (Participant 7)

Participant 3 indicated encountering difficulties accessing her online training package on her laptop. Although she could utilise the facilities at work, Participant 3 conveyed her thoughts regarding the advice provided by the organisation as follows:

"They said if I cannot do it on my tablet I can come here and do it on computer at work. but there are quite a lot to do so I will be here all the time... So last time when I looked,

there were 45 on there, and two of them were Two and half hours long. So, I will be coming to work a lot of time just to do them..." (Participant 3).

Most participants concurred that the absence of social interaction with colleagues and instructors in e-learning affects their ability to learn. Participants suggested that this issue would persist even with the adoption of personalised AI-based e-learning. Participant 7 noted that interacting with her colleagues has been an asset to her learning:

"…listening to my colleagues and staff and how they reacted to it because I was so new… learning about each resident and the way they communicate…" (Participant 7).

In addition, Participant 7 talked about her experience of using virtual reality (VR), where she used this technology with her children. She believed that facial expression and body language significantly influence the effectiveness of her learning:

"…it's still computerised, isn't it. I know on VR you can do facial expressions and stuff, but I think you can get a lot more from a person from facial expressions from the way they speak in person, body language, and I don't think you can get that all from VR it's my opinion. I think in some cases VR would be really amazing..." (Participant 7).

Furthermore, Participant 6 shared her viewpoint on adopting personalised AI-based e-learning through virtual reality (VR), while also expressing her belief that she would still prefer the interaction and support of her colleagues:

"...I think it would feel more real to me, having that [participant was referring to virtual reality] obviously feeling like you're there and you're seeing it. It probably would have been better than seeing it on a video. Then

at the same time, I think I would have still probably knowing me, been like I want to make sure I do it right and then have someone else to do it with me, but I think I'd be like that with every resident 'cause obviously every resident is different" (Participant 6).

On the other hand, Participant 10, Head of Care, stated her opinion as follows:

"...Probably just an expensive way of not doing face to face training, I think..." (Participant 10).

Regarding the adoption of personalised AI-based e-learning, participants appeared to exhibit a positive view. They each shared their perspectives on e-learning, all of which could influence the adoption of any new changes. For example, Participant 7 noted that e-learning incorporates various stimuli that can aid in her learning process:

"... I think stimuli for me on the online training is pretty good because it was compared to before, because...there is people talking...videos going on at the same time. There is bullet points that they put up, so it's a lot of things that I would use for my learning. That is all on that training..." (Participant 7).

Also, Participant 13 expressed his positive attitude, by emphasising the opportunity it provided him to take charge of his learning:

"...I can go back and check whatever I did. Online training I can read more whatever the work, the course I did. I can review. I can go back and read it again. It's good for me. no disadvantage..." (Participant 13).

On the other hand, Participant 3, senior healthcare assistance expressed her feeling about e-learning as follows:

"...honestly rubbish. absolutely rubbish. I think it is so much better to have somebody in the room talking to you because you take more in..." (Participant 3).

Participants articulated that taking their learning style into account, in e-learning, can influence their engagement with online content and courses. Participant 7 found herself engaged watching videos, and the visual aspect of the training kept her involved and engaged when completing e-learning:

"...I'm able to concentrate on it better when it's a mixture of people doing stuff that you can watch. say for instance, they did do some moving and handling on one of the videos and they did show you what to do, which was great to be able to watch it....It was also great for them to be able to talk you through it online, so it's really helpful and...And it did engage me, and it kept my attention...And I think most of them were exactly the same. They had the talking and so it did keep you involved..." (Participant 7).

Furthermore, Participant 11, who has a learning disability, articulated the advantages of personalised e-learning, for his learning, in the following manner:

"...probably the audio thing would be better because...microphones would probably be helpful as well..." (Participant 11).

4.3.2.2. Summary of Theme Two

In summary of theme two, it is evident that participants' learning styles significantly influence the adoption of personalised AI-based e-learning for healthcare professionals. Concerns were expressed regarding the absence of human interaction with colleagues and instructors. Additionally, participants highlighted the importance of integrating face-to-face training with personalised AI-based e-learning. However, participants displayed a positive attitude towards

adopting personalised AI-based e-learning when provided with adequate equipment and organisational support. The examination of theme two relates to the first objective of this research.

4.3.3. Theme Three: Issues and challenges that e-learning poses to healthcare staff can act as barriers toward adoption of AI based e-learning

Sub-Theme 3: A – There is a lack of IT skills and a difficulty accessing electronic devices

Sub-Theme 3: B - Being frightened of using e-learning, and embarrassed to approach higher managers

Sub-Theme 3: C - Some online courses are not relevant to job description.

Sub-Theme 3: D - Difficulty of completing e-learning for staff with a learning disability

Sub-Theme 3: E - Language barriers, and challenges with understanding the wording in e-learning courses

Sub-Theme 3: F - Lack of hands-on, and human interaction with other colleagues/ instructors

Sub-Theme 3: G - Frustration with the assessment process in e-learning

Sub-Theme 3: H - Lack of engagement with online courses as they are long winded and boring courses

4.3.3.1. Theme Three Interpretation

Theme three recognises the issues and challenges of the current e-learning from healthcare staff's perspective. Participant 2 expressed her experience and being frightened using e-learning for the first time:

"...I didn't receive anything to tell me how to use the online package...The IT person helped with the first couple and showed me that it is not that scary, introduced me if that is the word, and it helped, and I was off. I'm not very good at technology but his help did help me..." (Participant 2)

In addition, Participant 1, Head of care, stated that some staff need help to use computer and e-learning package:

"...There are people here can't do it. Somebody will help and sit there for the person to do it..." (Participant 1).

Furthermore, Participant 1 declared that she had to be present and operate the e-learning for another colleague which leads to a draw on her clinical time:

"...there is a lady here who can't use the computer, she can't even turn the computer on and you want her to do the online training! so what is the point... I sit with her and do it with her.... she is watching the video and she will give me the answer, but I have to type it in for her because she hasn't got a clue... in a way I suppose I'm double learning cause I'm taking in what she is saying. they haven't taken that onboard...do you know what, we've got someone can't do that. I think they should consider... it's not right for her. Cause she can't do it at home, and she only can come to work and be rely on me to doing for her... (Participant 1).

Also, Head of Care, Participant 1 expressed that it can be embarrassing to approach managers and colleagues asking how to use computer/ electronic devices for the purpose of accessing online training.

"...The directors are fantastic; you can go to them but sometimes it is embarrassing. People don't want to go and say do you know what I don't even know how to log on to that... I don't know how to do it..." (Participant 1).

However, the majority of participants expressed that they know how to use a computer, laptop or any relevant electronic device. They declared that they did not need any training to learn how to use electronic devices. Participant 8, non-native speaker of English, healthcare assistant, mentioned that she learned how to use a computer and electronic devices when she was young and studying:

"...I use computer at home...I do my training on my computer at home...I know how to use computer..." (Participant 8).

In addition, Healthcare Assistant, Participant 4 expressed:

"...Easy, easy. I was managing it fine.... we got us offer help, but I didn't need it personally... I just knew, I use a computer... I think I just grow up using computer, phones. I just know, it just come naturally..." (Participant 4).

Learning disability was another issue and challenge recognised in this research. Participant 9, Lifestyle Co-ordinator, and Participant 11, Night Co-ordinator, led this study to consider an e-learning system from a different perspective. Participant 9 and Participant 11 discussed their diagnoses with Dyslexia, and they talked about their challenges, and the difficulties they faced with online training. Participant 9 expressed her challenges with online training, and reading questions:

"...I really struggle and the same with the questions. Even the questions sometimes because of my Dyslexia where they're written because I don't understand what the question is actually asking of me, or because I don't understand what that word says I actually get the question wrong..." (Participant 9).

Participant 11 also declared in the interview that he struggled with the reading and writing in online training:

"...my challenge is definitely my Dyslexia and the whole reading, I can't read. I need to have a conversation with someone to be able to take it in. And keep it in. I can't read. I struggle to take it all in…" (Participant 11)

Participant 11 expressed revealed that reading and answering the questions in online training was challenging, and it took him longer to do online courses due to the effects of Dyslexia:

"... I'm dyslexic so I do find it hard to do the questions and it takes me longer to do it" (Participant 11).

In addition, participants for whom English is not their first language (Participant 8 and Participant 13) expressed language barriers, and the challenges of understanding words and sentences in their e-learning; Participant 13, healthcare assistant stated:

"...well, some of the words. I don't really understand. So, I've got to ask my son, what it means. And he explains me but in simple English. Then I can just pick it from there..." (Participant 13).

In addition, the majority of participants noted challenges regarding the assessment in e-learning, as there is no test or assessment attending face to face courses. Participant 6, Healthcare Assistant, expressed her feeling as:

"...I think that's the only problem with the courses is doing tests and stuff...isn't really my style of having to learn... It's not helpful really towards me..." (Participant 6).

Participant 4, Healthcare Assistant, also mentioned that she preferred completing a course without being assessed by tests and exams; she explained her frustration as follow:

"...I think it is different for everyone, like me personally I prefer to watch somebody and not do the test after. Because watching it for me I don't get bored but watching the video I get bored and when I get bored, I get distracted I'm not focusing and answering the questions I get them wrong then I won't be able to pass course and I have to watch the video all over again, so it is very long winded and time-consuming..." (Participant 4).

Regarding acquisition of new knowledge and retaining information; participants expressed their challenges with e-learning. Participants declared that face to face training provided more relevant information to their job role than e-learning. Therefore, it was more engaging and interactive, which resulted in a perception that it was more effective learning, and participants were more confident to operate their knowledge with patients. Participants criticised the currently utilised e-learning package, with a lack of relevancy, which thereby caused a lack of confidence for them to perform effectively at work. Participant 1 believed that online training should be more related to the level of care they provide, as she discovered some 'irrelevant courses':

"...I think it should be more personalised because there are some irrelevant courses on the library like child protection. You can learn about it but I clearly don't work with children..."(Participant 1).

Moreover, Participant 3, Senior Healthcare Assistant, explained that she failed tests in online training, having to then retake them, and believed that some information was not necessary:

> *"...what are the percentage of people with dementia or something, 4 categories and in each category what is the percentage, you are not gonna remember that…. we are in a care home we don't need to know the percentage of people with blue eyes or brown eyes, it is irrelevant to do at work…" (Participant 3).*

Furthermore, participants expressed the lack of a hands-on aspect for e-learning having a huge impact on being discouraged on their preferences of e-learning over a face-to-face training method. Participant 12, Healthcare Assistant, expressed her arguments regarding the benefit of face-to-face training compared to e-learning:

> *"...more hands on like first aid or CPR* training that can't really be taken from video. Seeing someone do it physically I suppose that's just how learn or doing bandages and that kind of things, that's to me it's better hands on whereas watching a video of someone doing it you only get one angle, whereas if it's face to face you can physically do it yourself as well. Whereas watching a video you're just watching someone doing it..."(Participant 12).*

*CPR: cardiopulmonary resuscitation means *"emergency procedure for reviving heart and lung function, involving special physical techniques and often the use of electrical and mechanical equipment"* (Dictionary.com, 2024).

Also, Lifestyle Co-ordinator, Participant 9, expressed the importance of being able to correctly learn and implement the knowledge at work:

"...when we did CPR he had to make sure that we did it in the correct manner and obviously online they would just ask you that as a question of how to do it like we've done the online training of it as well as the physical exercise, but when you do the physical one, obviously it's that opportunity for you to explain to them rather than yes or no questions…"(Participant 9).

In addition, Participant 7, Healthcare Assistant, explained that there have been changes to practice, and she expressed the importance of using devices safely with patients:

"...the hoist systems and stuff have changed, so to actually physically do it was much better for me to be able to learn than just watching a video of it. So, I think you need to be experiencing it, you know when you're handling residents. I think it works better for me if I'm shown how to do it in person rather than just watching the video..." (Participant 7).*

*Hoist: *"is simply a type of mechanical device for lifting that can work to elevate someone from a sitting position, and move them safely into another area, such as a bathtub, seat, or bed"* (Stehr, 2018).

Moreover, participants declared feeling isolated because of the lack of human interaction and socialisation with other colleagues/instructors when completing e-learning. Almost all participants declared that they prefer hands on training, where they can physically interact with the instructor and learn. For instance, Participant 9 criticised the lack of a socialising aspect of e-learning, where socialising with others was perceived to be a valuable aspect of attending face-to-face training for her:

"...Even though online training is brilliant, is the social side of it, because obviously you're getting that interaction with someone else. If someone else

has got those ideas and they can then, especially in my job role, it inspired me to do different games…" (Participant 9).

Likewise, Participant 7 stated the benefit of social interaction in face-to-face training, and feeling isolated when doing e-learning:

"…And you're very isolated when you're just doing it online. Although I don't like particularly like doing actual group stuff… It is beneficial so I will do it because I find it beneficial, and you do have social interaction and you do have that…" (Participant 7).

In addition, participants expressed the lack of engagement with e-learning courses. Participant 10, Head of Care, mentioned that "*it really depends on the training*" with regards to engagement. She mentioned e-learning as being 'boring' for her compared to face-to-face:

"…they're not really engaging, even though they're providing lots of information. Good information, but it's not really engaging… cause they're not face to face. It's a bit just boring, isn't it? Watching online training!..." (Participant 10).

Additionally, Participant 6 acknowledged the value of e-learning. However, she did raise a concern about the content being long-winded, which adversely affected her attention span and being able to engage:

"…But it's not too bad. Some of them could be quite long, though when you don't have a very good attention... I'm like oh God and you know I need a good attention spans being able to do them..." (Participant 6).

4.3.3.2. Summary of Theme Three

Analysis of theme three reveals that participants raised a diverse array of issues and challenges related to e-learning. These challenges encompassed difficulties with IT skills, struggles with learning disabilities, frustration with online assessments, and language barriers, along with feelings of isolation, and a lack of human interaction. Furthermore, participants noted that the absence of hands-on experience with e-learning, and lengthy course durations adversely affected their engagement with online training. Therefore, theme three concludes that there can be significant challenges and issues surrounding e-learning; highlighting the need to comprehensively understand healthcare staff's perspectives, to facilitate the adoption of effective personalised AI-based e-learning. The analysis of theme three corresponds to the second objective of this study.

4.3.4. Theme Four: Factors influencing employee empowerment in adopting personalised AI based e-learning are at an immature stage

Sub-Theme 4: A – Learning and training are accessible from anywhere at anytime

Sub-Theme 4: B - Opportunity to access various optional courses online, assisting with career progression

Sub-Theme 4: C- E-learning courses are related to residents' needs and can positively affect staff confidence in acquiring knowledge and decision making

Sub-Theme 4: D - Official certificates for e-learning courses should be available

Sub-Theme 4: E - The entitlement to be paid for time spent on e-learning

4.3.4.1. Theme Four Interpretation

Theme four delved into understanding the significant factors of engaging, involving, and motivating staff in adopting personalised AI based e-learning in healthcare. This theme

contains seven sub-themes, aiding in understanding the factors affecting employee empowerment.

It is observed that the accessibility of e-learning at any time and place, empowered participants to take control of their learning and training. Participant 1 believed that being able to do her training courses at home in a convenient time has made learning easier. She indicated that she was able to concentrate easier as she does not get disturbed:

> *"...I personally think the online is easier, I just think it's easier because you concentrate more. If you're sitting in a room, you don't wanna be at work, being talked at..." (Participant 1).*

Moreover, Participant 13 noted that the flexibility of e-learning in terms of time and location, is advantageous:

> *"I do at home... Oh, plenty time...it depends with the training... If it's too many trainings we need to do. Well, I do it at home... Online training you do it on your own time..." (Participant 13).*

On the other hand, Participant 3 believed that people should not be asked to spend their own time to do online training related to work:

> *"...I just think it's time spent at home doing things. You don't really want to do because it's not work. You're out of work. I'm not interested in it... you're sat at home, you don't really want to do it? It's late at night. It's just getting it done because you've been told you've got to do it..." (Participant 3).*

Participants deliberated on the advantages of accessing diverse courses online, providing healthcare staff with the opportunity to enhance their knowledge by accessing a range of

training courses at any time of the day, and from any location that suits them. Participant 1 expressed that having access to various courses online gave her confidence:

> *"...I think it's given me confidence. That's the main thing for me to be able to go home and have access to something that I can learn…I can do. I don't have to sit and say, Oh my God, I haven't got a clue how to do that. There's always something in that learning library that I can click on and go. You know what, I can do that…" (Participant 1).*

Participant 7 also remarked that she found optional, and additional online courses enjoyable, and she believed she would benefit from the additional information available online:

> *"...you can also access other stuff that you want to learn about within your healthcare setting. So I thought that was really good. I actually quite enjoyed it…" (Participant 7).*

Participants highlighted that e-learning, with the chance to access numerous courses online at any time and from any location; provided them with an opportunity to progress in their careers. Participant 1 who was recognised as the "learner of the year" within the care home, was enthusiastic about learning and progressing in her career. She found e-learning to be beneficial in her professional development:

> *"...pushes you forward in your job, you can succeed… with the training I've got now I could start my nursing and go to nursing and do that if I wanted to…it pushed me forward actually I've learned a lot and I can go forward with that and I wouldn't do that without online training…" (Participant 1).*

Also, Participant 11 mentioned that he was offered, in his previous workplace, to do an NVQ (National Vocational Qualification) level 3 diploma in adult care. Although the course was

based on the Isle of Wight, far from his place of residence, he attended the course online. He noted that while serving as a Senior Carer in his former position, completing his NVQ qualification online provided him with the chance to advance in his career to the role of Night Coordinator in his current job:

> *"...my last employer asked if I wanted to progress, and I just said yes. It's a free qualification and they set it all up for me and they're based on the Isle of Wight. So yeah, we Teams meetings now…" (Participant 11).*

Furthermore, participants noted the relevance of online courses to the residents' care, and particularly the care home environment. Thus, adopting personalised courses tailored to the care home, and the residents, gave participants the confidence that they were equipped with all the necessary information to support the residents. Participant 7 elaborated on the relevance of e-learning courses to the residents and the care home:

> *"...I think personally is relevant to the residents I work with… I actually quite enjoyed it...." (Participant 7).*

Also, Participant 9 explained the benefits of e-learning courses being relevant to residents, as staff were able to implement their knowledge without waiting to attend face to face courses:

> *"...For example, I did online training for exercises, so obviously the impact then was straight onto our residents. They got to learn how to do it. If I had to wait for a course, maybe to come up, there would have been a longer period of time for them to get the benefits from it. So obviously the benefits from an e-learning course… once you've done that course, you can instantly implement it, and it can be used straight away, your knowledge..." (Participant 9).*

Participant 11 declared that the care home provided relevant online courses for staff, in order to fulfil the needs of new residents:

"...if we get different patients with different needs that we've never dealt with before then we get some training in for their need..." (Participant 11).

Regarding participants' confidence in making decisions based on the knowledge gained from their online training, they voiced several concerns. Participant 10 expressed her opinion by comparing a first aid course being delivered face-to-face, versus online:

"...But first aid for example on the face to face, you'll actually be getting your partner into a recovery position. It's more realistic, it's when you have to do that. Then at work you can go back to that moment and feel like you can do it confidently. Whereas online you're watching somebody else do it, aren't you?..." (Participant 10).

Participant 3 shared similar experience regarding the Stoma Care course she learned face-to-face by a nurse, and compared her confidence with her colleagues who completed the course online:

"...I've done it before with a nurse but if I hadn't done it with them then you watch the video and you still don't know how to do it...everyone in this building done that training because it was mandatory but when it comes to doing it, nobody knows how to do it, so what's the point...what's the point if nobody knows how to do it, nobody is confident enough to do it. If it was done in the classroom situation you had to do it if they have to put stoma bag on someone or on a model or something or change the catheter bag, everyone had to do it in practice, everyone knew what they are doing..." (Participant 3).

Participant 10, as the head of care in the care home, declared that she preferred a new healthcare assistant attend face to face training, rather than completing the course online, Participant 10 expressed her feeling as follows:

> *"...Because I've done it in the past, I'm pretty confident anyway. However, if I had a new carer on my team that had never done care before I wouldn't feel confident with him just watching the online training, and I'd want them to do face to face training..." (Participant 10).*

It was noted that participants were required to invest additional personal, unpaid hours at home to complete their online training course. Participants declared that the entitlement for time spent on e-learning can affect the adoption of personalised AI based e-learning. Participant 3 believed that to motivate people to do their e-learning outside of work hours, staff should be paid for the overtime:

> *"...if you are getting paid for it, it's overtime so everyone's gonna want to do it. I don't wanna go to work for nothing, you sit at home do another 10 hours work and not get paid...." (Participant 3).*

Participant 1, Head of Care, also believed that unpaid hours of e-learning is one of the main reasons that staff prefer face to face training:

> *"...we don't get paid to do online training. That's a big thing. we get paid in the classroom. a reason most of the people prefer classroom because they get paid..." (Participant 1).*

Participant 2 also shared a similar experience:

> *"...it is time consuming... I do it at home. I don't get paid for doing at home..." (Participant 2).*

In addition, participants mentioned that providing an official, and recognised certificate for e-learning courses, can affect staff's motivation towards adopting personalised AI based e-learning. Participants indicated that face-to-face courses do provide official certificates, accepted be other organisations. However, it is stated that the e-learning certificates are not accepted in other care homes, within the same role description. Participant 3 stated that:

> *"…manual handling we actually get certificate send by, fire training send by company but all these online trainings you can't use them anywhere else so if I left the job, went somewhere else I've got to do it all again. it is more just this job so if I go to exactly the same job in a care home down the road I've got to do all those again cause you can't take the qualification with you which I think you should because you've learnt it once and you are confident with it then we shouldn't have to do it again…" (Participant 3).*

Moreover, Participant 1 believed that all care homes in Hampshire should have the same online training, with widely recognised qualifications, which would be accepted by all care homes in Hampshire. Participant 1 expressed that she would be more motivated to do online training if she would get certified qualifications:

> *"…qualifications that we can take elsewhere, because we will be more motivated to do it. Because everybody is not going to stay here forever. And we want to progress and move on but it doesn't make you want to do it…if you walk out the door nothing behind me that is a bit pointless..." (Participant 1).*

4.3.4.2. Summary of Theme Four

From the discussion within theme four, participants highlighted that various factors can influence their empowerment. This discussion provided valuable insights into the factors that

either motivated, or discouraged healthcare staff from adopting personalised AI based e-learning in a care home setting. Theme four was reinforced by; accessibility of e-learning anywhere at any time, and the opportunity to access various courses online in order to progress careers. Additionally, the importance of adopting personalised online training relevant to the needs of residents and the care home environment was emphasised. However, participants also expressed discouragement due to unpaid hours for attending e-learning in their own time, and the lack of wider recognition for e-learning course certificates. Furthermore, participants noted that relying solely on e-learning courses could impact their confidence in decision-making at work. The analysis of theme four fulfils the third objective of this research.

4.3.5. Theme Five: Influencing factors required to drive the adoption of personalised AI based e-learning are not well defined

Sub-Theme 5: A - Lack of IT skills with inadequate training provided

Sub-Theme 5: B - The entitlement to be paid for time spent on completing personalised AI based e-learning

Sub-Theme 5: C – Address difficulties in; managing work-life balance, encountering a lack of allocated time, and having a specific location for completing online training

Sub-Theme 5: D - Limited facilities and lack of electronic device compatibility for an effective outcome

Sub-Theme 5: F - Clear guidelines and policies for adopting personalised AI based e-learning

Sub-Theme 5: G - Staff with disabilities, and those with difficulties adapting to new changes in the system must be considered

Sub-Theme 5: H - The lack of practical and hands-on aspect of e-learning can have a major impact on patient safety

Sub-Theme 5: I - Lack of support and acceptance from the Care Quality Commission (CQC)

4.3.5.1. Theme Five Interpretation

Theme five represents the factors affecting the adoption of personalised AI based e-learning as perceived by staff within a healthcare organisation. This theme is underpinned by eleven sub-themes, some of which may overlap with those discussed in previous themes. Participants cited various factors influencing adoption, notably the lack of IT skills, and insufficient training in the utilisation of new technologies in the workplace. For instance, Participant 1, Head of Care, highlighted staff having inadequate IT skills, and the absence of training in electronic media device usage or e-learning systems:

> *"...she never had any training to learn how to use the computer. I think everybody here literally would benefit from a little short course on how to do it so… I do think that they should give a little bit of training on to how to use it, especially for new staff coming in. I think one-on-one. I mean, I think if we were just taking the office and just he sat there and went right it's 10 minutes of his time to show us how to do it…" (Participant 1).*

Furthermore, Participant 13 also expressed difficulties in utilising electronic media devices, and navigating the e-learning system:

> *"...I will use my phone. I'm not good on laptop…Computer, I'm not good on computer…So what I do, I'll phone you, I need help… I asked my colleagues, they will tell me…" (Participant 13).*

Additionally, participants highlighted a deficiency in electronic facilities for accessing e-learning at their workplace. Consequently, relying on personal devices became common. However, it was noted that participants encountered technical challenges with their e-learning platform. Some mentioned that their devices were incompatible with the e-learning system, resulting in issues and frustration. Participant 3 specifically mentioned the challenges she faced in operating the e-learning package on her personal tablet at home:

> *"…sometimes I put something in and it puts completely different in, so maybe it is just my tablet but couple of people mentioned it doesn't bring the right one up [multiple choice, you put the answer down and it puts something else]. you think it is a correct answer and it is a correct answer, but it put something else that you didn't press! this is technology, isn't it?... I get frustrated with it…" (Participant 3)*

Additionally, Participant 7 elucidated that having access to a computer at her workplace would be beneficial. She pointed out a current shortage of facilities and equipment within her workplace:

> *"…I think equipment wise. I suppose if I had a better equipment to be able to do it, whether that is a computer at work, to be able to specifically do it on rather than having to do it on my tiny little phone because I don't own a computer…" (Participant 7).*

Regarding the flexibility afforded by e-learning, certain participants emphasised the advantage of being able to engage in online training at their own convenience, both in terms of time and location. Participant 1 elaborated on how she found it beneficial to undertake her online training at home, at a time that suited her best:

"...if you go home and you make a cup of tea, you say, you know what, I'm gonna sit down and do that course. Now, in your own time, you're taking it in...I do it on a Sunday afternoon when I've got no children around and I sit down and do it, I've learned it and I can do it..." (Participant 1).

Additionally, Participant 6 shared a situation where her absence from a face-to-face training session due to illness, highlighted the potential downside of in-person training being limited to a specific location and time:

"when we did have it all sorted, I was ill on the day so I couldn't come in and do it, but I would have done if I wasn't poorly... Just like if you do miss it face to face like I did with being ill... So if you're not here or you can't do it..." (Participant 6).

On the other hand, some participants argued for the necessity of having a designated location and scheduled work hours for engaging in e-learning activities. Participant 3 articulated her reluctance to allocate personal time for additional work, advocating instead for dedicated work hours to accommodate e-learning activities:

"...I just think spending time at home doing things that you really don't wanna do cause it is work and it is out of work. people are not interested in it, if you understand what I mean... you sat at home you don't wanna do it , it is late at night, it's just get it done because you are told to do it..." (Participant 3).

Participant 11 also described facing a similar situation when spending his own time doing online training at home:

> *"...So I prefer doing face to face in the day... I've got a partner so I do get easily distracted. Because I've got nowhere, I can settle because hear him doing what he's doing and. Yeah, it's not Great environment..." (Participant 11).*

Participant 7 also experienced distractions while doing her e-learning at home due to being a single mother with a busy household:

> *"...my kids are in and out, so I found it quite distracting and I haven't really got anywhere in my house to go, where I can just lock myself away..." (Participant 7).*

Therefore, an imbalance between work duties and personal life can impact the adoption of personalised AI based e-learning. Participants discussed various factors affecting their ability to balance work responsibilities with personal life commitments. Participant 4 described her challenge in maintaining this balance, particularly with long shifts, and having to complete online training during her days off:

> *"...well I work full time, working here and my days are very difficult so I only get couple of days off in a week and I kind of have my own personal life so I don't find the time to do it at home..." (Participant 4).*

Additionally, Participant 11 highlighted the difficulty he faced in balancing a long night shift, with completing online training upon returning home:

> *"...I don't know why I just find online training a lot more difficult and like after I finish work as well. I don't want to go back on my computer and do more work at home..." (Participant 11).*

Participant 7 also articulated the challenge of managing childcare responsibilities at home, while engaging in online training:

> *"...I had to do it at home and…I had loads of distractions from the kids all the time and it was just, it was a lot of hours to try and fit in…" (Participant 7).*

It is acknowledged that when staff attended prepaid face to face training, all expenses such as traveling was paid by the care home. Also, staff were paid for the hours they attended face to face training. However, it is declared that staff used their own time to complete their online training, and the hours were unpaid. Participants stated that e-learning unpaid hours were the main disadvantage versus face-to-face training. Participants believed that if they spent their own time to complete e-learning, they should be paid, as Participant 3 expressed her opinion:

> *"...I have to do in my own time really and I don't get paid for it… I don't see why I should be sat here and not being paid for it..." (Participant 3).*

Participant 1, despite being recognised by her colleagues as the most enthusiastic person for e-learning, noted:

> *"...I can go home when children are at bed and do it at home. It is perfect for me. I rather get paid but it benefits me as much as benefits them cause I'm learning…" (Participant 1).*

Moreover, learning disabilities were identified in two participants, which emerged as influential factors affecting the adoption of personalised AI based e-learning. Participant 9 and Participant 11, have been diagnosed with Dyslexia, and noted they struggled with the reading and writing in online training courses. Participant 11 explained his challenges with reading and writing online:

"...they do have videos on there and the videos are helpful. But there is also a lot of reading where that is the downfall. And then, like with the typing as well. And there's a lot of typing. Not great at that..." (Participant 11).

Further, Participant 9 recognised that watching videos online was easier than reading and writing for her:

"...The video side of it, they're brilliant, because obviously it means they're telling you them verbally rather than it being needing to be read..." (Participant 9).

Moreover, the majority of participants emphasised the necessity, and criticality of the hands-on dimension in adopting personalised AI-based e-learning. Participants believed that working in health and care is a very practical environment, and accuracy is a key when dealing with residents. Therefore, a face-to-face element, allowing attendees to physically experiment during the training was crucial. Participant 2 expressed her perception of solely relying on online training:

"...I am more hands-on person and I believe you learn better on floor... I think online training helps but I believe in hands on and do it rather than sitting and typing it... someone show me and me actually practicing it..." (Participant 2).

However, Participant 6 highlighted the significance of watching online videos in fulfilling the practical aspect of e-learning. She recognised a preference for online training, but acknowledged that she learned more effectively through hands-on methods. Participant 6 described hands-on learning as the ability to watch videos rather than engaging in written or verbal explanations:

"...I think it's easier online for me. Just 'cause of the videos and stuff like you can see it. If it's one of the ones where it's like a scenario thing and then you can see it play out it's easier for me and I think that's because I work better when it's hands on. So I learn better when I'm seeing it rather than writing it down and explaining it..." (Participant 6).

Moreover, participants expressed that the accuracy of course content was crucial to patient safety. Participant 6 believed that face-to-face and hands-on methods are more appropriate for sensitive courses in regard to patient safety:

"...obviously you have the standing hoists and stuff and you do have that on the manual handling videos and you can use the hoist with someone else as long as you've actually done those courses online. But I was like, oh God, how do I do this with the standing hoist? cause obviously I didn't want to do it wrong for them to get hurt while I'm doing it.... you can't really help the residents if you don't know how to do it safely..." (Participant 6).

Also, Participant 9 indicated the benefit of hands-on training as the practical skill was crucial for patient safety:

"...obviously showing how to resuscitate and stuff, it is a lot easier when you show how to position a neck or you know when you want to free the airways or something, because on online even though the videos there is not going to show you the actual positioning..." (Participant 9).

Participants indicated that the care home implemented a strict policy, and provided clear guidelines for completing e-learning courses within specified timeframes. Participant 1 highlighted that the care home emphasised the importance of staying updated with e-learning courses as it could impact their shifts and payments:

"...we can't not be. You weren't allowed to come in the building... If I came in today and I had a course that was seven days overdue, it will be like you are not on your shift today. Go home complete your course and come back and work. For me, and I think it works. Because people will do it. Because you don't wanna lose Money..." (Participant 1).

Participant 11 also described the communication procedures implemented by the organisation regarding newly added e-learning courses online, or updates on their e-learning status:

"...we get emails through saying that we've got training and then obviously the [care home Registered Manger] will send a message out to everyone to say that we've got training to complete and a deadline when it's got to be done by. We get a few weeks to do it and then we get a warning and then if we sort of don't do it then we can't come to work. We get our shifts suspended..." (Participant 11).

However, Participant 6 elaborated on the experience of her colleague, who used to work in the care home, regarding the restricted policy of the care home concerning the completion of allocated e-learning courses within a specified time frame:

"...I remember one lady that was like she hated it. She hated it because she didn't want to spend her free time doing it. I think that's what it was, and then... because obviously if you're behind the [Administrator] would be like you're behind on it, but the [Administrator]ain't horrible. But obviously it would annoy her because she doesn't really want to do it on the outside, like during her own time. And she never had time to do it in work, so I think it depends on the person really. But she hated it..." (Participant 6).

In addition, all the health and social care organisations in the UK are under same regulations for staff training and health and care knowledge, inspected by the Care Quality Commission (CQC). Therefore, all health and social care sectors in England are under the same independent regulator, meaning the health and care standards should be the same across England. Participants noted that e-learning does not offer recognised qualifications that would be accepted by the CQC. Participants were told that e-learning in this care home is irrelevant in another care home, Participant 1 stated:

> *"...we were told by CQC that our qualifications online are irrelevant...here yes anywhere else no. because they are not official qualifications. They are not certified..." (Participant 1).*

On the other hand, Participant 1 expressed that that the care home's restrictive policy is influenced by pressure from the CQC:

> *"...It's just they need us to have those certificates For CQC coming in and that's all really counts..." (Participant 1).*

4.3.5.2. Summary of Theme Five

In summary of theme five, it is evident that several factors play a role in influencing the adoption of personalised AI-based e-learning in healthcare settings. The researcher observed that certain sub-themes overlapped with those discussed in earlier themes. Furthermore, participants discussed the importance of clear organisational policies and guidance, the lack of support and recognition of e-learning certificates by regulatory bodies such as the Care Quality Commission (CQC), and considerations regarding patient safety. Additionally, participants highlighted the challenge of maintaining a work-life balance. The analysis of theme five targets the last objective of this research.

4.4. Summary of the Chapter

In conclusion, this analysis chapter has provided a comprehensive examination of the themes and sub-themes that emerged from the qualitative data collected in this study. The thematic analysis revealed a multitude of issues and considerations impacting the adoption of personalised AI based e-learning among healthcare professionals. From challenges with IT skills and access to suitable devices, to the impact of COVID-19 on training strategies and the emotional toll of lockdown measures; participants' voices have shed light on the complexities inherent in integrating personalised AI based e-learning into healthcare settings. Furthermore, the analysis highlighted the importance of personalised and relevant e-learning content tailored to the needs of healthcare professionals and their respective care environments. Participants emphasised the value of practical, hands-on training opportunities and the significance of interpersonal interactions in the learning process. Moreover, the findings underscored the pivotal role of organisational support and infrastructure in facilitating successful e-learning adoption. Overall, this analysis chapter contributes valuable insights into the challenges and opportunities surrounding the adoption of personalised AI based e-learning in the healthcare sector. By understanding the nuanced perspectives of healthcare professionals; the policymakers and organisations can develop more targeted strategies to enhance e-learning uptake, thereby empowering healthcare professionals, and ultimately improving patient care outcomes. To organise the findings, the study employed the TOE framework developed by Tornatzky and Fleischer in 1990. Subsequent to this, Chapter 5 will explore the influential factors to support the construction of the framework aimed at addressing the research aim, objectives, and questions.

Chapter 5.0: Discussion

5.1. Introduction

As previously outlined, the aim of this research is to explore strategies towards the adoption of personalised AI based e-learning to add value through training and development for healthcare staff in the UK. To achieve the aim of this research and explore associated issues and challenges; a qualitative research approach was employed using semi-structured interview questions (detailed in Chapter 3). This qualitative research method facilitated an in-depth examination of the issues and challenges, as well as an analysis of the impact of adopting a personalised AI based e-learning for healthcare staff, ultimately addressing the research question. This chapter reflects on the findings derived from the interpretation of themes and sub-themes present in the research data, and aligning these with the theoretical framework presented in Chapter Two. Therefore, this discourse will integrate these findings into a structured series of points, to develop the argument for the adoption of personalised AI-based e-learning in the healthcare sector within the UK.

This study employed the six-phase process of thematic analysis outlined by Braun and Clarke (2006). It began with transcribing and thoroughly reading the collected data to become familiar with the content. Next, notable aspects of the data were identified, leading to the creation of initial codes. In this stage, codes were grouped together, and relevant data were organized to form potential themes. These themes were then reviewed in relation to the extracted codes and the entire dataset to ensure consistency. A detailed examination of the themes was conducted to refine their subtleties and enhance the overall narrative presented through the analysis, resulting in well-defined names and descriptions for each theme. The final step involved compiling the report, which provided the last opportunity for analysis. This included selecting vivid and illustrative data extracts, conducting a final analysis of the chosen examples, connecting the findings to the research question and existing literature, and presenting a

comprehensive scholarly report. A detailed explanation of these six phases is provided in Chapter 3 under the Thematic Analysis section. Additionally, Appendix D presents a sample interview transcript showing how the codes and themes were derived from the data by applying thematic analysis.

Consequently, the following sections will examine the overall outcomes concerning the issues, challenges, and impact of adopting personalised AI based e-learning within the technological, organizational, and environmental (TOE) contexts.

5.2. Technological Barriers of Adopting Personalised AI based E-learning

This section will discuss the technological characteristics that serve as barriers influencing the adoption of personalised AI based e-learning in healthcare organisations.

5.2.1. Lack of IT Skills and Knowledge

Information and Communications Technology (ICT) facilities, computer and information skills, which are the essential requirements for an engaging and a successfully adopting e-learning (Chong et al., 2016). In the subject of healthcare, Button et al. (2014) expressed the necessity of computer and information literacy for healthcare staff, as well as clinical knowledge and skills. This study also believes that ensuring learner's knowledge and skills with ICT is a key to adopting personalised AI based e-learning in healthcare organisations. In addition to adopting personalised AI based e-learning for learners; the organisations need to make sure staff have sufficient knowledge of ICT to be able to access and use e-learning contents without any difficulties.

This research affirmed that the majority of participants exhibited competence in utilising electronic devices and e-learning platforms. However, it is noteworthy that a subset of participants articulated feelings of apprehension and unease, expressed by a participant to be "frightened", when employing electronic devices, and using with e-learning. Also, some

participants reported feelings of embarrassment associated with seeking assistance from colleagues for guidance on utilising electronic devices and navigating the e-learning system. Lockyer et al. (2007) carried out an investigation across two hospital groups in the United Kingdom: identifying a notable absence of information technology skills and computer proficiency. It was observed that participants who did not successfully complete the program, encountered obstacles originating from their limited personal IT competence and self-confidence. In accordance with the Riley and Schmidt (2016) research findings, it becomes evident that the deficiency in computer literacy and competence in accessing e-learning platforms, exerts an adverse impact on staff confidence and the adoption of technology. In accordance with the Xing et al. (2020) study encompassing eight hospitals in Shanghai: Individuals with no prior exposure to e-learning indicated a greater number of obstacles related to their unfamiliarity with both e-learning itself and the associated platforms. Therefore, equipping staff with the necessary IT skills to effectively use e-learning platforms is essential for a successful transition and adoption of personalised AI based e-learning. These skills empower employees to navigate e-learning environments, access training materials, interact with content, and engage in e-learning.

5.2.2. Insufficient Facilities and Device Compatibility Limitations

One of the primary advantages of e-learning is the ability to access the platform from anywhere, using various devices, at any time. Therefore, the compatibility of e-learning platforms with different electronic devices significantly contributes to the successful transformation and adoption of personalised AI based e-learning within healthcare organisations. This issue was noted during interviews, where participants expressed significant challenges with software, and their frustration when using e-learning packages on their personal electronic devices. Likewise, prior studies conducted by Moule et al. (2010) and Tang et al. (2015) revealed that participants identified technical challenges related to online resources and inadequate software

functionality as significant concerns, where participants emphasised their requirement for training and practical assistance. The difficulties associated with accessing e-learning content on participants' personal devices resulted in considerable frustration, often necessitating the repetition of course material, or needing to resit the test at the end of the course. This matter is believed to have contributed to a negative perception of adopting personalised AI based e-learning, and can reduce the level of engagement with online training. It was indicated that the significance of compatibility and adaptability across diverse devices and platforms constitutes a critical concern within the realm of adopting personalised AI based e-learning infrastructure (Nawaz and Zubair Khan, 2012; Nedungadi and Raman, 2012). The careful consideration of ensuring the compatibility of a personalised AI based e-learning platform with the diverse electronic devices used by staff is essential. This study believes that this step is crucial in establishing a robust foundation for an effective, personalised system within healthcare organisations.

5.2.3. Insufficient Practical and Hands-On Training Experience

Prior studies have consistently highlighted the significance of the practical, hands-on aspect in the learning and training of healthcare staff (Social Care Institute for Excellence (SCIE), 2006; Petit dit Dariel, 2011; Barker et al., 2013; Saint-Marc et al., 2019; Azlan et al., 2020; Grundgeiger et al., 2023). This current study aligns with the findings of these previous studies, as participants similarly expressed their strong preference for hands-on, practical training experiences. The research findings underscore a substantial limitation of e-learning, particularly the absence of a practical, hands-on component, which is viewed as a significant drawback by staff. It is acknowledged that the practical dimension of training naturally attributes face-to-face instruction having a higher level of effectiveness compared to e-learning, a sentiment echoed in previous works by (Petit dit Dariel, 2011; Azlan et al., 2020). Additionally, participants emphasised the significance of precision in mastering certain courses

for ensuring patient safety. Participants suggested that face-to-face interaction and hands-on practice are preferable for delicate subjects concerning patient safety, with accuracy in learning physical skills related to these topics deemed as imperative. It is crucial to emphasise that this study does not advocate for the complete substitution of face-to-face training with e-learning. Instead, it contends that by harnessing the capabilities of technology, it is feasible to automate certain aspects and enhance the effectiveness and adoption of personalised AI based e-learning without entirely superseding it.

5.3. Organisational Barriers of Adopting Personalised AI based E-learning

This component focuses on the internal factors within an organisation that can influence the adoption of personalised AI based e-learning in healthcare organisations.

5.3.1. Lack of IT Competence and Training

Participants mentioned that the administrator helped staff to set up their e-learning account. Staff approached the administrator, managers, and other staff, who were more experienced, to help them with questions and challenges they had with e-learning. Participants expressed that the support and communication they received from their colleagues helped them to overcome the fear and lack of confidence of using e-learning. A qualitative research on the Mylink platform for nurses in NHS demonstrated that all nurses must be supported *"but especially those who do not have confidence in their computer skills in order to overcome negative feeling toward online learning, but more importantly, feelings of self-doubt and frustration about their own abilities"* (Riley, 2011, p. 24). Lockyer et al. (2007) expressed that nurses were discouraged to complete their online training, due to *"the lack of personal IT skills and confidence"* (p. 282). They argued that the successful completion of online training, increased nurse's confidence. Nurses declared that that they were encouraged to sign up to do more online courses as a result of building their confidence of using IT and online training (ibid). Also, previous studies emphasised the significance of furnishing sufficient ICT infrastructure, along

with the provision of technical support and training, as crucial factors in promoting staff engagement in e-learning, and thereby enhancing their educational advancement (Chong et al., 2016; Button et al., 2014; Moule et al., 2010). Therefore, effective communication and support between staff and managers is the key in the process of organisational change and transformation (Goodman and Truss †, 2004; Gilley et al., 2009; Welch, 2011; Richet, 2016). In addition to the benefit of staff communication and support, it is believed that fundamental IT training is required for staff to become more technologically competent, which was emphasised for building the capacity for online training at SCIE (Social Care Institute for Excellence (SCIE), 2006). It is widely acknowledged that each healthcare staff member represents a valuable asset for the organisation. Accordingly, it is crucial to provide comprehensive support to all staff, facilitating a seamless and trouble-free personalised AI based e-learning adoption in healthcare organisations. Therefore, it is important to offer thorough IT training programs, which focus on improving healthcare staffs' skills with electronic devices, and consequently being able to effectively interact with e-learning. These measures not only enhance staff acceptance and confidence, but also contribute significantly towards facilitating the adoption of personalised AI based e-learning for healthcare staff.

5.3.2. Learning Disability and Language Barriers

In recent years, educators have made efforts to accommodate individuals with learning disabilities through adaptation of their teaching methods. However, within the context of e-learning, this particular area necessitates further focus and enhancement. It is believed that adopting personalised AI into e-learning can enhance the ability to encompass individuals' specific needs, thereby fostering a more effective and engaging e-learning. Conducting interviews with staff members who have learning disabilities, has emphasised the need for adopting personalised online training in healthcare organisations. It is evident that individuals with learning disabilities have not received adequate attention, as they have typically been

given the same training and educational materials as all other learners. Therefore, participants diagnosed with learning disabilities, particularly dyslexia, have articulated the difficulties and frustrations they encounter while engaging with course materials, and responding to questions during online training sessions. It is observed that in comparison to online training, face-to-face instruction was favoured, primarily because learners encountered difficulties in their online learning experiences.

Furthermore, participants with learning disabilities experienced a sense of discomfort when seeking assistance from their colleagues, to help them understand and respond to online training materials. This discomfort stems from the fact that their unique challenges have not been adequately addressed within the provided e-learning packages. Consequently, individuals with dyslexia invested more time in completing online courses and responding to associated questions. This extended time commitment resulting in increased investments of personal time, which then fostered frustration among the learners. Previous studies have supported the idea that aligning the learning materials with the user's specific learning style or learning disability type; significantly augments their educational achievements (Alsobhi and Alyoubi, 2019).

In addition, this study values all participants' challenges and experiences regarding adopting personalised AI based e-learning in healthcare sector. Therefore, as well as two participants with learning disabilities; two participants recognised English as their second language, and they expressed their experience and feeling about learning in English. It is recognised that participants faced some challenges in understanding the online training content, and therefore sought help from family and colleagues. It was interesting that both participants that identified English as a second language, wished to do their e-learning in English. Participants believed that e-learning in English would help them to improve their English, as well as helping them to learn the professional terms used at work. However, it is believed that the care home should recognise these challenges, and provide multilingual support for e-learning materials, offering

language training or translation services for staff members, and ensuring that communication within the organisation is clear and accessible to all employees, regardless of their language proficiency. The Office for National Statistics declared that *"Non-British nationals make up 12% of the UK healthcare workforce"* (Briggs, 2019, p. 3).

5.3.3. Quality of Assessment

Some participants expressed satisfaction with multiple-choice questions, finding them effective. However, the research revealed that the quality of assessments in e-learning modules did cause confusion and frustration among other participants. This emphasised the importance of appropriate assessments as tools to guide learners toward key learning objectives and foster a positive learning environment. Participants also reported feeling confused by questions which were perceived as being deliberately designed to be confusing. The study outcomes indicated that learners experienced frustration due to ambiguous questions in e-learning assessments. The complexity of understanding the questions posed a challenge, leading to failures of tests, and necessitating a complete redo of that assessment or, in some cases, the entire course. This issue posed a particular challenge for learners with learning disabilities, and non-native English speakers employed in the care home.

It is suggested that enhancements can be made to the existing e-learning system to better align with the diverse needs of learners. This research brought to light the potential detrimental effects of employing a uniform system for all learners, impacting the overall quality of the learning and training experiences, as well as learner engagement and motivation. This issue came to the forefront during interviews, with two participants who have learning disabilities, particularly with respect to difficulties with reading. Consequently, the act of reading and successfully completing end-of-module questions within online modules posed significant challenges for participants with dyslexia. Pawlyn (2012) presented the findings from a study investigating the factors that influence nurses with learning disabilities in choosing e-learning

for work-related education. In addition, the necessity for flexibility in the learning mode, while engaging in e-learning activities was emphasised (Pawlyn, 2012). This study suggests that by considering the varying needs of learners and implementing software personalisation, a more user-centric e-learning system can be established. Also, a study of students with learning disabilities stated that the incorporation of innovative e-learning methods is arguably one of the most potent means of support, and it is imperative to utilise specialised platforms, software, and tools (Obradović et al., 2015). Therefore, personalising the software and the assessment process, is believed to be a positive potential strategy for mitigating the aversion to adopting personalised AI based e-learning.

5.3.4. Lack of Engagement

The lack of engaging content within online learning has faced criticism in previous studies (Petit dit Dariel, 2011; Riley and Schmidt, 2016; Smith and Crowe, 2017; Azlan et al., 2020). Participants involved within this research also expressed their dissatisfaction with the current e-learning package, citing a lack of engagement. As indicated in the analysis and findings chapters; participants expressed that the online modules were perceived as "boring," "lengthy," and "lacking engagement". Tang et al. (2015) reported that participants within their study expressed frustration regarding the length of videos, and the additional time required to complete the modules. These factors relate to how the e-learning content is designed, structured, and delivered by organisations. Factors such as the quality of instructional design, the relevance, the interactivity of the content, and the usability of the e-learning platform can all influence participant engagement. Through an extensive review of the literature, attentive consideration of participant opinions and suggestions, this research has identified a potentially effective solution to address this issue by adopting personalised AI based e-learning according to the learner's individual learning style (Al-Sarem et al., 2014; Essalmi et al., 2015; Obradović

et al., 2015; Alkhuraiji, 2016; Gavriushenko, 2017; Sweta and Lal, 2017; Wongwatkit et al., 2020; El-Sabagh, 2021; Nazempour and Darabi, 2023).

Therefore, the quality of e-learning content holds paramount importance in the creation of a user-friendly system that facilitates effective engagement, and therefore learning. Given that e-learning serves as the preferred mode of instruction for some learners, this study raised concerns about the quality of the current e-learning, specifically its lack of engagement, which led to participants losing concentration and, subsequently, diminished the overall effectiveness of their learning experience. Insights gathered from interviews underscored the perceived significance of incorporating video content for its visual impact. However, it was emphasised by participants that visual elements and content should closely mirror real-world scenarios and provide more relevant information to enhance the learner's interest and interactivity. Additionally, participants have suggested valuable additional features to help toward the adoption personalised AI based e-learning, such as the ability to take notes during the e-learning course, and the capacity to easily reference course information. Therefore, improving engagement may involve redesigning the e-learning content to be more interactive, incorporating multimedia elements, providing opportunities for active learning, and ensuring that the content is aligned with participants' learning needs and preferences.

This research provides compelling evidence indicating that placing a strong emphasis on individual opinions and experiences concerning e-learning, could yield substantial benefits towards driving the adoption personalised AI based e-learning in healthcare organisations. While several widely recognised frameworks (Warr et al., 1970; Hamblin, 1974; Phillips, 2003; Kirkpatrick and Kirkpatrick, 2006) endeavour to establish a connection between training programs and an individual's motivation and engagement; the outcomes proposed that a more appropriate approach might involve empowering healthcare personnel to actively participate

in the creation of an effective personalised online training system considering learner's learning style.

5.4. Environmental Barriers of Adopting Personalised AI based E-learning

This component considers the external factors outside the organisation that may impact the personalised AI based e-learning adoption.

5.4.1. Care Quality Commission (CQC)

CQC inspects care homes, services in patient's home, clinics, dentists, GP services, hospitals, community services, mental health services, and service providers in England (Care Quality Commission, 2022). Therefore, all health and social care sectors in England are under the same independent regulator meaning the health and care standards ought to be the same across England. Having the same regulation for all of the aforementioned sectors above makes the selected care home (case) a strong and valid case for this research. Also, the staffs' learning and training regulations and standards are the same for all the sectors governed by CQC in England. Therefore, it is believed that these similar standards and regulations is the advantage to deriving the outcomes of this research to other health and social care organisations in the UK. Participants stated that e-learning lacks recognised qualifications that would be approved by the Care Quality Commission (CQC). Additionally, participants indicated that the e-learning program used in this particular care home would not be applicable in another care home setting, emphasising a preference for face-to-face training than e-learning. Moreover, participants also mentioned that others perceived an online training method as ticking the box for CQC, and face-to-face training was preferred, which was also mentioned similar results by Yu et al. (2016) study. In addition, Higgins et al. (2020) highlighted a warning notification from the CQC to the University Hospitals of Leicester NHS Trust (UHL) emphasising apprehensions regarding the appropriate administration of insulin by frontline personnel. They noted that training was conducted through an external e-learning module, but compliance to

this training was lacking. It was evident that a comprehensive investigation into the training process was warranted, particularly in response to the CQC's warning notice (Higgins et al., 2020). It is widely held that the primary objective behind CQC's involvement in evaluating the quality of e-learning courses for healthcare organisations is to enhance the standard of care provided to patients and residents. As a result, personalised AI-based e-learning initiatives can provide relevant online courses and content, with the goal of positively influencing staff members and enhancing the quality of care. However, the CQC's standards and regulations may pose challenges or barriers to the adoption of personalised AI based e-learning within healthcare organisations. These standards might dictate certain requirements or limitations that healthcare providers must adhere to, potentially affecting their ability to implement new technologies effectively.

5.4.2. Unrecognised and Unofficial Certification

This aspect refers to external factors beyond the organisation's control that influence the adoption and use of technology. In the context of e-learning, recognised certificates are often governed by external regulatory bodies or accreditation. These certificates signify compliance with certain standards or competencies, and are important for validating the effectiveness and credibility of e-learning programs. The recognition of certificates by external authorities can impact organisational decisions regarding the adoption and implementation of personalised AI based e-learning initiatives. The results of this study revealed that face-to-face training offered official certificates that were recognised by other organisations, whereas, certificates obtained through e-learning were not acknowledged in other care homes, even when the roles were similar. Moreover, participants expressed dissatisfaction with the lack of recognition for e-learning certificates. Consequently, participants highlighted that the provision of official and recognised certificates for e-learning courses could influence their motivation. The findings supported by previous research suggests that a successful strategy to motivate both healthcare

workers and their managers, is to provide accredited certification upon the completion of programs for ongoing professional development (Lichtveld and Cioffi, 2003; Archer et al., 2020; Bastos et al., 2022; Grafton-Clarke et al., 2022; Akselrod et al., 2023).

5.4.3. Lack of Human Interactions

The findings presented in this research align with prior studies addressing the practical limitations of e-learning, and the significance of human interaction, as observed in studies conducted by (Xing et al., 2020; Guven Ozdemir and Sonmez, 2021). Specifically, this investigation reveals that one of the reasons participants favoured face to face training over online training, is the opportunity for direct engagement with instructors and fellow learners. Participants believed that learning from each other is an important element in the learning process, and they benefit from socialising and learning from other peers in during face-to-face training. Therefore, it was declared that being able to interact face to face with an instructor and peers, and being able to ask questions, made face to face training more effective than online training. These findings are in accordance with those of Xing et al. (2020), where 91.4% of participants expressed a preference for interaction with facilitators and peers, in contrast to 8.6% who favoured self-directed learning without interpersonal interaction. It is understood that individuals who exhibit a preference for a hands-on, practical approach, are more inclined to apply newly acquired knowledge in real-world contexts, and derive insights from their experiential learning. In consideration of this, an e-learning solution proves to be effective when it offers diverse learners, each with distinct learning styles, the appropriate educational content, and interactive activities (Pange and Pange, 2011).

5.4.4. Work-Life Balance

The context of work-life balance in this study, was about acknowledging the need for employees to assume responsibility for their e-learning work often expected in their own time, while also maintaining an equilibrium with their personal lives (Gould et al., 2007; Pawlyn,

2012; Panda, 2021). According to the perspectives shared by the participants, it is evident that conducting online training during one's personal time at home presents a significant challenge. The discussions highlighted that individuals with familial obligations and household responsibilities find it exceptionally difficult to maintain concentration and active engagement in online training. Nevertheless, prior research has posited that the flexibility inherent in e-learning exerts a relatively minor influence on family life (Alfaleh et al., 2023; Xing et al., 2020; Sheen et al., 2008). According to Xing et al. (2020), individuals' marital status and their geographical work locations may lead to distinct attitudes regarding e-learning. In addition, participants expressed that the care home ought to allocate dedicated time for staff to complete e-learning. Therefore, it is important for healthcare organisations to acknowledge the challenges that staff are facing to find a work-life balance. Moreover, it is believed that providing space and allocated time for staff that particularly encounter difficulties in carrying out their online training from home, can facilitate the adoption of personalised AI based e-learning.

5.5. Adapted Conceptual Framework based on the Barriers

Based on the preceding conversation about the barriers that can hinder the adoption of personalised AI based e-learning, this research has constructed a conceptual framework utilising the TOE framework. This framework incorporates the technological, organisational, and environmental barriers of adopting personalised AI based e-learning in healthcare organisation in the UK. The adapted framework is illustrated in the next page, Figure 33:

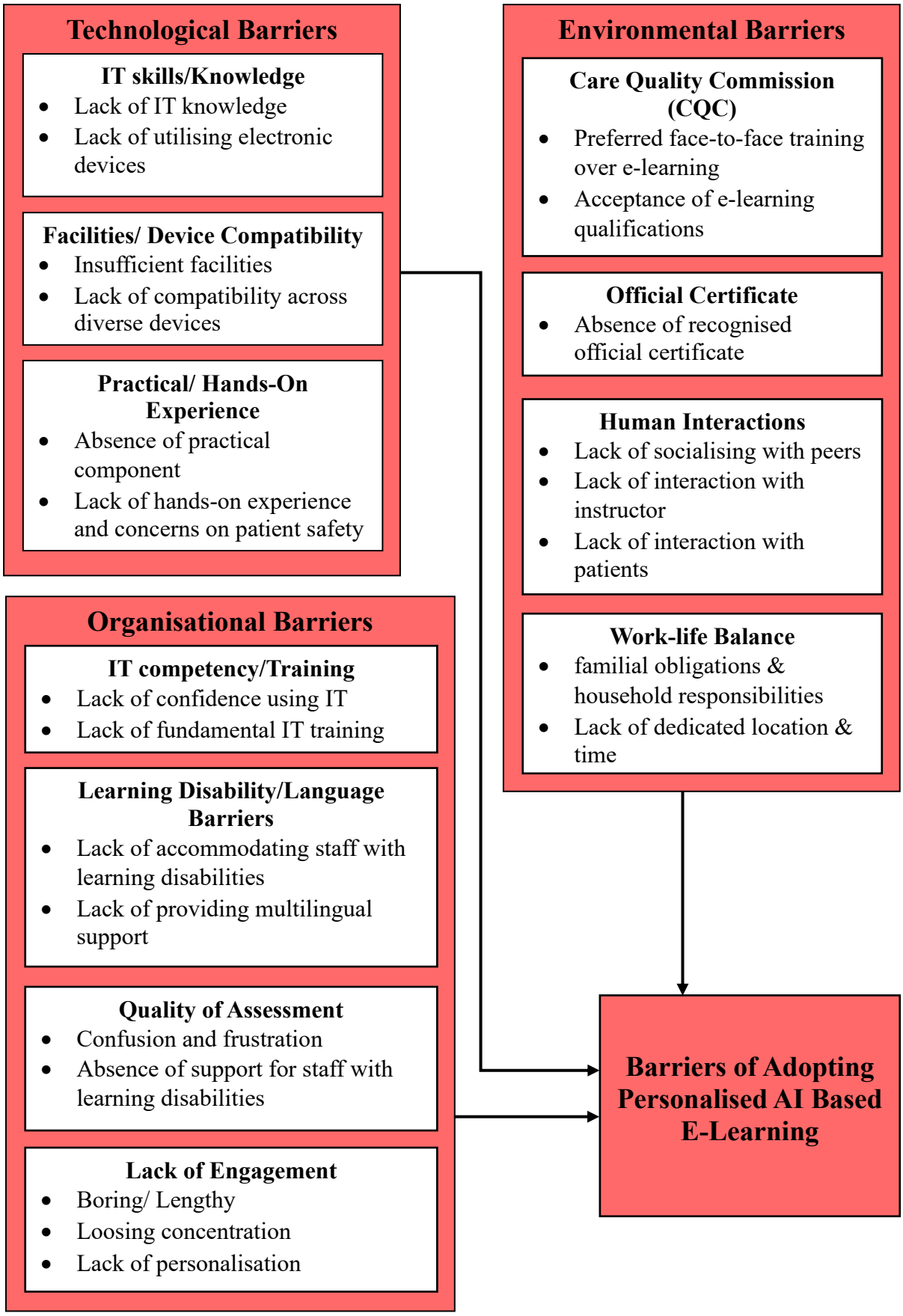

Figure 33: Adapted TOE Conceptual framework representing barriers of adopting personalise AI based e-learning.

5.6. Technological Incentives of Adopting Personalised AI based E-learning

5.6.1. Opportunity to Access Various Online Courses

Training and learning through Internet has brought a great opportunity for learners to have access to an extensive resource of online training (Alkhuraiji, 2016). Also, some participants declared that e-learning gave them the opportunity to access training courses instantly, whereas they had to wait for the availability of face-to-face courses. The research findings have revealed that e-learning offers learners a more convenient and effective method for expanding their knowledge. The capacity to conduct online searches and incorporate external links and modules, provides learners with the opportunity to delve deeper into their subjects of interest. Previous studies have highlighted the staff interest in having the capability to access external links to acquire additional information on specific topics in an e-learning module (Kala et al., 2010; Riley, 2011; Riley and Schmidt, 2016; Alfaleh et al., 2023). This study strongly asserts that e-learning outperforms traditional face-to-face instruction in terms of accessibility to a wider range of knowledge resources. It is suggested that learners can acquire knowledge more quickly through e-learning, considering the limitations of potentially delayed access to face-to-face settings. Furthermore, e-learning can be employed for the purpose of knowledge and information review at any time, thus representing a cost-effective and time-efficient solution for both organisations and learners alike.

Conversely, e-learning provides learners with the autonomy to take charge of their educational journeys by granting them access to a wide array of career development topics. Staff members can enjoy the freedom to select training subjects that stimulate their interest at their convenience. However, it is important to acknowledge that some participants have expressed concerns regarding the vast array of online training options, considering some of them to be incompatible with their daily job demands. For example, certain participants argued that modules related to childcare should be omitted as they hold little relevance given that staff

primarily interact with an older demographic. In contrast, other participants mentioned that the availability of a diverse range of topics provides them with an opportunity to enhance their knowledge and advance in their careers. These diverse preferences underscore the uniqueness of each individual, underscoring the imperative need of adopting personalised AI based e-learning.

5.6.2. Accessibility and Flexibility

One of the most valuable aspects of e-learning is the ability to access training anytime, anywhere. Previous research has highlighted the time and location flexibility associated with e-learning, as a significant advantage for healthcare staff (Karaman, 2011; Riley, 2011; Riley and Schmidt, 2016; Gavriushenko, 2017; Bahrambeygi et al., 2018; Xing et al., 2020; Laukkanen et al., 2022). Additionally, e-learning has been recognised as a cost-effective learning method for both trainees and organisations (Social Care Institute for Excellence (SCIE), 2006; Schreurs et al., 2009; Delf, 2013; Webb et al., 2017; Laukkanen et al., 2022), empowering trainees to complete courses at their preferred time and location, thus providing flexibility for effective learning.

In addition, this research spanned the COVID-19 era, and during the pandemic, face-to-face training was limited/cancelled. However, it was crucial for healthcare staff to continue with their training. Also, it was very important that healthcare professionals were available to provide care for patients during pandemic. Participants in this study mentioned that since COVID-19, the majority of, learning and training for healthcare staff became available online, and has remained online. Additionally, prior studies stated that saving time is one the advantages of e-learning over face-to-face, where e-learning can save traveling time for instructors and trainees, saving their precious time towards providing care for patients (Xing et al., 2020; Saint-Marc et al., 2019; Bahrambeygi et al., 2018; Riley and Schmidt, 2016). Also, e-learning is a more cost effective method than face-to face training (Alfaleh et al., 2023; Xing

et al., 2020; Riley and Schmidt, 2016); there are instructor, travelling, and material costs involved in the face-to-face method. Therefore, it is believed that adopting personalised AI based e-learning would help healthcare organisations to achieve an effective outcome from e-learning. Moreover, the availability of the healthcare staff can have a positive impact on patients receiving more timely and safer treatment.

5.7. Organisational Incentives of Adopting Personalised AI based E-learning

5.7.1. COVID-19 and its Impact

It is clear that COVID-19 lockdown measures had a notable impact on training strategies in healthcare organisations, making them adapt to new changes and challenges. While some internal training sessions continued during the pandemic, there were limitations on group sizes, resulting in reduced participation. Additionally, practical activities during these sessions were limited due to the risk of viral spread. It was observed that online learning became the primary mode of training for healthcare staff since the pandemic began. This research was initiated prior to the onset of the COVID-19 pandemic and continued during its course. While data collection had to be temporarily halted during this period, it provided a valuable opportunity for this study to reassess interview questions and explore the pandemic's impact on training within a healthcare organisation. The feedback gathered from interviews indicated that participants who had previously exclusively engaged in face-to-face training, found e-learning to be challenging during the pandemic. The findings aligned with other research, illustrating students' dissatisfaction with e-learning amidst the COVID-19 pandemic (Yekefallah et al., 2021). Likewise, approximately two-thirds of students surveyed by Compton et al. (2020) expressed a desire to return to face-to-face clinical settings, with over half of Alsoufi et al.'s (2020) respondents lacked confidence in using e-learning for clinical aspects. Additionally, Przymuszała et al. (2022) highlighted the challenge of limited interpersonal interaction during online learning in the pandemic era. Students expressed missing the companionship of peers

and instructors, firmly believing that online platforms could not replicate the vibrancy of in-person experiences. Equally significant was the absence of patient interaction, a crucial component in the training of future medical practitioners (Przymuszała et al., 2022). Moreover, this study understood that as the care home's director had already established the online training platform before the pandemic, the majority of staff did not encounter difficulties in utilising e-learning, and they were already familiar with the e-learning platform. It is believed that the introduction of an e-learning platform before the pandemic, and the transformation of the care home's culture can have a positive impact towards adopting personalised AI based e-learning.

5.7.2. Considering Various Learning Styles

Interviewing healthcare staff revealed that every participant has different learning style, where they expressed their expectations and differing needs for adopting personalised AI based e-learning. It is recognised that the majority of participants had clear a vision of their learning preferences, and what can be changed in order to adopt a personalised AI based e-learning. Involving staff to express their perceptions and experiences was the most valuable aspect of this study toward understanding aspects critical to the adoption of personalising AI based e-learning. For instance, the study's findings highlighted that the current e-learning system primarily focuses on the delivery of video content. However, participants feedback clearly indicated that while videos are indeed valuable in the context of e-learning, there is a preference for a more diversified set of materials within an online course. In addition, learners favoured face-to-face training, where they have the opportunity to engage in writing or practical activities, in addition to watching and listening to instructors. This underscores the presence of diverse learning styles among healthcare staff and emphasises the importance of taking these learning preferences into account, to ensure that learners remain engaged with the e-learning content.

Also, participants mentioned that additional factors contributing to challenges with the current e-learning system include; the inability to revisit course materials, lengthy videos, and challenges in sustaining focus during the online training. The researcher believes that the healthcare organisation can potentially mitigate these challenges through a consideration of learners' individualised learning styles within the system. From various perspectives gathered from participants, it is firmly held by the researcher that adopting personalised AI based e-learning within healthcare organisations can have a profound impact on enhancing the motivation of staff members to engage more actively in their e-learning courses. In regard to the hands-on aspect of learning, participants believed that they learn better if it is 'hands-on' and face-to-face. As a result, participants expressed that the current e-learning system should be more user-friendly and more interactive. Therefore, adopting personalised AI based e-learning could derive substantial benefits from the integration of Virtual Reality (VR) technology to support healthcare staff in their practical learning and training endeavours. VR presents the nearest approximation to real-life scenarios within the context of online training, and its inclusion can improve the efficacy of e-learning by addressing the shortfall in hands-on experiences for learners. A recent study undertook the implementation and evaluation of Virtual Reality (VR), and arrived at the conclusion that the use of VR had a beneficial impact on student learning (Villena-Taranilla et al., 2022). Furthermore, it is declared that VR is valuable, because learners can deeply engage with the instructional material, fostering increased participation, skill acquisition and performance, thereby enhancing overall learning outcomes (Kozhevnikov et al., 2013; Alhalabi, 2016; Passig et al., 2016; Webster, 2016; Parong and Mayer, 2018; Jensen and Konradsen, 2018; Meyer et al., 2019; Wu et al., 2020). Therefore, VR has the potential to assist healthcare organisations overcome the practicality limitations of e-learning for their staff, ultimately enhancing learners' confidence in applying their knowledge when providing care to patients.

5.7.3. Providing Required Electronic Devices and Support

Participants declared that colleagues and management supported them with their e-learning. However, a need for ICT training is recognised throughout the interviews by participants. In addition, available IT support is essential in order to build a learner's trust and confidence in adopting personalised AI based e-learning. As it was mentioned that the fundamental principle of e-learning centres on the accessibility and adaptability of information and knowledge (Gavriushenko, 2017), which learners can access through their preferred electronic devices. Consequently, when initiating the adoption of personalised AI based e-learning within a healthcare organisation, careful attention to the foundational infrastructure and the provision of necessary equipment play pivotal roles in establishing an effective and engaging e-learning system. Lockyer et al. (2007) also highlighted that the absence of access to information technology (IT) equipment, which was perceived as "discriminatory", as nurses lacking home computers were not afforded equal opportunities for learning and professional advancement. Moreover, Tyson et al. (2013) elaborated on the e-learning protocol within the East London NHS Foundation Trust. They explained that if computer access is unavailable for any reason, line managers are instructed to reach out to the training department, which will then inform them of available facilities at alternative Trust locations. Additionally, the authors noted that managers should organise essential IT training and assistance as needed (Tyson et al., 2013). In addition, Lockyer et al. (2007) stated that *"developing the manager's awareness of online provision and support strategies"* is essential to engage learners with e-learning courses and being able to deliver their learning to practice (p. 284). It is suggested that an IT department is required to support staff with their IT issues, and also give staff feedback to the organisation or the provider of the e-learning content. Therefore, as demonstrated by Pawlyn's (2012) research, employers should be encouraged to engage in proactive preparations for the adoption

of e-learning within their organisational frameworks, entailing investments in infrastructure, equipment, and technical support.

5.7.4. Knowledge Acquisition and Staff Confidence in Decision Making

Healthcare professionals are required to engage in lifelong learning, and participate in continuous professional development by means of continued education (Xing et al., 2020; Mlambo et al., 2021; Gaur et al., 2020; Alfaleh et al., 2023). It is widely recognised that e-learning affords healthcare staff immediate access to the necessary subjects for their work. This accessibility allows staff to engage with relevant online training topics promptly, particularly, in this case, when a new patient is admitted to the care home. Consequently, this ability fosters confidence among both staff and the organisation, facilitating the rapid adaptation of staff to diverse health conditions patients may present with, and the allocation of relevant online training to assist patients.

Xing et al. (2020) and Sheen et al. (2008) stated that e-learning has the potential to address job-related requirements, but the results in these studies indicated that face-to-face training sessions offered participants a higher degree of job-relevant information compared to e-learning. Consequently, face-to-face training proved to be more engaging and interactive, resulting in more effective learning outcomes, and strengthening participants' confidence in applying their knowledge in patient interactions. Consequently, the findings highlighted that e-learning modules lacking in relevance, led to a lack of confidence among participants in their ability to effectively perform their job duties. Nevertheless, earlier research studies indicated that e-learning enhanced learners' knowledge, consequently boosting their confidence in delivering patient care (Lockyer et al., 2007; Smyth et al., 2012; Back et al., 2014; Barnard et al., 2014; Tang et al., 2015). It is believed that adopting personalised AI based e-learning with a user-friendly system, can motivate learners to get involved and engaged in their learning and training process. As the system is individualised based on the person’s specifications and preferences,

the learner will feel more engaged with the course materials. Consequently, this can improve leaner's knowledge acquisition and confidence to implement their knowledge with patients. Moreover, improving the current e-learning system from a 'generic package', to adopting personalised AI based e-learning, can enhance obtaining and retaining knowledge and information for learners.

5.7.5. Organisational Guidelines and Policies

Participants in this investigation reported the implementation of restricted policies and explicit guidelines by the care home, concerning the completion of e-learning courses within designated time frames. Additionally, participants emphasised the care home's emphasis on remaining current with e-learning courses, acknowledging the potential implications for their schedules and wages. The findings supported by Royal College of Nursing (2018) indicating that many employers have their own regulations, where employees face consequences for non-compliance. These consequences may involve withholding pay raises, being excluded from professional development opportunities, and facing the possibility of suspension, or reduced pay grade (Royal College of Nursing, 2018). In addition, communication channels such as email and group chat facilitated by the care home, contributed to participants' confidence in staying informed about required online training. However, participants voiced frustration with managerial follow-up regarding incomplete training. Furthermore, participants expressed uncertainty about being compensated for conducting e-learning during their personal time at home. It is believed that organisational guidelines and policies incorporate aspects related to an organisation's internal structures, processes, and policies that influence the adoption of personalised AI based e-leaning in healthcare organisation. Organisational guidelines and policies can shape how personalised AI based e-leaning is implemented, utilised, and integrated into daily operations within a healthcare organisation. Additionally, it is argued that the motivation and engagement levels of staff can influence their willingness to complete their

online training. Thus, adopting a personalised e-learning system tailored to learners' preferences can positively affect the acceptance of technology, and learners' self-discipline. Also, previous research conducted by Regmi and Jones (2020) indicated that suitable policies and strategies were influential factors in the adoption of e-learning within health science education.

5.7.6. Entitlement to be Paid

This study places significant importance on identifying the issues and challenges that can impact the adoption of personalised AI based e-learning in healthcare organisations. One of the prominent issues raised by participants related to the uncompensated time they invest in e-learning, which significantly contributed to their preference for face-to-face training. It is noteworthy that this particular issue is specific to the business strategy adopted by the selected care home and may not be applicable to other healthcare organisations in the UK. The findings are however consistent with the report from Royal College of Nursing (2018), which noted that alongside recognising the advantages of training, and the possible consequences of not participating, numerous staff members indicated that they complete mandatory training outside of regular working hours. Although certain organisations provide compensatory time off or monetary compensation, many do not. Moreover, it was declared that *"the Working Time Regulation Act 1998 specifically notes that 'working time' includes any period during which a worker is receiving relevant training"* (Royal College of Nursing, 2018, p. 20).

However, it remains essential to highlight that this issue stood out as a primary source of frustration among participants, who perceived it as unfair to dedicate hours to training for their work during personal time without receiving compensation. Therefore, it is imperative to address all significant issues that can obstruct adopting personalised AI based e-learning. This particular concern has diminished the perceived value of adopting e-learning for healthcare

staff, underscoring the need to rectify it to enhance staff engagement and adoption of personalised AI based e-learning.

5.8. Environmental Incentives of Adopting Personalised AI based E-learning

5.8.1. Relevant Courses relating to Resident Needs

This research declared the importance of an effective e-learning training system for healthcare staff, as the need for more complex treatment for the needs of older people is increasing in the UK. Office for National Statistics (2017) claimed that the population of older people, aged 65 and over, will increase more than the population of zero to 15 years in the UK in the following years, shown in Table 10 (Randall, 2017). Considering the number of older patients is increasing (Randall, 2017; Gilbert-Johns et al., 2022), more complicated care will generate a need for more well-trained healthcare staff. The Health and Social Care Information Centre (2016) stated the mission for digital NHS in order to improve the health and care:

> *"...we will empower the health and care system to be intelligent in the way it uses data and information to drive improvements in health and care, by delivering world class data and analytics services through the highest level of skills, expertise, tools, techniques and technology"* (The Health and Social Care Information Centre, 2016, p. 9).

	0 to 15 years (%)	16 to 64 years (%)	Aged 65 and over (%)	UK population
1976	24.5	61.2	14.2	56,216,121
1986	20.5	64.1	15.4	56,683,835
1996	20.7	63.5	15.9	58,164,374
2006	19.2	64.9	15.9	60,827,067
2016	18.9	63.1	18.0	65,648,054
2026	18.8	60.7	20.5	69,843,515
2036	18.0	58.2	23.9	73,360,907
2046	17.7	57.7	24.7	76,342,235

Table 10: Age distribution of the UK population, 1976 to 2046 – Source: Office for National Statistics (Randall, 2017, p. 3).

In academic discourse, it is acknowledged that e-learning provides healthcare professionals with immediate access to essential subjects relevant to their professional responsibilities. This accessibility facilitates prompt engagement with relevant online training modules, especially during the admission of new patients to healthcare facilities. As a result, this capability fosters a sense of confidence among both healthcare staff and the organisation, facilitating expedited familiarisation of staff with a range of health conditions that patients might exhibit, and the provision of relevant online training to support patient care. As part of organisational procedure, organisations had to enrol staff in face-to-face training sessions, which entailed waiting for courses to become available, a time-consuming process (Saint-Marc et al., 2019). This, in turn, imposed substantial pressure on the organisation, with an added pressure on existing qualified staff to provide support to new patients, until all staff members became qualified. E-learning is believed to mitigate time and cost constraints associated with teaching and learning, by offering flexibility and the capacity to reach an extensive number of nurses (Cheng, 2012; Saint-Marc et al., 2019). In addition, healthcare staff can be more available for patients, in order to deliver more timely treatment. Therefore, some participants declared that

e-learning gave them the opportunity to access training courses instantly, whereas they had to wait for the availability of face-to-face courses. Therefore, waiting for healthcare staff to attend face-to-face courses can cause staff shortages, and consequently affect patient care. However, because of the ease of access to e-learning courses, care and medical requirements of residents was responded in a shorter period of time, with more staff being competent and being able to perform required care tasks. Therefore, adopting personalised AI based e-learning can facilitate the work process, improve the patient services, increase the patient satisfaction, achieve a better and more responsive treatment, and thereby increase staff empowerment.

5.8.2. COVID-19 and Government Policy

Due to the spread of COVID-19 and the vulnerability of care home residents, the government imposed a lockdown. Consequently, visits to care homes were either restricted or prohibited. This challenge occurred due to the risk of spreading the virus to the most vulnerable people, and it was the government's decision for the lock down in the UK in 2020. During this time healthcare organisations were in a most critical state, and access to residential and care homes was withheld. Therefore, the enforcement of lockdown during COVID-19 affected training strategies employed within the care home and resulted in staff attending online training meetings with instructors, as most of face-to-face training was, cancelled. Participants described the emotional impact of government lockdown policies on visits to healthcare, organisations and their training and development. Therefore, the global effect of the lockdown on the training and professional development of healthcare workers was further confirmed by the research conducted by Osman Abdelmola and colleagues in 2021. They noted that health authorities enforced restrictions on medical students participating in clinical placements to minimise exposure to diseases *"which affected the students' performance and competency during the clinical assessment"* (Osman Abdelmola et al., 2021, p. 3). Furthermore, according to Przymuszała et al. (2022), the emergence of the COVID-19 pandemic posed an exceptional

risk to public health worldwide, leading governmental bodies to implement social distancing measures, and minimising social interactions among their populations. This also impacted the education sector significantly, prompting numerous educational institutions to halt traditional face-to-face classes and transition to online learning formats. Additionally, there have been innovative initiatives stimulated by the developments of the COVID-19 pandemic, leading to the displacement of traditional learning methods with e-learning approaches (Alhur et al., 2023).

5.9. Adapted Conceptual Framework based on the Incentives

After reviewing the diverse incentives associated with the adoption of personalised AI-based e-learning discussed earlier, this study has formulated a conceptual framework for the incentives. The framework integrates the 'Technological', 'Organizational', and 'Environmental' (TOE) factors, reflecting their influence on the adoption of personalised AI-based e-learning in the healthcare sector in the UK. The conceptual framework, illustrated on the following page (Figure 34), employs the same terminology as the TOE concept to elucidate this adoption process.

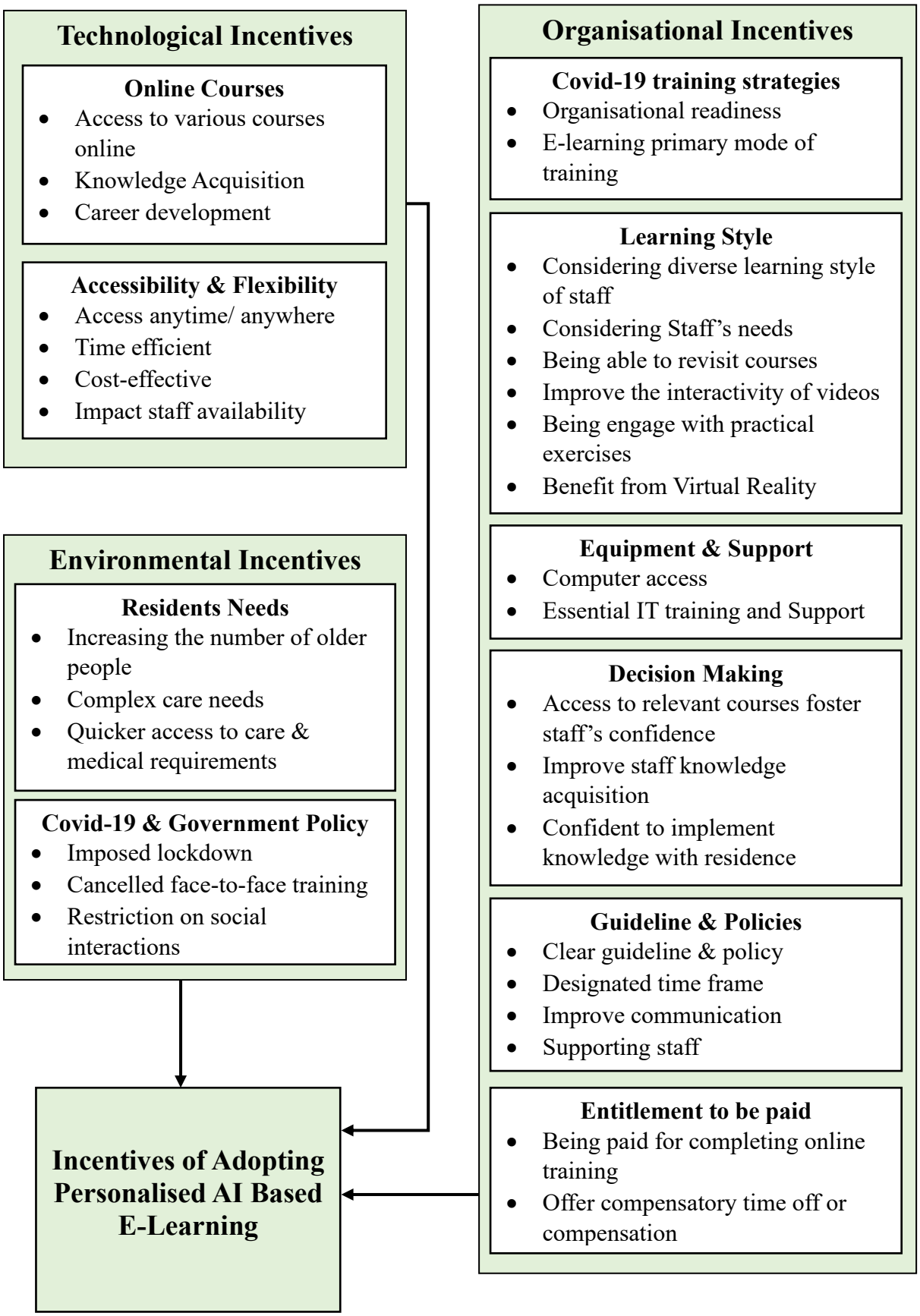

Figure 34:Adapted TOE Conceptual framework representing incentives of adopting personalised AI based adoption.

5.10. Summary of the Chapter

This chapter aimed to comprehensively examine the outcomes of the investigation, delving into the barriers that hinder the adoption of personalised AI-based e-learning in the UK healthcare sector. This chapter discussed both the challenges and potential incentives for successful adoption of personalised AI based e-learning, while also aligning the research findings with relevant theoretical literature. Drawing comparisons with previous studies, the chapter identified key issues related to both barriers and incentives to e-learning adoption. To facilitate better understanding, revised conceptual frameworks were presented separately. However, the following chapter will propose an integrated framework detailing how healthcare organisations in the UK can adopt personalised AI-based e-learning to add value through training and development for healthcare staff, and enhance the efficacy of e-learning and thereby delivery of care.

Chapter 6.0: Proposed Conceptual Framework

6.1. Introduction

It has been mentioned that this study aims to develop and propose a conceptual framework to address identified barriers of adoption of personalised AI-based e-learning within the healthcare sector. To address these barriers, the researcher has already created a partially revised framework in the previous chapter. In this chapter, to answer the research question "How do healthcare staff address issues, challenges and impact of adoption of personalised AI based e-learning to add value within the healthcare sector in the UK?", an integrated framework will be introduced. This integrated framework incorporates both the TOE framework and the Felder-Silverman Learning Style Model (FSLSM). A thorough discussion will be presented in this chapter, along with a roadmap illustrating how healthcare organisations in the UK can adopt personalised AI-based e-learning using various incentives. Furthermore, all stages will be examined, along with justifications of how both the TOE framework and FSLSM were integrated.

6.2. Proposed Integrated Framework for Personalised AI based e-learning Adoption

The discussion within this research has revealed that due to numerous environmental, organisational, and technological barriers, the healthcare sector in the UK is currently falling behind in its adoption of personalised AI-based e-learning. The lessons learned from the COVID-19 experience, and the ongoing advancements in technology underscore the need for businesses, including those in the healthcare sector, to adapt their strategies to incorporate high-level technologies for delivering superior health and care services to patients. Many researchers emphasised the significance of technology adoption for businesses. For instance, Božić and Poola (2023) stated that *"by implementing strategies, organizations can motivate employees to use AI in their work, leading to increased adoption and utilization of AI technologies, and*

ultimately driving better outcomes and performance" (p. 10). Hence, to address the barriers hindering the adoption of personalised AI-based e-learning, the healthcare sector in the UK requires both strategies and a roadmap. The findings suggest that overcoming the majority of, these barriers, could enable healthcare organisations to embrace personalised AI-based e-learning, thereby supporting the Training and Development (T&D) of healthcare staff, and meeting patient needs more effectively.

Moreover, the findings indicate that numerous incentives can facilitate the creation and implementation of personalised AI-based e-learning adoption within healthcare organisations in the UK, further highlighting that this technology adoption is still in its early stages. To mitigate the potential risks associated with the implementation of personalised AI-based e-learning in healthcare organisations, this study has proposed a systematic approach. Consequently, this research utilised the TOE framework, supplemented by incentives to assist healthcare organisations in implementing an AI-based e-learning system. Subsequently, the study suggests integrating the TOE framework with FSLSM to enable the adoption of personalised AI-based e-learning.

Therefore, this study has integrated the TOE framework and FSLSM to offer a comprehensive understanding of how healthcare organisations can systematically adopt personalised AI-based e-learning to enhance value within the UK healthcare sector. Figure 35, illustrated on the following pages, presents the developed framework of adopting personalised AI based e-learning in healthcare organisations in the UK, providing a roadmap with a detailed strategy for implementation. This framework proposes potential strategies to facilitate the successful integration of personalised AI-based e-learning by healthcare organisations, recognising its pivotal role in staff training and development (T&D), and the advancement of health and care services. Consequently, a step-by-step process will be discussed to aid healthcare organisations in implementing this framework and understanding the entire adoption process. Initially, step

1 will delve into the discussion of all feasible incentives gleaned from the findings of the TOE framework (Figure 34) and explain their respective purposes. Subsequently, step 2 will recommend AI-based e-learning solutions grounded in these incentives. In step 3, the process of personalising AI-based e-learning within the UK healthcare sector by integrating both TOE and FSLSM will be explained and justified. Finally, step 4 will discuss the adoption of personalised AI based e-learning within UK healthcare organisations, highlighting the imperative need for support from the UK government and the Care Quality Commission (CQC) to ensure the effective and successful implementation of personalised AI-based e-learning. All steps of the integrated framework for the adoption of personalised AI-based e-learning in the UK are illustrated in Figure 35.

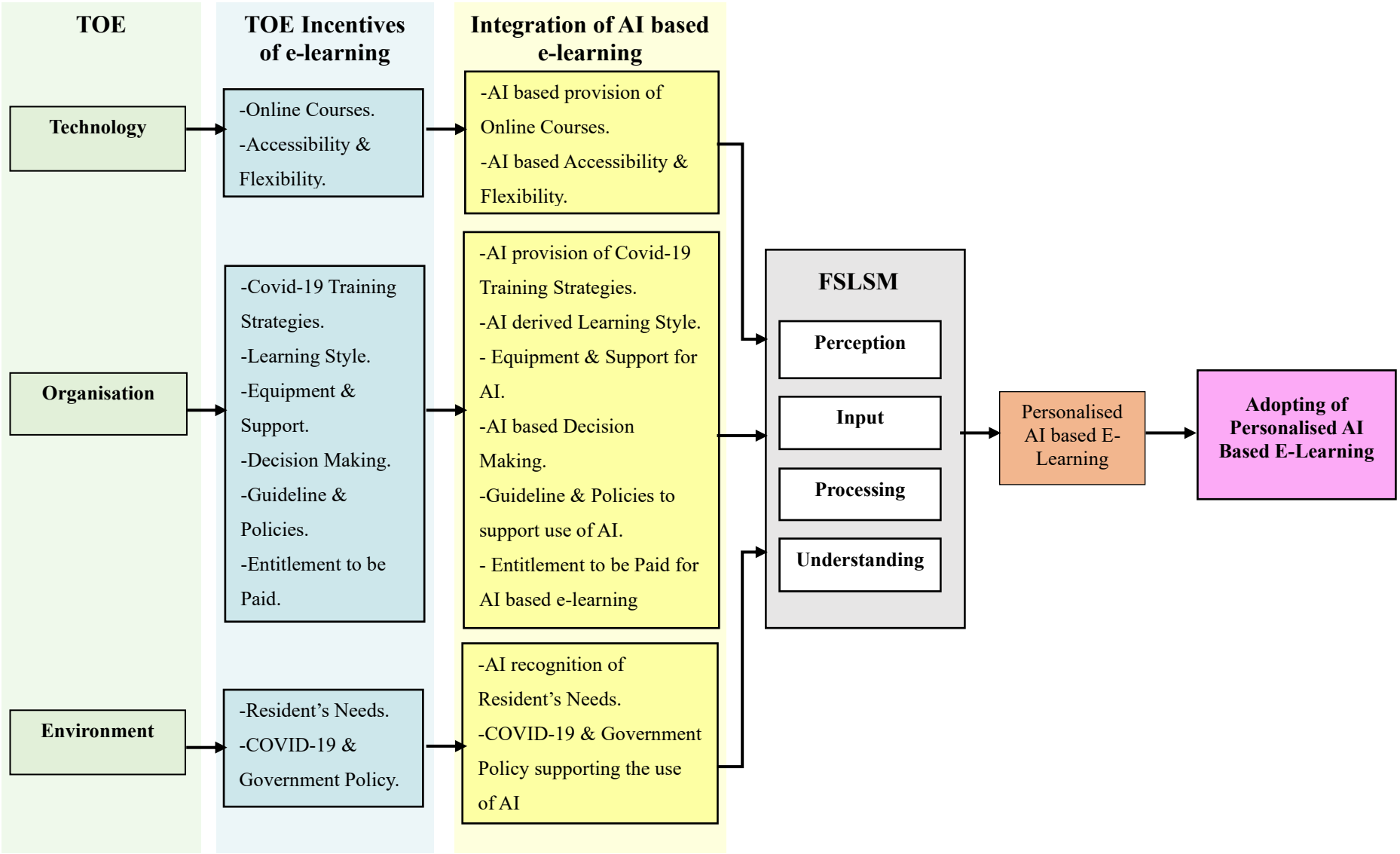

Figure 35: Proposed Integrated Framework of TOE and FSLSM to Support Healthcare Organisations in the UK for Adopting Personalised AI based E-Learning.

6.2.1. Step 1

The framework commences with a comprehensive exploration of all potential incentives associated with the adoption of personalised AI based e-learning, as identified through the utilisation of the TOE model. These incentives, categorised under technology, organisation, and environment, are visually represented in Figure 35, with arrows extending from each category to the corresponding incentives. The framework outlining these incentives was previously introduced in Figure 34 in Chapter 5. The purpose of using these incentives is to initially encourage healthcare organisations in the UK to become familiar with the adoption of personalised AI based e-learning. In addition, these initiatives are to give healthcare organisations understanding of how personalised AI based e-learning can drive innovation, enhance staff training and development (T&D), and improve health and care outcomes for patients. This initial step offers valuable insights into the consideration of AI-based e-learning over generic e-learning solutions for healthcare staff, thereby paving the way for the next step within this framework.

6.2.2. Step 2

In this step, the research proposes that an e-learning system can benefit from the incentives mentioned above, to adopt AI based e-learning. This phase aims to elucidate for healthcare organisations, how AI based e-learning can be implemented, and the factors that need to be taken into account for future adoption. For instance, under the first incentive factor of technology, namely ‘online courses’, it is discussed that access to diverse online courses can enhance knowledge acquisition and impact the career development of healthcare staff. Therefore, by embracing ‘AI-based online courses’, AI technology could generate varied learning materials each time healthcare staff revisit the courses, eliminating the constraint of reliance on a single source.

Additionally, AI-based e-learning has the potential to play a pivotal role in the training and development process of healthcare staff.

6.2.3. Step 3

This step of the framework integrated TOE framework with FSLSM in order to adopt an AI based e-learning system that is aligned with healthcare staffs' learning styles and preferences. By integrating these frameworks, healthcare organizations can understand how AI based e-learning adoption, and learning preferences interact within the organizational context. This understanding can help design effective e-learning programs that cater to employees' needs, and promote successful adoption of personalised AI based e-learning.

6.2.3.1. Justification of Integrating Technological Incentives with FSLSM

The 'online courses' and 'accessibility and flexibility' are two identified incentives factors of technology influencing the adoption of personalised AI based e-learning. Therefore, it is believed that these technological incentives can be integrated to the 'Input' element in FSLSM. In other words, 'Input' in FSLSM refers to how staff prefer to receive information and engage in learning activities. So, the link here is understanding how employees' preferences for how they receive information and engage in learning activities, influence the adoption of personalised AI based e-learning. Moreover, technology that supports learning on various electronic devices, offers content in multiple languages, or provides alternative formats for learners with disabilities, can ensure equitable access to learning resources for all learners.

6.2.3.2. Justification of Integrating Organisational Incentives with FSLSM

Furthermore, 'COVID-19 Training Strategies', 'Learning Style', 'Equipment & Support', 'Decision Making', 'Guidelines & Policies', 'Entitlement to be Paid' are the Organisational

Incentives identified to influence the adoption of personalised AI based e-learning in healthcare organisations.

It appears that COVID-19 and organisational training strategies may align more closely with the 'Perception' element of FSLSM. The 'Perception' element in the FSLSM refers to how learners perceive and interpret information. COVID-19 has affected how learners perceive and engage with training content due to the shift to remote and online training formats. For example, learners may perceive online courses differently from in-person training sessions, impacting their engagement, motivation, and learning outcomes. Organisational training strategies can incorporate multimedia elements, interactive features, and adaptive learning technologies to cater to diverse sensory preferences identified in the FSLSM's 'Perception' element. Therefore, while both 'Input' and 'Perception' elements of the FSLSM are relevant to understanding the impact of COVID-19 and organisational training strategies, the emphasis on how learners perceive and interpret information suggests that 'Perception' may be a more fitting element to consider in this context.

'Learning style' also considered as an incentive in this study, as well as the model used to identify how this element can influence the adoption of personalised AI based e-learning in healthcare organisation. It is believed that a learner's learning style aligns with multiple elements of FSLSM, namely 'Processing' and 'Perception'; discussed as follow:

'Processing' dimension - This dimension describes how learners prefer to process information. Active learners prefer hands-on activities, experimentation, and immediate engagement with the material. Reflective learners, on the other hand, prefer to observe, analyse, and reflect on the material before taking action. Learners with an active learning style may engage more readily with interactive online courses, virtual labs, or collaborative projects. They may prefer training activities that involve problem-solving, discussions, and practical application of concepts.

Reflective learners may benefit from online courses that offer opportunities for self-reflection, critical thinking exercises, and asynchronous learning modules. They may appreciate time to process information independently, and engage in deeper analysis before applying concepts.

'Perception' dimension **-** This dimension describes how learners prefer to perceive information. Sensing learners focus on concrete facts, details, and practical applications. They prefer learning materials that are straightforward and directly applicable to real-world situations. Intuitive learners, on the other hand, focus on underlying principles, patterns, and theoretical concepts. They prefer learning materials that explore broader concepts and emphasise connections between ideas. Sensing learners may prefer online courses that provide clear, step-by-step instructions, practical examples, and hands-on activities. They may value training content that addresses immediate needs and focuses on practical skills development. Intuitive learners may engage more with online courses that offer conceptual discussions, theoretical frameworks, and opportunities for creative problem-solving. They may appreciate training activities that encourage exploration of complex concepts and connections between different topics.

Considering the provision of 'equipment and organisational' support aligns most closely with the 'Processing' dimension of FSLSM. Providing equipment and organisational support can create an environment that accommodates both active and reflective learners. Active learners may benefit from hands-on experiences with personalised AI-based e-learning tools, interactive simulations, and practical applications facilitated by equipment and support. Reflective learners, meanwhile, may appreciate access to self-paced learning materials, opportunities for independent study, and reflective exercises that encourage deeper understanding and analysis with organisational support.

In regard to 'decision making', the 'Perception' dimension of FSLSM is indeed a fitting element to consider. Therefore, understanding staff perception can help with adopting personalised AI-

based e-learning solutions to meet their diverse decision-making preferences, ultimately enhancing their confidence and effectiveness in patient care.

In addition, it is believed that organisational ‘guidelines and policies’ can be integrated with the ‘Understanding’ element of the FSLSM. The ‘Understanding’ dimension of the FSLSM refers to how individuals prefer to process information. Sequential learners prefer linear, step-by-step approaches, where information is presented in a logical order and builds upon previous concepts. Global learners, on the other hand, prefer holistic, big-picture views, where they can see the overall context before delving into details. Organisational guidelines and policies often involve a structured approach to presenting information, outlining procedures, and specifying steps to follow. This aligns with the preferences of sequential learners, who prefer clear, well-defined processes and guidelines. However, organisational guidelines and policies may also need to be understood within the broader context of the organisation's goals, culture, and external environment. This aspect aligns with the preferences of global learners, who prefer to understand the overall context and implications before focusing on specific details. Therefore, understanding employees' preferences in this dimension can help organisations develop and communicate guidelines and policies in a way that resonates with diverse learning styles, ultimately affecting personalised AI based e-learning adoption in healthcare organisations.

The ‘entitlement to be paid’ for completing e-learning by staff, can be linked with the ‘Perception’ element of FSLSM. Individuals' perceptions about the value of their time and efforts in learning, play a significant role. This perception can be influenced by various factors, including the organisation's compensation policies, the perceived relevance of the e-learning content to their job roles, and their expectations regarding compensation for additional learning activities.

6.2.3.3. Justification of Integrating Environmental Incentives with FSLSM

Furthermore, ‘Resident’s Needs’ and ‘COVID-19 & Government Policy’ are the Environmental Incentives identified that can influence the adoption of personalized AI based e-learning in healthcare organisations.

It is concluded that ‘resident’s needs’ can be linked to ‘Understanding’ element of FSLSM. In addition, healthcare organisations can enhance staff members' understanding of patient needs, and develop and adopt a targeted, relevant, and effective personalised AI based e-learning that empowers staff to deliver high-quality, patient-centred care.

With regards to ‘COVID-19 and government policy’, there is a strong link with the ‘Understanding’ element of FSLSM which can impact the adoption of personalised AI based e-learning. Understanding the nuances of public health measures, epidemiological data, and regulatory guidelines is crucial for individuals, and organisations, to navigate the pandemic effectively. Staff who prioritise understanding are more likely to engage with these resources actively, enabling them to adapt quickly to evolving policy requirements, and contribute to organisational resilience.

Ultimately, this phase offered a roadmap for implementing personalised AI-based e-learning by integrating the TOE framework and FSLSM, thus facilitating the adoption of AI-based e-learning personalised to staff preferences and learning styles.

6.2.4. Step 4

This marks the concluding phase of the proposed framework. Following the integration of the AI-based e-learning system with the FSLSM, and the establishment of a roadmap towards personalised AI-based e-learning, healthcare organisations in the UK will have the opportunity to

explore various avenues for engagement. This exploration aims to facilitate the identification of strategies for adopting personalised AI-based e-learning and transitioning from traditional e-learning systems. It is anticipated that this integrated framework will furnish healthcare organisations, the Care Quality Commission (CQC), and governmental entities with sufficient information to embrace personalised AI-based e-learning for healthcare staff. Furthermore, gaining deeper insights into the benefits of utilising personalised AI-based e-learning in their operations will strengthen confidence in the adoption process. With a comprehensive understanding of the advantages and challenges associated with adoption, and by leveraging these advantages, healthcare organisations are now ready to embrace and adopt personalised AI-based e-learning, transitioning from traditional training and development processes to a more personalised and user-friendly approach. It is imperative to underscore that healthcare organisations will require assistance and support from governmental bodies, the CQC, and healthcare staff to effectively adopt and implement personalised AI-based e-learning.

6.3. Summary of the Chapter

In summary, this chapter underscores the critical role of healthcare organisations in the UK in delivering high-quality health and care services. This chapter introduced a proposed framework intended to serve as a roadmap for the successful implementation of personalised AI-based e-learning within the healthcare sector. Furthermore, the chapter provided justification for the proposed framework, suggesting that if healthcare organisations leverage all the incentives outlined in the TOE model, they may be able to effectively adopt personalised AI-based e-learning for their staff. The potential outcomes of such adoption include not only positive impacts on staff training and development, and enhanced care quality for patients, but also the possibility of cost-effective solutions for the business. Additionally, the chapter highlighted the significant role that

government and CQC support can play in supporting healthcare staff and facilitating the adoption of personalised AI-based e-learning. Ultimately, the proposed framework for adopting personalised AI based e-learning in UK healthcare organisations represents a novel and innovative approach, breaking new ground in its field, and offering significant promise. In the next chapter, therefore, the research aim, objectives, research question accomplishment, summary of research findings, research contribution, future research recommendations, research confines, and future research deliberation will be presented.

Chapter 7.0: Validity & Reliability of Research Findings

7.1. Introduction

This chapter focuses on justifying the exploration of the framework developed for healthcare staff in a selected care home in the UK. Based on the research findings and recommendations, the framework has been designed to facilitate the adoption and effective use of personalised AI-based e-learning within healthcare organisations. Before widespread implementation, it is crucial to assess the framework's acceptability to ensure its fairness and consistency. The purpose of this justification is to evaluate whether the research findings and recommendations that contributed to the framework's development are valid and aligned. Additionally, justification provides a strong contextual foundation for interpreting the study's outcomes comprehensively.

In the following section, the concept of justification, and the methods employed in carrying out this validation process will be discussed.

7.2. The justification Concept

According to Kennedy et al. (2005), justification is a crucial aspect of the framework development process, as it enhances confidence in the framework and increases its overall value. Justification helps determine whether the research has effectively measured what it intended to measure and assesses the reliability of its findings (Golafshani, 2003). In qualitative research, the concept of justification encompasses various dimensions, including conceptual, methodological, and empirical aspects (McGrath and Brinberg, 1985). Conceptually, justification can be assessed by examining internal consistency, adaptability, effectiveness, and testability. Methodologically, it involves ensuring impartiality, competence, and rigor. Empirically, justification highlights the practical applicability of research outcomes. Although some qualitative researchers, such as Winter

(2000), argue that justification may not be entirely applicable in qualitative research, they still acknowledge the necessity of incorporating some form of validation or assessment to ensure the credibility of their findings (Golafshani, 2003).

Conversely, Bryman (2008) strongly asserted that the most effective way to assess the quality of qualitative research is through the findings of its justification. Furthermore, McGrath and Brinberg (1992) and Walliman (2001) emphasised three key dimensions—value, robustness, and correspondence—that can be incorporated into research justification. Value pertains to the routine application of the research, robustness focuses on assessing the reliability of empirical findings, and correspondence examines the interrelations among various elements to ensure they align cohesively. Winter (2000) also recognised that justification is not a fixed, universal concept but rather a flexible construct shaped by the specific methodologies and objectives of a given research project. From this discussion, it is evident that research justification plays a crucial role in the framework development process, as it helps explore, explain, and enhance the value of research findings. Therefore, in the following section, the justification of the framework will be discussed in detail.

7.3. Justification of the Framework

According to Frees (1996), justifying a framework involves verifying whether it accurately reflects its intended meaning in alignment with the research objectives. Similarly, Egbu (2007) stated that framework justification serves as a method for evaluating the overall capability of the proposed framework to achieve its intended purpose. Hair et al. (1998) further described justification as a process that ensures the proposed framework represents the characteristics of the broader population rather than being limited to the specific sample used in the study. Additionally, Ankrah (2007) defined framework justification as assessing the extent to which the framework can predict

outcomes in terms of above- or below-average performance. The reliability of research findings largely depends on the justification process used to validate or challenge them. In this study, the proposed framework was developed based on thematic analysis of qualitative data. Having established a framework illustrating how personalised AI-based e-learning can be integrated to enhance the healthcare sector, it was essential to assess the validity of the research findings for broader application within healthcare organisations.

To justify the research findings, postal surveys, primarily via email, were utilised. Due to constraints related to cost, time, and the pandemic, interviews or focus groups were not chosen. However, recognising the limitations of traditional questionnaires and the lack of opportunities for participants to clarify their concerns, the questionnaires were redesigned alongside the proposed framework to address any misunderstandings identified earlier. It was essential to validate the research findings with healthcare professionals to ensure that the results accurately reflected their experiences. Therefore, a cover letter was emailed to all participants, requesting their support in verifying the research outcomes. Along with this, the redesigned questionnaires were attached to the framework to clearly outline what was expected from participants during the justification process. Follow-up reminders were also sent via mobile to encourage participation. All original participants were included in this phase, as their previous involvement in interviews made them familiar with the study, ensuring more informed and meaningful responses. This process allowed participants to revisit the study topics and confirm the validity of the findings. However, Silverman (2006) argues that while participant validation can enhance confidence in research findings, it does not guarantee absolute validity.

The justification of the framework has been conducted to ensure that this study effectively identifies all the barriers to the adoption of personalised AI-based e-learning in healthcare organisations. It has also assessed how well the framework aims to address the issues faced by healthcare staff. Specifically, it examines whether the framework provides clear recommendations for overcoming the barriers hindering the adoption of personalised AI-based e-learning in healthcare settings. In the following section, the justification methods used in this study will be outlined, which will help demonstrate the value of the research findings.

7.4. Methods Implemented for Justification

The methods for justifying research findings can be categorised into two main types: internal justification and external justification. These approaches have been widely used by qualitative researchers, including Ikpe (2009) and Egbu (2007). Both methods have been applied to justify the outcomes of this study. Many scholars, such as Fellows et al. (2002), agree that both methods are equally crucial for validating a research process. In the following section, I will explain how internal and external justification have been implemented in this study.

7.4.1. Internal Justification

As Egbu (2007) explains that internal justification focuses on demonstrating the strength of the framework and assessing the thoroughness of the literature review. It focuses primarily on the reliability of the interpretations drawn from interview data. To achieve internal justification in this study, several measures were taken, with a key measure being the feedback of interview transcripts and findings to participants. This served two purposes: first, it allowed participants to verify the accuracy of the transcripts, thereby enhancing the validity of the study (Maxwell, 1992). Second, it provided participants with an opportunity to offer feedback on the researcher's interpretation of personalised AI based e-learning adoption and practice, which further strengthened the

interpretative validity of the research (Maxwell, 1992). Internal justification in this study was employed primarily to confirm the conceptual and methodological strength of the framework.

7.4.2 External Justification

Eisenhardt and Howe (1992) and Fellows and Liu (1997) emphasise that external justification focuses on the generalisability of research findings and the extent to which confidence can be placed in the outcomes and their significance. Healy and Perry (2000) explain that the purpose of external justification in qualitative research is to systematically extend findings, allowing researchers to relate specific results to broader concepts. However, Eisenhardt and Howe (1992) challenge this perspective, arguing that external justification is not essential in qualitative studies. To establish external justification in this study, the findings were compared with similar results from previous research. Additionally, feedback was gathered from participants regarding the study's findings and recommendations. Although the sample size for this justification process was relatively small, the responses received were highly encouraging, indicating that the research outcomes have the potential to be widely accepted. Furthermore, the results of this study suggest that the adoption of personalised AI-based e-learning could be beneficial in enhancing healthcare staff training and development, ultimately improving patient care.

Although the concepts of internal and external justification have been outlined above to highlight the aspects of my research findings that have been validated, the specific details of how the entire justification process was carried out remain unclear. Therefore, in the following section, I will provide a comprehensive explanation of the steps undertaken in this process.

Step 1: I initially reached out to all participants included in my final research sample via email and telephone.

Step 2: I discussed the research findings with them, providing brief insights that sparked their interest, and they expressed enthusiasm about reviewing the full outcomes.

Step 3: I then kindly requested that they review my findings along with the fully developed theoretical framework and provide their feedback, including their thoughts and insights.

Step 4: To facilitate this, I compiled all findings, the framework, and a detailed explanation of the framework development process into a password-protected electronic file, which I emailed to all participants.

Step 5: After sending the email, I followed up with each participant via phone to confirm receipt of the email and its attachment. All participants acknowledged receiving it.

Step 6: Approximately two weeks later, I contacted them again. Three participants confirmed that they had reviewed the findings and framework, stating that the steps were clearly outlined and easy to understand. They also assured me that they would send their feedback via email.

Step 7: Within a few days, I received emails from eight participants containing their feedback and evaluations. However, due to time constraints and a busy work period, a few respondents were unable to provide written feedback but shared their evaluations over the phone.

7.4.3. Overview of Participants' Feedback

The feedback received from participants confirmed that the proposed framework would not only aid healthcare staff in their training and development but also support owner and managers of healthcare organisations and the government in adopting personalised AI-based e-learning. Additionally, participants acknowledged that the framework could serve as a valuable tool for government initiatives, particularly with the support of healthcare organisations. Moreover, several participants recognised the framework as a comprehensive and practical roadmap for the

healthcare sector. My objective was not merely to obtain respondents' approval or disapproval of the findings and framework, but rather to gain deeper insight into their individual evaluations. Instead of simple "yes," "no," or "perhaps" responses, I sought to understand why and how they perceived the findings as relevant and the proposed framework as practical. Participants further assessed that the developed framework is not only realistic but also implementable, as each step is clearly outlined with detailed breakdowns and multiple options. This structure ensures that healthcare owners/ managers, and government bodies can effectively adopt personalised AI-based e-learning to support healthcare staff training and development and enhance patient care.

7.5. Summary of the Chapter

The preceding chapter outlined the justification of the research findings and the proposed framework by detailing the justification process, which incorporated both internal and external justification methods. Through these validation approaches, it was determined that the findings are reliable and that the proposed framework would be highly beneficial for healthcare staff, healthcare organisation owners/managers, and the UK government. Additionally, the majority of participants who provided feedback expressed agreement with the outcomes to a significant extent. Consequently, the findings have the potential to be gradually applied across the entire healthcare sector in the UK.

Chapter 8.0: Conclusion

8.1. Introduction

This chapter aims to provide a final overview of the research, contemplate the overall process of comprehending, and describe the activities conducted throughout this study. In particular, this chapter will underscore the accomplishment of the research aims and objectives, along with elucidating how the research question was addressed. This chapter will also offer a comprehensive explanation of the entire study, which identified diverse issues that could facilitate enhancing the adoption and efficient utilisation of personalised AI-based e-learning in healthcare in the UK. To comprehensively address the entirety of the process, this chapter initiates with discussions centred on achieving of the research aim, objectives, and question (section 8.2). Following on from that, there will be reflection regarding the overall findings and outcomes of this research (section 8.3). Section 8.4 will clarify the original contribution of this research in four principal domains: theoretical, practical, knowledge and methodological. This will result in the examination of future research recommendations in section 8.5, followed by the exploration of various implications emerging from this research in section 8.6. Next, section 8.7 will outline future research deliberations. Lastly, a summary of the chapter will be provided.

8.2. Research Aim, Objectives, and Question - Accomplishment

The aim of this research was to investigate the strategies for leveraging Artificial Intelligence based e-learning to enhance training and development for healthcare staff in the UK. To effectively address this research aim, and to provide comprehensive responses to the research question; various strategies were identified in this study. These strategies were identified with the aim of personalising and supporting healthcare organisations in the UK, thereby enabling them to overcome existing issues and challenges related to e-learning among their staff members.

Additionally, a series of recommendations were proposed as a result of these findings. These recommendations served as the basis for the development of a conceptual framework aimed at aiding healthcare organisations in the successful adoption and implementation of personalised AI-based e-learning initiatives. The conceptual framework introduced, integrates a learning style model and a technology adoption model, with the intention of enhancing training and developmental opportunities for healthcare staff members in the UK.

8.3. Research Findings and Outcomes – Summary

This research has played a significant role in investigating the challenges associated with the adoption of personalised AI-based e-learning by healthcare organisations in the UK. The first objective of this research was to understand the context of personalised AI based e-learning strategies used for healthcare staff. Through a review of relevant literature in AI, e-learning, and personalised AI-based e-learning, it has become evident that there is a notable absence of a comprehensive plan for achievement, which could act as a guide to facilitate the adoption and efficient utilisation of personalised AI-based e-learning among healthcare staff in the UK.

To address the second objective of the research, and to respond to the research question, this study delved into the issues and challenges of adopting personalised AI based e-learning encountered by healthcare staff in the UK. The investigation revealed that some of these challenges, categorised as 'Technological', 'Organizational', and 'Environmental', echoed issues already documented in existing literature, while others were specific to the chosen care home. Through a comprehensive review of current literature, a thorough understanding of the adoption of personalised AI-based e-learning by healthcare organisations was attained. However, it was noted that much of the existing literature primarily focused on academic settings and student education in various countries, with limited research specifically addressing the adoption of personalised AI-based e-learning within

UK healthcare organisations. These identified issues and barriers are collectively presented and explained in Chapter 5 (Figure 33).

To fulfil the third objective, and respond to the research question, this study examined the implications of adopting personalised AI-based e-learning for healthcare staff. Both positive and negative impacts of adoption were identified and integrated into the adapted frameworks outlined in Chapter 5. Certain impacts were highlighted, contributing to the construction of a conceptual framework designed to influence the effective adoption of personalised AI-based e-learning for healthcare staff.

The final objective of this study was to develop and propose a conceptual framework that comprehensively addresses the factors essential for the adoption of personalised AI-based e-learning within healthcare organisation in the UK. This proposed framework was derived by integrating a learning style model, specifically the Felder-Silverman Learning Style Model, with a technology adoption model, namely the Technology, Organization, Environment Model. As the aim was not to validate a hypothesis or constrain the data within a predefined framework, this research allowed the emerging themes and evidence from respondents regarding the adoption of personalised AI-based e-learning, to unfold without being confined by specific theoretical perspectives. Each section provided a brief discussion and presentation of the key findings from each phase, evaluating whether the research aim outlined in Chapter 1 was met. Furthermore, academic contributions and recommendations for future research were deliberated upon. Lastly, potential avenues for further research and associated confines were addressed.

8.4. Research Contribution

This section categorises the contributions of this research into three distinct groups, namely: theoretical contribution, practical contribution, and contribution to the overall body of knowledge as follows:

8.4.1. Theoretical Contribution

This study contributes to the existing literature on the adoption of personalised AI-based e-learning within the healthcare sector in the UK by conducting a review of relevant literature in this area. By examining the broader adoption of innovative technologies in healthcare, it aims to enhance understanding and insights into the process of modernisation amongst rapid technological advancements. Furthermore, this research endeavours to construct and examine an integrated conceptual framework rooted in both the TOE framework and the Felder-Silverman Learning Style Model (FSLSM).

The framework draws upon current literature on e-learning, and AI innovation and diffusion, claiming that the decision to adopt personalised AI-based e-learning is influenced by a range of factors. This framework has contributed a fresh perspective to existing literature and has provided novel avenues for future investigation. To the best of the researcher’s knowledge, this study is an initial research endeavour, examining the adoption of personalised AI-based e-learning within the healthcare sector in the UK. Given the nature of personalised AI-based e-learning, there is an opportunity to generalise findings beyond the specific geographical context considered, extending to healthcare organisations in other regions of the UK, and even to those in different countries.

This framework comprehensively incorporates key elements cited in the literature concerning a business's adoption of personalised AI-based e-learning innovations. Notably, this research did not aim to selectively prioritise specific empirically validated issues influencing innovation adoption.

Hence, this study adopted a qualitative research design to ensure the credibility and relevance of the framework. It's essential to underscore that this framework stems from the findings of the qualitative study. By integrating the TOE framework developed by Tornatzky and Fleischer (1990), with the Felder-Silverman Learning Style model (FSLSM) developed by Felder and Silverman (1988), it was determined that the healthcare sector in the UK required forethought in the adoption of personalised AI based e-learning systems to accommodate their staffs' learning styles and needs. This framework can be considered essential to successfully adopt personalised AI-based e-learning systems, thereby enhancing training and development opportunities for healthcare staff.

8.4.2. Practical Contribution

This study has enriched the policies and practices concerning personalised AI-based e-learning adoption in UK healthcare organisations by providing substantial insights into healthcare staff experiences and perceptions. These insights, gathered from individual contributors to the research, have highlighted areas requiring attention from government agencies, private and public healthcare sectors, CQC, and IT companies offering training packages. As a result of this research, healthcare staff can expect a driver towards enhanced support and benefits from both healthcare organisations and governmental bodies, thereby improving their e-learning experiences.

This study has proposed recommendations for healthcare organisations and government agencies to support healthcare staff, a crucial step for the adoption of personalised AI-based e-learning, which can ultimately enhance patient care and treatment. Moreover, considering the challenges identified in the adoption and utilisation of personalised AI-based e-learning, and the current government initiatives to support and facilitate such endeavours, implementing the integrated framework proposed in this study has the potential to enhance the quality of e-learning. This can

assist in improving patient care and satisfaction by developing staff through personalised learning programmes, to deliver more up-to-date and evidence-based care and treatment.

8.4.3. Contribution to the General Body of Knowledge

This study has made a valuable contribution to the field of e-learning and Artificial Intelligence (AI) by addressing the shortcomings of prior research on AI based e-learning adoption in the UK, with a specific focus on healthcare staff within care home settings. By uncovering the inadequacies of previous studies, and shedding light on the challenges associated with the adoption of personalised AI-based e-learning in a care home, this research has filled a significant gap in current literature. Prior to this study, there was a lack of qualitative research and interviews conducted with care home staff in the UK, as well as a failure to recognise the specific issues and obstacles related to the adoption of personalised AI-based e-learning. Therefore, this research not only contributes to the existing body of literature, but also offers valuable insights into the adoption of personalised AI based e-learning for healthcare staff in the UK.

This study noted a lack of prior research proposing effective strategies to address challenges encountered by healthcare organisations regarding the adoption and utilisation of personalised AI-based e-learning. Therefore, this study stands out as a pioneering effort in the field of personalised e-learning and AI, as it presents a comprehensive strategy, outlined in the form of a framework, aimed at assisting healthcare organisations in resolving staff-related issues.

The findings indicated that challenges influencing the adoption and utilisation of e-learning vary significantly across different countries, though some issues are common. Previous research has highlighted that insufficient human interaction with instructors and peers, as well as a lack of IT skills, and access to suitable electronic devices, are among the primary barriers to effective e-learning adoption in healthcare organisations. However, it has become evident that the absence of

personalised and relevant e-learning content, tailored to the specific needs of healthcare professionals, along with the uncompensated time they invest in e-learning, are additional factors that can affect the adoption of personalised AI-based e-learning in the healthcare sector. The results of this study suggest that providing e-learning content tailored to learners' individual learning styles, and addressing their specific needs can have a positive impact on the adoption of personalised AI-based e-learning in healthcare organisations in the UK.

8.5. Future Research Recommendations

Recognising the incentives of adopting personalised AI-based e-learning in the UK healthcare sector, it is evident that healthcare organisations must deepen their understanding of the key issues related to the adoption and implementation of this approach to training and learning. This study has undertaken efforts to investigate these issues. Furthermore, the findings of this research offer several essential implications that could assist healthcare organisations, governmental bodies, policymakers, and e-learning providers in facilitating the adoption of personalised AI-based e-learning, as previously discussed. Additional significant implications of this study are highlighted below:

8.5.1 Recommendations for Practice

In terms of practical recommendations, the framework developed in this study offers a comprehensive guide and roadmap for the adoption process of personalised AI-based e-learning. This resource would be particularly advantageous for healthcare organisations seeking to expand their capabilities, and influence others within the industry, thereby transitioning from traditional training methods to more advanced personalised online systems. Therefore, the integrated framework could serve as a recommended roadmap for healthcare organisations in various locations, both within the UK and internationally. It would aid these organisations in

comprehending the benefits of personalised AI-based e-learning and how to effectively adopt and implement it. Furthermore, this framework outlines all necessary steps for healthcare organisations to follow in adopting personalised AI-based e-learning and addresses potential challenges throughout the process.

8.5.2. Recommendations for Leaders

The findings of this study offer valuable insights for owners and managers of healthcare organisations who are striving to implement personalised e-learning solutions. These individuals are responsible for determining cost-effective training approaches that are most pertinent to patients' needs. Indeed, this study aimed to assist healthcare organisations in prioritising the needs of healthcare staff when making decisions about adopting personalised e-learning that aligns with their staff learning styles and needs. This research can undoubtedly aid leaders and managers in transitioning from traditional training systems to more sophisticated and personalised platforms successfully. Moreover, the results highlighted the significant role played by healthcare staff in driving the adoption of personalised AI-based e-learning. The findings also underscored the importance of staff involvement and support in increasing the adoption and utilisation of e-learning. Furthermore, strong support and encouragement from senior management is essential to enhance the implementation of e-learning. Owners and managers must offer ongoing support to motivate employees to embrace and engage with e-learning more actively.

8.5.3. Suggestions for Management and Strategy Makers

The research findings indicate that regulatory bodies and policymakers employ significant influence that could aid healthcare organisations in adopting and implementing personalised AI-based e-learning initiatives. Moreover, it has been revealed that to encourage healthcare staff to utilise e-learning, regulatory bodies such as the CQC must establish appropriate policies,

regulations, guidelines, and support mechanisms. These measures will assist organisations in enhancing their effectiveness in delivering optimal care and treatment for patients. Therefore, it is imperative for the government and regulatory bodies like the CQC to reassess their current policies regarding online training, and provide support to healthcare organisations, particularly in light of unexpected events such as the COVID-19 pandemic. This will ensure the development of policies and guidelines that facilitate staff training and development with access to the latest, most relevant, and readily available information.

8.5.4. Significance for Private E-learning Package Providers

This research has also derived significant practical recommendations for private e-learning package providers serving healthcare organisations. The findings underscore the importance of their role in shaping educational practices, particularly by delving deeper into how individuals effectively engage with, and internalise information. Additionally, the research outcomes indicate that e-learning providers should enhance their engagement with healthcare staff to address the complexities of learner diversity. This entails incorporating learners' learning styles, feedback, and experiences, thereby paving the way for a more personalised and effective learning journey for healthcare staff.

Considering all the aforementioned factors, it can be argued that the contributions of this study hold significant relevance for healthcare organisations, managers, governmental bodies, and policymakers. Therefore, this study is deemed pertinent in the current era of rapid e-learning development. The findings obtained will contribute to addressing gaps in the existing academic literature. Moreover, the framework developed in this study has the potential to aid healthcare organisations in the UK in transitioning from traditional training methods to more personalised and user-friendly processes, not only domestically but also in other countries.

8.6. Confines of the Research

Akin to other research endeavours, this study is not without its limitations, which must be acknowledged and discussed. These limitations primarily stem from the systematic literature review, theoretical frameworks, methodological issues, and the interpretation and discussion of the findings. Therefore, while the outcomes of this study are intriguing and valuable, it is crucial to view them in the context of these limitations. Careful consideration should be exercised when interpreting these findings. The primary constraints of this research are outlined below:

- This research aimed to enhance understanding of personalised AI-based e-learning adoption among healthcare organisations in the UK. While the study successfully achieved its aim and objectives, there remain areas that require further investigation. Consequently, this study represents only a fraction of the extensive knowledge available on both the adoption and effective utilisation of personalised AI-based e-learning. Nevertheless, it is deemed to have a significant impact on advancing knowledge in this area, particularly within the healthcare sector in the UK. As previously mentioned, limited research has been conducted on personalised AI-based e-learning from the UK perspective, especially within the healthcare sector, indicating abundant opportunities for exploring how various healthcare organisations can adopt personalised AI-based e-learning and its associated services. Although this research predominantly focused on certain issues elucidated from the challenges of personalised AI-based e-learning adoption from the perspective of healthcare staff, it did not comprehensively identify all issues, thus necessitating further investigation in certain areas.

- This study was primarily carried out in a rural area of the UK, and many of the findings may be specific to that locality. It is important to note that these outcomes may not be

applicable to the entire population of health and social care organisations across the UK. Therefore, the generalisation of these findings may be limited, necessitating further investigation to include organisations in urban areas or other regions. Despite efforts to analyse and discuss the outcomes in terms of their overall applicability, some limitations remain.

- In this study, the chosen data collection method solely involved semi-structured, open-ended interview questions. This approach aimed to comprehend and elucidate the issues and challenges surrounding the adoption of personalised AI-based e-learning from the perspectives of healthcare staff. The decision to utilise this method was influenced by several limitations outlined in the methodology chapter, particularly due to time constraints and obligatory cost limitations imposed on the study, especially for a DBA researcher. Although this approach was deemed most suitable for understanding participants' perspectives on a subject that had not been extensively investigated, other methodologies could also have been considered. However, these alternative approaches are not discussed here. For instance, focus groups could have been employed to allow owners, managers, and CQC representatives to collectively discuss issues related to the current e-learning system. This would not only have highlighted issues with the current system but also delved deeper into the reasons behind barriers and incentives of adopting personalised AI-based e-learning from a different perspective.

- Another confine of this research is that participants were exclusively selected from a single care home. Consequently, some of the findings may be highly specific to that particular organisation. Therefore, attempting to generalise these outcomes to other sectors within the UK may not be suitable. Generally speaking, location and cultural factors are more prone

to variation across different sectors, whereas financial considerations, patient needs, and competitive factors are likely to be specific to the overall sector.

- Another limitation of this research concerns the literature review process. Despite thorough examination of numerous articles and websites for pertinent information on personalised AI-based e-learning within the UK healthcare sector, the scarcity of studies addressing the perspective of healthcare staff, especially regarding personalised AI-based e-learning, posed a challenge in terms of obtaining sufficient relevant information for this research. While the researcher is confident in the thoroughness of the search conducted on selected articles and websites, it is acknowledged that other potential sources may have remained unidentified, or were not reviewed due to time constraints.

- This study relied on semi-structured, face-to-face interviews, meaning that all the collected data is susceptible to memory and recall biases inherent to the participants. This limitation was unavoidable given the nature of the methods employed, thus raising the possibility of potential bias in the data collected.

- The final confine identified pertains to the validity of the integrated framework developed in this study. Due to time constraints of the DBA course, there was insufficient opportunity to validate whether the developed framework would effectively support healthcare organisations in the UK in their adoption of personalised AI-based e-learning, with the support of governmental entities, CQC, and private IT organisations. However, within the confines of this study, the researcher has prioritised robust research and development of a subsequent framework that accurately reflects staff perceptions, and extensive literature review. Additionally, it was not possible to determine whether healthcare organisations

could feasibly implement this framework, as it would necessitate a robust infrastructure, which is not yet in place, and therefore this could not be explored.

8.7. Future Research Deliberation

The research findings, outcomes, and limitations of this study have led to the formulation of some recommendations for potential future research. Consequently, the considerations for future research endeavours are outlined below:

- Future research endeavours could entail exploring the adoption of personalised AI-based e-learning across various healthcare settings, including hospitals, nursing homes, and general practices situated in different urban and rural areas throughout the UK. This investigation could employ both qualitative and quantitative methodologies to comprehensively grasp the underlying challenges associated with the adoption of personalised AI-based e-learning within healthcare organisations. Additionally, similar investigations should be conducted in other countries to ascertain the applicability and relevance of the findings derived from this UK study.

- Future researchers must exercise caution when determining the sample size, as it significantly influences the representation of the adoption of personalised AI-based e-learning in healthcare organisations. A larger number of respondents from various sectors would offer a more comprehensive portrayal of trends within each sector, leading to more reliable assessments.

- To enhance the applicability of the findings across different regions within the UK, further investigation is warranted to ensure the credibility of subsequent outcomes. Establishing

trustworthiness will facilitate an understanding of whether the outcomes will yield similar or varying impacts in other areas.

- Future researchers should delve deeper into understanding the operational aspects of personalised AI-based e-learning before and after adoption. Given the novelty of AI-driven personalised e-learning in the healthcare sector, additional investigations should contain this aspect to determine how healthcare organisations perceive personalised AI-based e-learning and its integration into their operational processes, as well as their willingness to adopt it.

- Future researchers should undertake a comparative study to perceive the fundamental distinctions in the adoption of personalised AI-based e-learning across various countries. This investigation aims to determine whether healthcare organisations in the UK can replicate strategies employed by other countries.

- The literature revealed that personalised AI-based e-learning and its initiatives are still in their immature stage concerning the training and development of healthcare organisations in the UK. Consequently, it would be advantageous for future researchers to delve deeper into these areas through additional research.

- Future researchers should further explore the integration of the TOE framework and the Felder-Silverman Learning Style Model to optimise outcomes from both models and reinforce existing theories.

8.8. Summary of the Chapter

In conclusion, future research endeavours are expected to expand upon the understanding of both the adoption, and effective implementation of personalised AI-based e-learning in areas

throughout the UK, areas that are beyond the scope of this study. Insights extracted from the investigation suggest that numerous barriers hinder the adoption and utilisation of personalised AI-based e-learning within UK healthcare organisations. However, despite these challenges, healthcare staff demonstrate a willingness to embrace personalised AI-based e-learning, driven by its myriad of benefits. Furthermore, this study revealed that healthcare personnel themselves can play a pivotal role in advocating for and effectively utilising personalised AI-based e-learning within the UK healthcare sector.

This research has successfully achieved its aim and objectives and has addressed the research question posed at the outset of this study. Notably, this study has made significant contributions regarding the obstacles and motivations related to the adoption and effective implementation of personalised AI-based e-learning by healthcare organisations in the UK. While numerous scholars have discussed the challenges affecting e-learning adoption in the healthcare sector, no comprehensive roadmap has been proposed to guide the overcoming of these obstacles specifically for the adoption of personalised AI-based e-learning. This research has developed a framework that can serve as guidance for healthcare organisations, government entities, and regulatory bodies like the CQC in the UK, illustrating how personalised AI-based e-learning can be adopted to support healthcare staff in the UK.

References

Abbasi, M., Montazer, G., Ghrobani , F. & Alipour, Z., 2021. Categorizing E-Learner Attributes in Personalized E-learning Environments: A Systematic Literature Review. *Interdisciplinary journal of virtual learning in medical sciences (Online),* 1 March , 12(1), pp. 1-21.

Abd-Alrazaq, A. et al., 2023. Large Language Models in Medical Education: Opportunities, Challenges, and Future Directions. *JMIR medical education,* 1 June, Volume 9, p. e48291.

Abdullah, M. et al., 2015. Learning Style Classification Based on Student's Behavior in Moodle Learning Management System. *Transactions on Machine Learning and Artificial Intelligence,* 18 February, 3(1), pp. 28-40.

Aeni Hidayah, N. et al., 2020. *Analysis Using the Technology Acceptance Model (TAM) and DeLone & McLean Information System (D&M IS) Success Model of AIS Mobile User Acceptance.* s.l., IEEE, pp. 1-4.

Ahmadi, H., Nilashi, M. & Ibrahim, O., 2015. Organizational decision to adopt hospital information system: An empirical investigation in the case of Malaysian public hospitals. *International journal of medical informatics (Shannon, Ireland),* 1 March, 84(3), pp. 166-188.

Akselrod, S. et al., 2023. Building an interdisciplinary workforce for prevention and control of non-communicable diseases: the role of e-learning. *BMJ (Online),* 23 May, Volume 381, p. e071071.

Al-Azawei, A. & Lundqvist, K., 2015. Learner Differences in Perceived Satisfaction of an Online Learning: an Extension to the Technology Acceptance Model in an Arabic Sample. *Electronic Journal of E-Learning,* 1 October, 13(5), p. 408.

Al-Balas, M. et al., 2020. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. *BMC medical education,* 2 October, 20(1), p. 341.

Al-Balas, M. et al., 2020. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. *BMC medical education,* 2 October, 20(1), pp. 1-341.

Alfaleh, R., East, L., Smith, Z. & Wang, S.-Y., 2023. Nurses' perspectives, attitudes and experiences related to e-learning: A systematic review. *Nurse education today,* June, Volume 125, pp. 105800-105800.

Alhalabi, W., 2016. Virtual reality systems enhance students' achievements in engineering education. *Behaviour & information technology,* 1 November, 35(11), pp. 919-925.

Alhur, A., Alhur, A. & Alhur, A., 2023. Medical and Health Students' Acceptance and Perceptions of E-learning during the COVID-19 Lockdowns in the Kingdom of Saudi Arabia: Technology Acceptance Model. *Journal of Pedagogy and Education Science(JPES),* 3 December, 2(3), pp. 197-208.

Alkhuraiji, S. M., 2016. *DYNAMIC ADAPTIVE E-LEARNING MECHANISM BASED ON LEARNING STYLES,* Manchester: UNIVERSITY OF MANCHESTER.

Alliger, G. M. & Janak, E. A., 1989. Kirkpatrick's Levels of Training Criteria: Thirty Years Later. *Personnel psychology,* June, 42(2), pp. 331-342.

Almaiah, M. A., Al-Khasawneh, A. & Althunibat, A., 2020. Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Education and information technologies,* 1 November, 25(6), pp. 5261-5280.

Alowais, S. A. et al., 2023. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. *BMC medical education,* 22 September, 23(1), pp. 1-689.

Al-Sarem, M., Bellafkih, M. & Ramdani, M., 2014. *Adaptation Patterns with respect to Learning Styles.* Morocco, s.n.

Alshmrany, S., 2022. Adaptive learning style prediction in e-learning environment using levy flight distribution based CNN model. *Cluster computing,* 1 February, 25(1), pp. 523-536.

Alsobhi, A. Y. & Alyoubi, K. H., 2019. Adaptation algorithms for selecting personalised learning experience based on learning style and dyslexia type. *Data technologies and applications,* 7 June, 53(2), pp. 189-200.

Alsoufi, A. et al., 2020. Impact of the COVID-19 pandemic on medical education: medical students' knowledge, attitudes, and practices regarding electronic learning. *PloS one,* 25 November, 15(11), p. e0242905.

Ankrah, N. A. (2007). An Investigation into the Impact of Culture on Construction Project Performance. PhD Thesis, University of Wolverhampton

Ansong, E., Lovia Boateng, S. & Boateng, R., 2017. Determinants of E-Learning Adoption in Universities. *Journal of educational technology systems,* September, 46(1), pp. 30-60.

Apulu, I., 2012. *Developing a Framework for Successful Adoption and Effective Utilisation of ICT by SMEs in Developing Countries: a Case Study of Nigeria,* s.l.: University of Wolverhampton.

Archer, A. et al., 2020. Preferred modalities for delivering continuing education to the public health workforce: a scoping review. *Health Promotion and Chronic Disease Prevention in Canada,* April, 40(4), pp. 116-125.

Australian Digital Health Agency, 2019. *Australian Digital Health Agency.* [Online] Available at: https://www.digitalhealth.gov.au/newsroom/blogs/the-healthcare-workforce-of-the-future-a-global-perspective
[Consultato il giorno 24 January 2024].

Awa, H. O., Ukoha , O. & Emecheta, B. C., 2012. *Integrating TAM and TOE Frameworks and Expanding their Characteristic Constructs for E-Commerce Adoption by SMEs.* s.l., Informing Science Institute.

Azlan, C. A. et al., 2020. Teaching and learning of postgraduate medical physics using Internet-based e-learning during the COVID-19 pandemic – A case study from Malaysia. *Physica medica,* 1 December.Volume 80.

Azzi, I. et al., 2020. A robust classification to predict learning styles in adaptive E-learning systems. *Education and information technologies,* 1 January, 25(1), pp. 437-448.

Babbie, E. R., 2010. *The practice of social research.* 12. ed., international ed. a cura di Belmont, Calif: Wadsworth, Cengage Learning.

Back, D. A. et al., 2014. Blended learning approach improves teaching in a problem-based learning environment in orthopedics - a pilot study. *BMC Medical Education,* 27 January, 14(1), p. 17.

Bączek, M. et al., 2021. Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. *Medicine (Baltimore),* 19 February, 100(7), p. e24821.

Bahrambeygi, F. et al., 2018. The Effectiveness of an E-Learning Program on Nurse's Knowledge and Behavior for Caring of Patients with Thromboembolism: A Comparative Study. *Journal of Nursing and Healthcare Management,* August, 1(1), pp. 1-7.

Bahrambeygi, F. et al., 2018. The Effectiveness of an E-Learning Program on Nurse's Knowledge and Behavior for Caring of Patients with Thromboembolism: A Comparative Study. *Journal of Nursing and Healthcare Management,* August, 1(1), pp. 1-7.

Banerjee, M. et al., 2021. The impact of artificial intelligence on clinical education: perceptions of postgraduate trainee doctors in London (UK) and recommendations for trainers.. *BMC Medical Education,* 21(1), pp. 1-10.

Baniasadi, T., Ayyoubzadeh, S. M. & Mohammadzadeh, N., 2020. Challenges and Practical Considerations in Applying Virtual Reality in Medical Education and Treatment. *Oman Medical Journal,* 35(3), pp. 1-10.

Barker, K. et al., 2013. 'Moving with the times' taking a glocal approach: A qualitative study of African student nurse views of e learning. *Nurse education today,* April, 33(4), pp. 407-412.

Barnard, P. A., Koch, L. & Rothberg, A., 2014. The influence of blended learning on student performance in an undergraduate occupational therapy curriculum. *South African Journal of Occupational Therapy,* 1 January, 44(1), pp. 75-80.

Bastos, R. A. et al., 2022. Solutions, enablers and barriers to online learning in clinical medical education during the first year of the COVID-19 pandemic: A rapid review. *Medical teacher,* February, 44(2), pp. 187-195.

Bazeley, P. & Richards, L., 2000. *The Nvivo Qualitative Project Book.* 1st Edition a cura di London: SAGE Publications.

Becher, T., 1994. The significance of disciplinary differences. *Studies in higher education (Dorchester-on-Thames),* 1 January , 19(2), pp. 151-161.

Bell, E., Bryman, A. & Harley, B., 2019. *Business research methods.* 5th Edition a cura di Oxford: Oxford University Press.

Bell, J., 1993. *Doing your research project.* Buckingham u.a: Open Univ. Pr.

Bell, J., 2005. *Doing your Research Project: A guide for first time researchers in education.* 4th edition a cura di Maidenhead [u.a.]: Open Univ. Press.

Berente, N., Gu, B., Recker, J. & Santhanam, R., 2021. MANAGING ARTIFICIAL INTELLIGENCE. *MIS Quarterly,* September, 45(3), pp. 1433-1450.

Bernard, J., Chang, T.-W., Popescu, E. & Graf, S., 2017. Learning style Identifier: Improving the precision of learning style identification through computational intelligence algorithms. *Expert systems with applications,* 1 June, Volume 75, pp. 94-108.

Beveridge, W. I. B., 1957. *The art of scientific investigation.* New York: W. W. Norton & Company .

Bissonnette, V. et al., 2019. Artificial Intelligence Distinguishes Surgical Training Levels in a Virtual Reality Spinal Task. *Journal of bone and joint surgery. American volume,* 4 December, 101(23), p. e127.

Bohr, A. A. & Memarzadeh, K. K., 2020. The rise of artificial intelligence in healthcare applications. *Artificial Intelligence in Healthcare,* pp. 25-60.

Boyatzis, R. E., 1998. *Transforming qualitative information.* Thousand Oaks [u.a.]: Sage Publ.

Božić, V. & Poola, I., 2023. *THE ROLE OF ARTIFICIAL INTELLIGENCE IN INCREASING THE DIGITAL LITERACY OF HEALTHCARE WORKERS AND STANDARDIZATION OF HEALTHCARE.* [Online]
Available at: https://www.researchgate.net/publication/370265085
[Consultato il giorno 07 December 2023].

Bozkurt, A. et al., 2021. Artificial Intelligence and Reflections from Educational Landscape: A Review of AI Studies in Half a Century. *Sustainability (Basel, Switzerland),* 1 January, 13(2), p. 800.

Braun, V. & Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology,* 1 January, 3(2), pp. 77-101.

Briggs, B., 2019. *International migration and the healthcare workforce,* United Kingdom: Office for National Statistics.

Brock, K. L., & Cameron, B. J., (1999). Enlivering Political Science Courses with Kolb's Learning Preference Model. *PS, Political Science & politics, 32(2), 251-256*.

Brocki, J.M. and Wearden, A.J., 2006. A critical evaluation of the use of interpretative phenomenological analysis (IPA) in health psychology. *Psychology and health*, *21*(1), pp.87-108.

Brun, A., Caridi, M., Fahmy Salama, K. & Ravelli, I., 2006. Value and risk assessment of supply chain management improvement projects. *International journal of production economics,* 1 January, 99(1), pp. 186-201.

Bryman, A., 2008. *Social research methods.* 3rd Edition a cura di Oxford [u.a.]: Oxford Univ. Press.

Bryman, A. & Bell, E., 2003. *Business research methods.* 1st Edition a cura di Oxford: Oxford Univ. Press.

Bryman, A. & Bell, E., 2011. *Business research methods.* 3rd Edition a cura di Oxford [u.a.]: Oxford Univ. Press.

Bulut, M., 2023. Key Statistics on the NHS. [Online]

Available at: https://www.nhsconfed.org/articles/key-statistics-nhs

[Accessed 23 October 2024].

Burrell, G. & Morgan, G., 1979. *Sociological paradigms and organisational analysis.* 1st Edition a cura di London: Heinemann.

Burrell, G. & Morgan, G., 2016. *Sociological paradigms and organisational analysis : elements of the sociology of corporate life.* 1st Edition a cura di Abingdon: Routledge.

Button, D., Harrington, A. & Belan, I., 2014. E-learning & information communication technology (ICT) in nursing education: A review of the literature. *Nurse education today,* October, 34(10), pp. 1311-1323.

Capuano, N. & Caballé, S., 2020. Adaptive Learning Technologies. *The AI magazine,* 22 June , 41(2), pp. 96-98.

Care Quality Commission, 2022. *Care Quality Commission (CQC).* [Online]
Available at: www.cqc.org.uk
[Consultato il giorno 10 August 2022].

Chan, K. S. & Zary, N., 2019. Applications and Challenges of Implementing Artificial Intelligence in Medical Education: Integrative Review. *JMIR Medical Education,* 15 June, 5(1), p. e13930–e13930.

Chaudhary, S., Bharti, R. K., Yadav, S. & Garg, R., 2022. Comparative analysis of e-learning during covid-19 pandemic: a cross sectional survey among health sciences students in northern India. *Journal of Research in Applied and Basic Medical Sciences,* 8(1), pp. 44-49.

Chau, P. Y. & Tam, K. Y., 1997. Factors Affecting the Adoption of Open Systems: An Exploratory Study. *MIS quarterly,* 1 March, 21(1), pp. 1-24.

Cheng, Y.-M., 2012. The Effects of Information Systems Quality on Nurses' Acceptance of the Electronic Learning System. *The journal of nursing research,* March, 20(1), pp. 19-31.

Chen, H. et al., 2020. Enhanced learning resource recommendation based on online learning style model. *Tsinghua science and technology,* June, 25(3), pp. 348-356.

Chen, L.-H., 2011. Enhancement of student learning performance using personalized diagnosis and remedial learning system. *Computers and education,* 56(1), pp. 289-299.

Chen, L., Chen, P. & Lin, Z., 2020. Artificial Intelligence in Education: A Review. *IEEE access,* Volume 8, pp. 75264-75278.

Chen, L., Chen, P. & Lin, Z., 2020. Artificial Intelligence in Education: A Review. *IEEE access,* Volume 8, pp. 75264-75278.

Chen, M. & Decary, M., 2020. Artificial intelligence in healthcare: An essential guide for health leaders. *Healthcare management forum,* 33(1), pp. 10-18.

Ching, C. W., Maarof, N. & Lumpu, K., 2021. Effect of Student Satisfaction on e-learning Quality and Learning Outcome Among Malaysian Undergraduate Nursing Students. *The journal of educators online,* 18(3).

Chiu, T. K. & Hew, T. K. F., 2018. Factors influencing peer learning and performance in MOOC asynchronous online discussion forum. *Australasian Journal of Educational Technology,* 1 January, 34(4), p. 16.

Chong, M. C. et al., 2016. Access to, interest in and attitude toward e-learning for continuous education among Malaysian nurses. *Nurse Education Today,* January, Volume 36, pp. 370-374.

Christudas, B. C. L., Kirubakaran, E. & Thangaiah, P. R. J., 2018. An evolutionary approach for personalization of content delivery in e-learning systems based on learner behavior forcing compatibility of learning materials. *Telematics and informatics,* 1 June, 35(3), pp. 520-533.

Chua, G. P., 2020. Challenges Confronting the Practice of Nursing in Singapore. *Asia-Pacific Journal of Oncology Nursing,* 1 July, 7(3), pp. 259-265.

Coffield, F., Moseley, D., Hall, E. & Ecclestone, K., 2004. *Learning styles and pedagogy in post-16 learning: A systematic and critical review.* London: Learning and Skills Research Centre.

Cohen, L., Manion, L. & Morrison, K., 2007. *Research methods in education.* 6th Edition a cura di London [u.a.]: Routledge.

Collins, C., Dennehy, D., Conboy, K. & Mikalef, P., 2021. Artificial intelligence in information systems research: A systematic literature review and research agenda. *International journal of information management,* October, Volume 60, p. 102383.

Collis, J. & Hussey, R., 2003. *Business research : a practical guide to undergraduate and postgraduate students.* 2nd edition a cura di Basingstoke: Palgrave Macmillan.

Collis, J. & Hussey, R., 2009. *Business research : a practical guide for undergraduate & postgraduate students.* 3rd Edition a cura di Basingstoke [u.a.]: Palgrave Macmillan.

Compton, S., Sarraf-Yazdi, S., Rustandy, F. & Radha Krishna, L. K., 2020. Medical students' preference for returning to the clinical setting during the COVID-19 pandemic. *Medical Education,* October, 54(10), pp. 943-950.

Cook, D. A. et al., 2008. Internet-Based Learning in the Health Professions: A Meta-analysis. *JAMA : the journal of the American Medical Association,* 10 Spetember, 300(10), pp. 1181-1196.

Cornford, T. & Smithson, S., 1996. *Project Research in Information Systems.* 1st Edition a cura di London: Macmillan Education UK.

Creswell, J. W., 2003. *Research Design: qualitative, quantitative and mixed methods.* 2nd Edition a cura di Thousand Oaks, Calif: Sage Publications.

Crockett, K. et al., 2011. *On predicting learning styles in conversational intelligent tutoring systems using fuzzy classification trees.* Taipei, Taiwan, IEEE, pp. 2481-2488.

Crotty, M. J., 1998. *The Foundations of Social Research.* 1st Edition a cura di London: SAGE Publications.

Crowther, D. & Lancaster , G., 2008. *Research methods: a concise introduction to research in management and business consultancy.* 2nd Edition a cura di USA: Butterworth: Routledge.

David, F. R. & David, F. R., 2016. *Strategic Management: A Competitive Advantage Approach, Concepts and Cases, Global Edition.* s.l.:Pearson Education.

Davis, F. D., 1986. *A TECHNOLOGY ACCEPTANCE MODEL FOR TESTING NEW END-USER INFORMATION SYSTEMS: THEORY AND RESULTS.* s.l.:ProQuest Dissertations Publishing.

Davis, F. D., Bagozzi, R. P. & Warshaw, P. R., 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science,* 1 August, 35(8), pp. 982-1003.

de Laat, M., Joksimovic, S. & Ifenthaler, D., 2020. Artificial intelligence, real-time feedback and workplace learning analytics to support in situ complex problem-solving: a commentary. *Campus-wide information systems,* 9 November, 37(5), pp. 267-277.

Delf, P., 2013. Designing effective eLearning for healthcare professionals. *Radiography,* 19(4), pp. 315-320.

DeLone, W. H. & McLean, E. R., 1992. Information Systems Success: The Quest for the Dependent Variable. *Information systems research,* 1 March, 3(1), pp. 60-95.

DeLone, W. H. & McLean, E. R., 2003. The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of management information systems,* 1 April, 19(4), pp. 9-30.

Denscombe, M., 2007. *The good research guide: for small-scale social research projects.* 4th Edition a cura di s.l.:McGraw-Hill.

Denzin, N. K. & Lincoln, Y. S., 2018. *The SAGE handbook of qualitative research.* 5th Edition a cura di Los Angeles: SAGE.

Department of Health and Social Care, 2022. *People at the Heart of Care: adult social care reform,* London: Crown copyright.

Dictionary.com. (2024, February 10). *Dictionary.com*. Retrieved from Dictionary.com: https://www.dictionary.com/browse/CPR

Doherty, R. E., 2022. *Kolb Learning Styles and the best Teaching Methods for Lifelong Learners.* Leicester: University of Leicester.

Dong, Y., Yin, H., Du, S. & Wang, A., 2021. The effects of flipped classroom characterized by situational and collaborative learning in a community nursing course: A quasi-experimental design. *Nurse education today,* Volume 105, pp. 105037-105037.

Duan, Y., Edwards, J. S. & Dwivedi, Y. K., 2019. Artificial intelligence for decision making in the era of Big Data – evolution, challenges and research agenda. *International journal of information management,* October, Volume 48, pp. 63-71.

Dubois, A. & Gadde, L.-E., 2002. Systematic combining: an abductive approach to case research. *Journal of business research,* 55(7), pp. 553-560.

Dung, P. Q. & Florea, A. M., 2012. An approach for detecting learning styles in learning management systems based on learners' behaviours. *International Conference on Education and Management Innovation IPEDR,* 30(2012), pp. 171-177.

Egbu, A. U. (2007). Impact of Land Use Planning on Urban Housing Development in Nigeria. PhD Thesis, University of Wolverhampton

Eisenhardt, K. M., 1989. Building Theories from Case Study Research. *The Academy of Management review,* 1 October, 14(4), pp. 532-550.

Eisenhardt, K. M. & Graebner, M. E., 2007. Theory Building from Cases: Opportunities and Challenges. *Academy of Management journal,* 1 February, 50(1), pp. 25-32.

Eisenhardt, K. M. and Howe, K. R. (1992). Validity in educational research. In LeCompte, M. D. Millroy, W. L. and Preissle, J. (Eds.). The handbook of qualitative research in education (pp. 643-680). San Diego, CA: Academic Press

El-Bishouty, M. M. et al., 2019. Use of Felder and Silverman learning style model for online course design. *Educational technology research and development,* 1 February , 67(1), pp. 161-177.

Ellaway, R. H. & Tolsgaard, M., 2023. Artificial scholarship: LLMs in health professions education research. *Advances in health sciences education : theory and practice,* 1 August, 28(3), pp. 659-664.

El-Sabagh, H. A., 2021. Adaptive e-learning environment based on learning styles and its impact on development students' engagement. *International Journal of Educational Technology in Higher Education,* 1 October, 18(1), pp. 1-24.

Essalmi, F. et al., 2015. Generalized metrics for the analysis of E-learning personalization strategies. *Computers in human behavior,* 1 July, Volume 48, pp. 310-322.

Esteva, A. et al., 2019. A guide to deep learning in healthcare. *Nature medicine,* 1 January, 25(1), pp. 24-29.

Eze, S. C., Chinedu-Eze, V. C. & Bello, A. O., 2018. The utilisation of e-learning facilities in the educational delivery system of Nigeria: a study of M-University. *International Journal of Educational Technology in Higher Education,* 19 September, 15(1), pp. 1-20.

Fakoya, J. T., Adewale , O. S. & Agbonifo, O. C., 2020. Design and Implementation of an Extended FSLM Learning Style Model. *International Journal of Computer Science and Information Security (IJCSIS),* 30 November, 18(11), pp. 29-38.

Feigerlova, E., Hani, H. and Hothersall-Davies, E., 2025. A systematic review of the impact of artificial intelligence on educational outcomes in health professions education. *BMC Medical Education*, *25*(1), p.129.

Felder, R. M. & Silverman, L. K., 1988. Learning and Teaching Styles in Engineering Education. *Engineering Education,* 78(7), p. 674.

Felder, R. M. & Spurlin, J., 2005. Applications, Reliability and Validity of the Index of Learning Styles. *International Journal of Engineering Education,* 21(1), pp. 103-112.

Fellows, R., Langford, D. Newcombe, R. and Urry, S. (2002). *Construction Management in Practice.* 2nd ed. Oxford. Blackwell Science Ltd. UK

Fellows, R. and Lui, A. (1997). *Research Methods for Construction.* Blackwell Science, Oxford: Maiden, MA, USA

Fenton, W. et al., 2023. The state of the adult social care sector and workforce in England, England: Skills for Care.

Flyvbjerg, B., 2010. Five Misunderstandings About Case-Study Research. In: P. Atkinson & S. Delamont, a cura di *SAGE Qualitative Research Methods.* Thousand Oaks: SAGE Publications, Inc, pp. 219-245.

Fontaine, G. et al., 2019. Efficacy of adaptive e-learning for health professionals and students: a systematic review and meta-analysis. *BMJ Open,* 9(8), p. e025252.

Frendø, M. et al., 2019. Decentralized virtual reality mastoidectomy simulation training: a prospective, mixed-methods study. *European archives of oto-rhino-laryngology,* 1 October, 276(10), pp. 2783-2789.

Frey, B. C. & Osborne, M. A., 2017. The future of employment: How susceptible are jobs to computerisation?. *Technological forecasting & social change,* 1 January, 114(January), pp. 254-280.

Frees, W. E. (1996). *Data Analysis Using Regression Models: The Business Perspective.* Prince Hall, Englewood Cliffs, USA

Furo , P. T., 2014. Effect of Mastery Learning Approach on Secondary School Students Achievement in Chemistry in Rivers State Nigeria. *International Institute for Science, Technology and Education (IISTE): E-Journals,* 6(9), pp. 104-110.

Găman, M.-A., Ryan, P. M. & Bonilla-Escobar, F. J., 2020. To Stay at Port or to Go to Sea: Are Clinical Clerkships a Double-Edged Sword During the COVID-19 Pandemic? Where Do We Go From Here?. *International journal of medical students,* 31 August, 8(2), pp. 92-95.

García, P., Amandi, A., Schiaffino, S. & Campo, M., 2007. Evaluating Bayesian networks' precision for detecting students' learning styles. *Computers and education,* 1 November, 49(3), pp. 794-808.

Garrett, B. et al., 2018. Virtual Reality Clinical Research: Promises and Challenges. *JMIR serious games,* 17 October, 6(4), p. e10839.

Gaur, R., Mudgal, S. K., Kaur, S. & Sharma, R., 2020. Undergraduate nursing students' attitude towards online classes during lockdown period in India: imposed or interested?. *International Journal Of Community Medicine And Public Health,* 28 August, 7(9), p. 3371.

Gavriushenko, M., 2017. *On personalized adaptation of learning environments.* Jyväskylä: University of Jyväskylä.

George, P. P. et al., 2014. Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. *Journal of Global Health,* 1 June, 4(1), p. 010406.

Ghaleb, E. A. A. et al., 2021. The Assessment of Big Data Adoption Readiness with a Technology–Organization–Environment Framework: A Perspective towards Healthcare Employees. *Sustainability (Basel, Switzerland),* 1 August, 13(15), p. 8379.

Gilbert-Johns, S., Mason, R., Ward, M. & Humby, P., 2022. Overview of the UK population: 2020. *Office for National Statistics,* 25 February.

Gilley, A., Gilley, J. W. & McMillan, H. S., 2009. Organizational change: Motivation, communication, and leadership effectiveness. *Performance improvement quarterly,* 21(4), pp. 75-94.

Gillham, B., 2005. *Research interviewing: the range of techniques.* s.l.:Open University Press.

Gill, P., Stewart, K., Treasure, E. & Chadwick, B., 2008. Methods of data collection in qualitative research: interviews and focus groups. *British dental journal,* 22 March, 204(6), pp. 291-295.

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report,* 8(4), pp. 597 – 607

Goodman, J. & Truss †, C., 2004. The medium and the message: communicating effectively during a major change initiative. *Journal of change management,* 1 September , 4(3), pp. 217-228.

Gooshi, M., Sirati, M. & Khaghanizade, M., 2014. Utilization Conditions of Virtual Education at Continuing Education for Nurses: A review. *International Journal of Medical Reviews,* 1(3), pp. 111-118.

Gould, D., Drey, N. & Berridge, E.-J., 2007. Nurses' experiences of continuing professional development. *Nurse education today,* 1 August, 27(6), pp. 602-609.

Graf, S., Viola, S. R., Leo, T. & Kinshuk, 2007. In-Depth Analysis of the Felder-Silverman Learning Style Dimensions. *Journal of Research on Technology in Education,* 40(1), p. 79–93.

Grafton-Clarke, C. et al., 2022. Pivot to online learning for adapting or continuing workplace-based clinical learning in medical education following the COVID-19 pandemic: A BEME systematic review: BEME Guide No. 70. *Medical teacher,* 4 March, 44(3), pp. 227-243.

Graneheim, U. & Lundman, B., 2004. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse education today,* 1 February, 24(2), pp. 105-112.

Grundgeiger, T. et al., 2023. Improving procedural skills acquisition of students during medical device training: experiments on e-Learning vs. e-Learning with hands-on. *Advances in health sciences education : theory and practice,* 1 March, 28(1), pp. 127-146.

Guba, E. G., 1981. Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational communication and technology,* June.29(2).

Guskey, T. R., 2007. Closing Achievement Gaps: Revisiting Benjamin S. Bloom's "Learning for Mastery". *Journal of advanced academics,* 1 November, 19(1), pp. 8-31.

Gutierrez, G. et al., 2023. Cognitive load theory in action: e-learning modules improve performance in simulation-based education. A pilot study. *Canadian journal of emergency medicine,* 25(11), pp. 893-901.

Guven Ozdemir, N. & Sonmez, M., 2021. The relationship between nursing students' technology addiction levels and attitudes toward e-learning during the COVID-19 pandemic: A cross-sectional study. *Perspectives in Psychiatric Care,* July, 57(3), pp. 1442-1448.

Hachoumi, N., Eddabbah, M. & El Adib, A. R., 2023. Health sciences lifelong learning and professional development in the era of artificial intelligence. *International journal of medical informatics (Shannon, Ireland),* 1 October, Volume 178, p. 105171.

Hair, J. F., Andeson, R. E., Tatham, R. L. and Black, W. C. (1998). *Multivariate data analysis.* Upper Saddle River, N. J., Prentice Hall

Hamblin, A. C., 1974. *Evaluation and control of training.* London [u.a.]: McGraw-Hill.

Hariyanto, D. & Köhler, T., 2020. A Web-Based Adaptive E-learning Application for Engineering Students: An Expert-Based Evaluation. *International Journal of Engineering Pedagogy,* 11 March , 10(2), pp. 60-71.

Havens, D. S., Wood, S. O. & Leeman, J., 2006. Improving Nursing Practice and Patient Care: Building Capacity With Appreciative Inquiry. *The Journal of nursing administration,* 1 October, 36(10), pp. 463-470.

Hayat, A. A. et al., 2021. Challenges and opportunities from the COVID-19 pandemic in medical education: a qualitative study. *BMC medical education,* 29 April, 21(1), p. 247.

Healy, M and Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative Market Research – An International Journal,* 3(3), pp. 118-126

Higgins, K. et al., 2020. Transforming healthcare professional diabetes education to improve patient safety outcomes. *Journal of diabetes nursing,* 1 January, 24(1), p. 114.

HM Government (2018) *Government response to the Lords Select Committee report on long-term sustainability of the NHS and adult social care*. Department of Health and Social Care. Available at: [https://assets.publishing.service.gov.uk/media/5a8c1f6240f0b6195633a114/Government_response_report_on_Long-Term_Sustainability_of_the_NHS_and_Adult_Social_Care__web_accessible_.pdf] (Accessed: 27 February 2025)

Hmedna, B., El Mezouary, A. & Baz, O., 2020. A predictive model for the identification of learning styles in MOOC environments. *Cluster computing,* 1 June, 23(2), pp. 1303-1328.

Holme, T. A., Reime, T. E. & Sagberg, O., 2023. *Setup and Management of an E-Learning Platform,* Norway: NTNU.

Honey, P. & Mumford, A., 1982. *The manual of learning styles.* Berkshire: Peter Honey Publications Limited.

Honey, P. & Mumford, A., 1992. *The manual of learning styles.* 3rd. a cura di Berkshire: Peter Honey Publications Limited.

Horváth, T. & de Carvalho, A. C., 2017. Evolutionary computing in recommender systems: a review of recent research. *Natural computing,* 1 sEPTEMBER, 16(3), pp. 441-462.

Househ, M., Kushniruk, A. W. & Borycki, E., 2019. *Big data, big challenges : a healthcare perspective : background, issues, solutions and research directions.* 1st. a cura di s.l.:Springer.

Huang, E. Y., Lin, S. W. & Huang, T. K., 2012. What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers and education,* 58(1), pp. 338-349.

Huang, E. Y., Lin, S. W. & Huang, T. K., 2012. What type of learning style leads to online participation in the mixed-mode e-learning environment? A study of software usage instruction. *Computers & Education,* 58(1), p. 338–349.

Hu, J., Peng, Y., Chen, X. & Yu, H., 2021. Differentiating the learning styles of college students in different disciplines in a college English blended learning setting. *PloS one,* 20 May, 16(5), p. e0251545.

Ikpe, E. O. (2009). Development of cost benefit analysis model of accident prevention on construction projects. PhD Thesis: University of Wolverhampton

Ilić, M., Mikić, V., Kopanja, L. & Vesin, B., 2023. Intelligent techniques in e-learning: a literature review. *The Artificial intelligence review,* 1 December , 56(12), pp. 14907-14953.

Ismail Fawaz, H. et al., 2019. Accurate and interpretable evaluation of surgical skills from kinematic data using fully convolutional neural networks. *International journal for computer assisted radiology and surgery,* 1 September, 14(9), pp. 1611-1617.

Jack, K., Tetley, J. & Chambers, A., 2019. The education of nurses working in care homes for older people: An Appreciative Inquiry. *International journal of older people nursing,* 14(2), pp. 1-8.

Javeed, D. et al., 2023. Federated Learning-based Personalized Recommendation Systems: An Overview on Security and Privacy Challenges. *IEEE transactions on consumer electronics,* pp. 1-10.

Jensen, L. & Konradsen, F., 2018. A review of the use of virtual reality head-mounted displays in education and training. *Education and information technologies,* 1 July, 23(4), pp. 1515-1529.

Jha, N. et al., 2022. Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine. *Advances in medical education and practice,* Volume 13, pp. 927-937.

Jing, Y. et al., 2015. THE DISCRIMINATION OF LEARNING STYLES BY BAYES-BASED STATISTICS: AN EXTENDED STUDY ON ILS SYSTEM. *Control and intelligent systems,* 1 January, 43(2), pp. 68-75.

Joo, Y. J., Lim, K. Y. & Lim, E., 2014. Investigating the structural relationship among perceived innovation attributes, intention to use and actual use of mobile learning in an online university in South Korea. *Australasian Journal of Educational Technology,* 1 January, 30(4), pp. 427-439.

Kala, S., Isaramalai, S.-a. & Pohthong, A., 2010. Electronic learning and constructivism: A model for nursing education. *Nurse education today,* 30(1), pp. 61-66.

Kamel Rahimi, A., Pienaar, O., Ghadimi, M., Canfell, O.J., Pole, J.D., Shrapnel, S., van der Vegt, A.H. and Sullivan, C., 2024. Implementing AI in hospitals to achieve a learning health system: systematic review of current enablers and barriers. *Journal of medical Internet research*, *26*, p.e49655.

Karabacak, M. et al., 2023. The Advent of Generative Language Models in Medical Education. *JMIR medical education,* 6 June, Volume 9, p. e48163.

Karaman, S., 2011. Nurses' perceptions of online continuing education. *BMC Medical Education,* 20 October , 11(1), p. 86.

Kaushik, K., Dahiya, S., Aggarwal, S. & Dwivedi, A. D., 2023. *Revolutionizing Healthcare Through Artificial Intelligence and Internet of Things Applications.* 1st. a cura di Hershey: IGI Global.

Kennedy, R. C., Xiang, X., Madey, G. R., and Cosimano, T. F. (2005). Verification and validation of scientific and economic models. Agent 2005 Conference Proceedings. Chicago, IL, October 2005.

Khalid, S. et al., 2020. Evaluation of Deep Learning Models for Identifying Surgical Actions and Measuring Performance. *JAMA Network Open,* 2 March, 3(3), p. e201664.

Khanal, S. S., Prasad, P., Alsadoon, A. & Maag, A., 2020. A systematic review: machine learning based recommendation systems for e-learning. *Education and information technologies,* 25(4), pp. 2635-2664.

Khan, B. et al., 2023. Drawbacks of Artificial Intelligence and Their Potential Solutions in the Healthcare Sector. *Biomedical Materials & Devices,* 8 February.pp. 1-8.

Khan, F. M. A. & Masood, M., 2013. The Development and Testing of Multimedia-assisted Mastery Learning Courseware with regard to the Learning of Cellular Respiration. *Procedia, social and behavioral sciences,* Volume 103, pp. 999-1005.

Kirkpatrick, D. L. & Kirkpatrick, J. D., 2006. *Evaluating training programs.* 3rd ed. a cura di San Francisco: Berrett-Koehler Publishers.

Kolb, A. Y. & Kolb, D. A., 2005. The Kolb learning style inventory-version 3.1 2005 technical specifications. 200(72), pp. 166-171.

Kolb, A. Y. & Kolb, D. A., 2005. The Kolb Learning Style Inventory—Version 3.1: 2005 Technical Specifi cations. *Version 3.1: 2005 Technical Specifi cations*, 15 May, pp. 1-72.

Kolb, A. Y. & Kolb, D. A., 2021. The Kolb Experiential Learning Profile: A Guide to Experiential Learning Theory, KELP Psychometrics and Research on Validity. *Home.Retrieved July,* Volume 2022, p. 135.

Kolb, D. A., 1984. *Experiential Learning : Experience as the Source of Learning and Development.* New Jersey: Prentice.

Kolbjørnsrud, V., Amico, R. & Thomas, R. J., 2017. Partnering with AI: how organizations can win over skeptical managers. *Strategy & leadership,* 1 January, 45(1), pp. 37-43.

Kolekar, S. V., Pai, R. M. & M M, M. P., 2017. Prediction of Learner's Profile based on Learning Styles in Adaptive E-learning System. *International journal of emerging technologies in learning,* 1 January, 12(6), p. 31.

Komasawa, N. and Yokohira, M., 2023. Simulation-based education in the artificial intelligence era. *Cureus*, *15*(6).

Konstantinidis, K., Apostolakis, I. & Karaiskos, P., 2022. A narrative review of e-learning in professional education of healthcare professionals in medical imaging and radiation therapy. *Radiography (London, England. 1995),* 1 May, 28(2), pp. 565-570.

Konttila, J. et al., 2019. Healthcare professionals' competence in digitalisation: A systematic review. *Journal of clinical nursing,* March, 28(5-6), pp. 745-761.

Kozhevnikov, M., Gurlitt, J. & Kozhevnikov, M., 2013. Learning Relative Motion Concepts in Immersive and Non-immersive Virtual Environments. *Journal of science education and technology,* 1 December, 22(6), pp. 952-962.

Kuljis, J. & Liu, F., 2005. *A Comparison of Learning Style Theories on the Suitability for elearning.* s.l., Proceedings of the IASTED International Conference on Web Technologies, Applications, and Services, WTAS 2005.

Kung, T. H. et al., 2023. Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS digital health,* 9 February, 2(2), p. e0000198.

Kynge, L., 2020. Finding the Best Way to Deliver Online Educational Content in Low-Resource Settings: Qualitative Survey Study. *JMIR medical education,* 26 May, 6(1), pp. e16946-e16946.

Lamya, A., Kawtar, Z., Mohamed , E. & Mohamed, K., 2020. Personalization of an educational scenario of a learning activity according to the learning styles model David Kolb. *Global Journal of Engineering and Technology Advances,* 30 December , 5(3), pp. 99-108.

Lange, A.-K.et al., 2020. Learning With Virtual Reality in Nursing Education: Qualitative Interview Study Among Nursing Students Using the Unified Theory of Acceptance and Use of Technology Model. *JMIR nursing,* 1 January , 3(1), p. e20249.

Latham, A., Crockett, K., McLean, D. & Edmonds, B., 2012. A conversational intelligent tutoring system to automatically predict learning styles. *Computers and education,* 1 August, 59(1), pp. 95-109.

Laukkanen, L., Suhonen, R., Löyttyniemi, E. & Leino-Kilpi, H., 2022. The usability, feasibility and fidelity of the Ethics Quarter e-learning intervention for nurse managers. *BMC medical education,* 15 March, 22(1), p. 175.

Leedy, P. D. & Ormrod, J. E., 2015. *Practical research: planning and design.* 7th Edition a cura di Harlow: Pearson Education.

Lee, J., Song, H.-D. & Hong, A., 2019. Exploring Factors, and Indicators for Measuring Students' Sustainable Engagement in e-Learning. *Sustainability,* 14 February, 11(4), p. 985.

Leinster, S. J., Pereira, J. H., Down, S. & Simpson, A. D., 2021. Blended Learning in Healthcare Education. *Medical Research Archives,* 9(8), pp. 1-12.

Lenci, A. & Padó, S., 2022. Editorial: Perspectives for natural language processing between AI, linguistics and cognitive science. *Frontiers in artificial intelligence,* Volume 5, p. 1059998.

Lewis, J. & Ritchie, J., 2003. Generalizing from qualitative research. In: *Qualitative research practice: a guide for social science students and researchers.* London: Sage Publications, pp. 263-286.

Liaw, S. Y. et al., 2020. Nurse-Physician Communication Team Training in Virtual Reality Versus Live Simulations: Randomized Controlled Trial on Team Communication and Teamwork Attitudes. *Journal of Medical Internet Research,* 8 April, 22(4), p. e17279.

Lichtveld, M. Y. & Cioffi, J. P., 2003. Public Health Workforce Development: Progress, Challenges, and Opportunities. *Journal of public health management and practice,* November, 9(6), pp. 443-450.

Lincoln, Y. S. & Guba, E. G., 1985. *Naturalistic inquiry.* 3rd Edition a cura di Beverly Hills [u.a.]: Sage Publ.

Liu, B., Mazumder, S., Robertson, E. & Grigsby, S., 2023. AI Autonomy: Self-initiated Open-world Continual Learning and Adaptation. *The AI magazine,* 1 June, 44(2), pp. 185-199.

Liu, D., Castle, N. G. & Jill, D., 2010. Does Use of Advanced Information Technology in Commercial Minimum Data Set Systems Improve Quality of Nursing Home Care?. *American Journal of Medical Quality,* 25(2), pp. 116-127.

Liu, M. & Yu, D., 2023. Towards intelligent E-learning systems. *Education and information technologies,* 1 July, 28(7), pp. 7845-7876.

Liu, Z., Lin, Y. & Sun, M., 2023. Representation Learning and NLP. In: Z. Liu & M. Sun, a cura di *Representation learning for natural language processing.* 2 a cura di Singapore: Springer Nature Singapore, pp. 1-27.

Lockyer, L., Moule, P. & McGuigan, D., 2007. Web-Based Learning in Practice Settings: Nurses' Experiences and Perceptions of Impact on Patient Care. *Electronic Journal of e-Learning,* 5(4), pp. 279-286.

Lomis, K. et al., 2021. Artificial Intelligence for Health Professions Educators. *NAM Perspectives,* 8 September, Volume 2021, pp. 1-14.

Longoni, C., 2019. Resistance to Medical Artificial Intelligence. *The Journal of consumer research,* 1 December, 46(4), pp. 629-650.

Low, C., Chen, Y. & Wu, M., 2011. Understanding the determinants of cloud computing adoption. *Industrial management + data systems,* 23 August, 111(7), pp. 1006-1023.

Lysaght, T., Lim, H. Y., Xafis, V. & Ngiam, K. Y., 2019. AI-Assisted Decision-making in Healthcare: The Application of an Ethics Framework for Big Data in Health and Research. *Asian bioethics review,* 11(3), pp. 299-314.

Mack, N. et al., 2005. *Qualitative Research Methods: A Data Collector's Field Guide.* North Carolina: Family Health International.

Maduku, D. K., Mpinganjira, M. & Duh, H., 2016. Understanding mobile marketing adoption intention by South African SMEs: A multi-perspective framework. *International journal of information management,* October, 36(5), pp. 711-723.

Maghsudi, S., Lan, A., Xu, J. & van der Schaar, M., 2021. Personalized Education in the Artificial Intelligence Era: What to Expect Next. *IEEE signal processing magazine,* 38(3), pp. 37-50.

Mahdavi Ardestani, S. F., Adibi, S., Golshan, A. & Sadeghian, P., 2023. Factors Influencing the Effectiveness of E-Learning in Healthcare: A Fuzzy ANP Study. *Healthcare (Basel),* 16 July , 11(14), p. 2035.

Maita, K.C., Maniaci, M.J., Haider, C.R., Avila, F.R., Torres-Guzman, R.A., Borna, S., Lunde, J.J., Coffey, J.D., Demaerschalk, B.M. and Forte, A.J., 2024. The impact of digital health solutions on bridging the health care gap in rural areas: A scoping review. *The Permanente Journal*, *28*(3), p.130.

Makridakis, S., 2017. The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. *Futures,* Volume 90, pp. 46-60.

Malek, M. et al., 2023. Interprofessional Needs Analysis and User-Centred Prototype Evaluation as a Foundation for Building Individualized Digital Education in Dementia Healthcare Supported by Artificial Intelligence: A Study Protocol. *Healthcare (Basel),* 22 may, 11(10), p. 1508.

Manolis, C., Burns, D. J., Assudani, R. & Chinta, R., 2013. Assessing experiential learning styles: A methodological reconstruction and validation of the Kolb Learning Style Inventory. *Learning and Individual Differences,* February, Volume 23, pp. 44-52.

Manolis, C., Burns, D. J., Assudani, R. & Chinta, R., 2013. Assessing experiential learning styles: A methodological reconstruction and validation of the Kolb Learning Style Inventory. *Learning and Individual Differences,* February, Volume 23, pp. 44-52.

Marshall, C. & Rossman, G. B., 2011. *Designing qualitative research.* 5th Edition a cura di Thousands Oaks, Calif. [u.a.]: Sage Publ.

Martin-Parra, J. et al., 2014. Changing the paradigm in health care education: Hospital virtual Valdecilla. *Journal of surgical education,* January, 71(1), pp. 142-146.

Mason, M., 2010. Sample size and saturation in PhD studies using qualitative interviews. *Forum, qualitative social research,* 11(3), pp. 19-11:3<19.

Materla, T. & Cudney, E. A., 2020. An integrated methodology for evaluating patient service quality. *Total quality management & business excellence,* 16 November, 31(15-16), pp. 1738-1759.

Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review,* 62, pp. 279 – 300

Maxwell, J. A., 2005. *Qualitative research design: An interactive approach.* 2nd Edition a cura di Thousand Oaks [u.a.]: SAGE Publ.

Mazumdar, A., 2018. *Adoption of Cloud Computing in the SMEs: An Exploration of the Issues and Challenges for Adoption of Cloud Computing by SMEs in Bangladesh in the Context of "Digital Bangladesh",* London: ProQuest Dissertations Publishing.

McCorduck, P., 2004. *Machines who think : a personal inquiry into the history and prospects of artificial intelligence.* 2 a cura di Boca Raton: CRC Press.

McCutcheon, K., Lohan, M., Traynor, M. & Martin, D., 2015. A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. *Journal of advanced nursing,* February, 71(2), pp. 255-270.

McGrath, J. E. and Brinberg, D. (1985). *Validity and the Research Process.* Beverly Hills, CA: Sage Publications

M, C. & Nazeer, I., 2023. Effectiveness of E-learning Platform in Training and Development of Employees in I.T Sector at Bangalore City. *Journal of Emerging Technologies and Innovative Research (JETIR),* 4 August, 10(8), pp. 588-667.

Merriam, S. B., 1998. *Qualitative research and case study applications in education.* 2nd Edition a cura di San Francisco: Jossey-Bass.

Meyer, O. A., Omdahl, M. K. & Makransky, G., 2019. Investigating the effect of pre-training when learning through immersive virtual reality and video: A media and methods experiment. *Computers and education,* October, Volume 140, p. 103603.

Micheel, C. M. et al., 2017. Internet-Based Assessment of Oncology Health Care Professional Learning Style and Optimization of Materials for Web-Based Learning: Controlled Trial With Concealed Allocation. *Journal of Medical Internet Research,* 19(7), p. e265.

Miles, M. B. & Huberman , M. A., 1994. *Qualitative data analysis: An Expanded Sourcebook.* 2nd Edition a cura di London: SAGE.

Mlambo, M., Silén, C. & McGrath, C., 2021. Lifelong learning and nurses' continuing professional development, a metasynthesis of the literature. *BMC nursing,* 14 April, 20(1), p. 62.

Moore, Z. E. et al., 2022. A Clinical Support App for routine wound management: reducing practice variation, improving clinician confidence and increasing formulary compliance. *International Wound Journal,* 19(5), pp. 1263-1275.

Morrow, S.L., 2005. Quality and trustworthiness in qualitative research in counselling psychology. *Journal of counseling psychology*, *52*(2), p.250.

Mosby, I., 2009. *Mosby's medical dictionary.* 8th Edition a cura di St. Louis: Mosby/Elsevier.

Moule, P., Ward, R. & Lockyer, L., 2010. Nursing and healthcare students' experiences and use of e-learning in higher education. *Journal of advanced nursing,* December, 66(12), pp. 2785-2795.

Murtaza, M. et al., 2022. AI-based Personalized E-Learning Systems: Issues, Challenges, and Solutions. *IEEE access,* Volume 10, pp. 81323-81342.

Naik, N. et al., 2022. Legal and Ethical Consideration in Artificial Intelligence in Healthcare: Who Takes Responsibility?. *Frontiers in surgery,* 14 March, Volume 9, p. 862322.

Nawaz, A. & Zubair Khan, M., 2012. Issues of Technical Support for e-Learning Systems in Higher Education Institutions. *International journal of modern education and computer science,* 9 March, 4(2), pp. 38-44.

Nazempour, R. & Darabi, H., 2023. Personalized Learning in Virtual Learning Environments Using Students' Behavior Analysis. *Education sciences,* 28 April, 13(5), p. 457.

Nedungadi, P. & Raman, R., 2012. A new approach to personalization: integrating e-learning and m-learning. *Educational technology research and development,* 1 August, 60(4), pp. 659-678.

Nguyen, T. H., Newby, M. & Macaulay, M. J., 2015. Information Technology Adoption in Small Business: Confirmation of a Proposed Framework. *Journal of small business management,* January, 53(1), pp. 207-227.

Obradović, S., Bjekić, D. & Zlatić, L., 2015. Creative Teaching with ICT Support for Students with Specific Learning Disabilities. *Procedia - Social and Behavioral Sciences,* 1 August, Volume 203, pp. 291-296.

Oliveira, T. & Martins, M. F., 2010. Firms Patterns of e-Business Adoption: Evidence for the European Union-27. *Electronic journal of information systems evaluation,* 1 January, 13(1), p. 47.

Oliveira, T. & Martins, M. F., 2011. Literature Review of Information Technology Adoption Models at Firm Level. *Electronic journal of information systems evaluation,* 1 January, 14(1), pp. 110-121.

Omar, N. D., Hassan, H. & Atan, H., 2012. Student Engagement in Online Learning: Learners Attitude Toward E-Mentoring. *Procedia, social and behavioral sciences,* Volume 67, pp. 464-475.

Osman Abdelmola, A., Makeen, A., Makki Hanafi, H. & Ageeli, E., 2021. E- learning during COVID-19 pandemic, faculty Perceptions, challenges, and recommendations. *MedEdPublish,* 10(1), pp. 1-16.

Panda, A., 2021. Work–life balance, retention of professionals and psychological empowerment: an empirical validation. *European Journal of Management Studies,* 3 December, 26(2/3), pp. 103-123.

Pange, A. & Pange, J., 2011. Is E-learning Based On Learning Theories? A Literature Review. *International Journal of Educational and Pedagogical Sciences,* 22 August, 5(8), pp. 932-936.

Pan, Y. et al., 2022. The adoption of artificial intelligence in employee recruitment: The influence of contextual factors. *International journal of human resource management,* 26 March , 33(6), pp. 1125-1147.

Park, S. Y., 2009. An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational technology & society,* 1 July, 12(3), pp. 150-162.

Parong, J. & Mayer, R. E., 2018. Learning Science in Immersive Virtual Reality. *Journal of educational psychology,* August, 110(6), pp. 785-797.

Passig, D., Tzuriel, D. & Eshel-Kedmi, G., 2016. Improving children's cognitive modifiability by dynamic assessment in 3D Immersive Virtual Reality environments. *Computers and education,* April, Volume 95, pp. 296-308.

Patterson, C. et al., 2017. The significance of personal learning environments (PLEs) in nursing education: Extending current conceptualizations. *Nurse education today,* Volume 48, pp. 99-105.

Patton, M. Q., 1987. *How to use qualitative methods in evaluation.* 2nd Edition a cura di Newbury Park, Calif. u.a: Sage Publ.

Patton, M. Q. (1990). Qualitative evaluation and research methods (2nd ed.). Newbury Park, CA: Sage.

Pawlyn, J., 2012. The use of e-learning in continuing professional development. *Learning Disability Practice,* 1 February , 15(1), pp. 33-37.

Peña, C. I., Marzo, J. L. & de la Rosa, J. L., 2005. Intelligent Agents to Improve Adaptivity in A Web-Based Learning Environment. In: *Knowledge-Based Virtual Education.* Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 141-170.

Peng, H., Ma, S. & Spector, J. M., 2019. Personalized adaptive learning: an emerging pedagogical approach enabled by a smart learning environment. *Smart Learning Environments,* 18 September, 6(1), pp. 1-14.

Petit dit Dariel, O., 2011. *Exploring e-learning adoption in nurse education: a socio-cultural case study using q and bourdieu.* s.l.:ProQuest Dissertations Publishing.

Petit, J. et al., 2018. Jutge.org: Characteristics and Experiences. *IEEE transactions on learning technologies,* 1 July, 11(3), pp. 321-333.

Petticrew, M. & Roberts, H., 2006. *Systematic reviews in the social sciences: a practical guide.* Oxford : Blackwell.

Phillips, J. J., 2003. *Return on Investment in Training and Performance Improvement Programs.* 2nd ed. a cura di s.l.:Routledge Ltd.

Picciano, A. G., 2017. Theories and Frameworks for Online Education: Seeking an Integrated Model. *Online learning (Newburyport, Mass.),* 1 September, 21(3), p. 166.

Plastino, E. & Purdy, M., 2018. Game changing value from Artificial Intelligence: eight strategies. *Strategy & leadership,* 46(1), pp. 16-22.

Pokrivcakova, S., 2019. Preparing teachers for the application of AI-powered technologies in foreign language education. *Journal of language and cultural education,* 1 December, 7(3), pp. 135-153.

Polit, D. F. & Hungler, B. P., 1999. *Nursing research : principles and methods.* 6th Edition a cura di Philadelphia: Lippincott.

Poquet, O. & Laat, M., 2021. Developing capabilities: Lifelong learning in the age of AI. *British journal of educational technology,* July, 52(4), pp. 1695-1708.

Portz, J. D. et al., 2019. Using the Technology Acceptance Model to Explore User Experience, Intent to Use, and Use Behavior of a Patient Portal Among Older Adults With Multiple Chronic Conditions: Descriptive Qualitative Study. *Journal of Medical Internet Research,* 1 April, 21(4), p. e11604.

Preiksaitis, C. & Rose, C., 2023. Opportunities, Challenges, and Future Directions of Generative Artificial Intelligence in Medical Education: Scoping Review. *JMIR medical education,* 20 October , Volume 9, p. e48785.

Price, J. K., 2015. Transforming learning for the smart learning environment: lessons learned from the Intel education initiatives. *Smart Learning Environments,* 18 December, 2(1), pp. 1-16.

Przymuszała, P. et al., 2022. Distance Learning and Assessment During the COVID-19 Pandemic—Perspectives of Polish Medical and Healthcare Students. *SAGE open,* 1 January, 12(1), p. 215824402210850.

Qamar, K. et al., 2021. CHALLENGES OF E-LEARNING FACED BY MEDICAL TEACHERS AND STUDENTS DURING COVID-19 PANDEMIC. *Pakistan Armed Forces medical journal,* 31 January, 71(Suppl-1), pp. S3-9.

Rahayu, N. W., Ferdiana, R. & Kusumawardani, S. S., 2022. A systematic review of ontology use in E-Learning recommender system. *Computers and education. Artificial intelligence,* Volume 3, p. 100047.

Rai, A., Constantinides, P. & Sarker, S., 2019. Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS Quarterly,* March, 43(1), pp. iii-ix.

Rekha, K., Gopal, K., Satheeskumar, D., Anand, U.A., Doss, D.S.S. and Elayaperumal, S., 2024, May. Ai-Powered Personalized Learning System Design: Student Engagement And Performance Tracking System. In *2024 4th International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)* (pp. 1125-1130). IEEE.

Hari Rajan, M., Herbert, C. and Polly, P., 2024, January. Disrupted student engagement and motivation: observations from online and face-to-face university learning environments. In *Frontiers in Education* (Vol. 8, p. 1320822). Frontiers Media SA.

Ramdani, B., Kawalek, P. & Lorenzo, O., 2009. Predicting SMEs' adoption of enterprise systems. *Journal of enterprise information management,* 13 February, 22(1/2), pp. 10-24.

Randall, M., 2017. Overview of the UK population: July 2017. *Office for National Statistics,* 21 July.

Randhawa, G. K. & Jackson, M., 2020. The role of artificial intelligence in learning and professional development for healthcare professionals. *Healthcare management forum,* January, 33(1), pp. 19-24.

Ravi Shankar, P., 2022. Artificial intelligence in healthcare in Nepal. *Janaki Medical College Journal of Medical Science,* 26 April, 10(1), pp. 1-4.

Reeves, S. et al., 2017. Interprofessional online learning for primary healthcare: findings from a scoping review. *BMJ Open,* 1 August, 7(8), p. e016872.

Regmi, K. & Jones, L., 2020. A systematic review of the factors - enablers and barriers - affecting e-learning in health sciences education. *BMC medical education,* 20(1), pp. 1-18.

Richet, J.-L., 2016. Internal communication failure in times of change. In: *Organizational change management strategies in modern business.* s.l.:Business Science Reference, pp. 289-300.

Ridder, H.-G., Hoon, C. & McCandless Baluch, A., 2014. Entering a Dialogue: Positioning Case Study Findings towards Theory. *British journal of management,* April, 25(2), pp. 373-387.

Riley, K., 2011. *Does on line learning click with nurses? A qualitative study,* s.l.: NSW Government.

Riley, K. & Schmidt, D., 2016. Does online learning click with rural nurses? A qualitative study. *The Australian journal of rural health,* August, 24(4), pp. 265-270.

Riley, K. & Schmidt, D., 2016. Does online learning click with rural nurses? A qualitative study. *The Australian journal of rural health,* August, 24(4), pp. 265-270.

Rizvi, Y. S. & Zaheer, S., 2022. Training Healthcare Professionals in Artificial Intelligence Augmented Services. In: S. Dutta, a cura di *Industry 4.0 and Intelligent Business Analytics for Healthcare.* New York: Nova Science Publishers, pp. 117-134.

Royal College of Nursing, 2018. *Improving Mandatory Training: How reps can play their part,* London: Royal College of Nursing.

Russell SJ. Artificial intelligence a modern approach. Pearson Education, Inc.; 2010.

Ruiz, J. G., Mintzer, M. J. & Leipzig, R. M., 2006. The Impact of E-Learning in Medical Education. *Academic medicine,* 1 March, 81(3), pp. 207-212.

Sabeh, H. N. et al., 2021. A Systematic Review of the DeLone and McLean Model of Information Systems Success in an E-Learning Context (2010-2020). *IEEE access,* Volume 9, pp. 81210-81235.

Sachdeva, J., 2009. *Business research methodology.* Mumbai: HIMALAYA PUBLISHING HOUSE.

Safavi, A. A., 2008. Developing countries and e–learning program development. *Journal of Global Information Technology Management,* 11(3), pp. 47-64.

Saint-Marc, P., Ratiney, R. & Schlatter, J., 2019. Challenges in Implementing an E-Learning Education Program for Syringe Pump Use. *International journal of nursing education scholarship,* 22 January, 16(1), pp. 1-10.

Saint-Marc, P., Ratiney, R. & Schlatter, J., 2019. Challenges in Implementing an E-Learning Education Program for Syringe Pump Use. *International journal of nursing education scholarship,* 22 January.16(1).

Salomon, G., Perkins, D. N. & Globerson, T., 1991. Partners in Cognition: Extending Human Intelligence with Intelligent Technologies. *Educational researcher,* 20(3), pp. 2-9.

Sanal, A., 2018. *XLPro.* [Online]
Available at: https://playxlpro.com/5-benefits-of-using-e-learning-animations-in-pharma-and-healthcare/
[Consultato il giorno 26 January 2024].

Saner, P., Tratschin, L., Leder, C. & Rost, K., 2023. Introduction to the Special Issue: Digital Academia. Investigating Science and Higher Education in the Digital Age. *Swiss Journal of Scociology,* 1 November, 49(3), pp. 449-472.

Sanjabi, T. & Montazer, G. A., 2020. *Personalization of E-Learning Environment Using the Kolb's Learning Style Model.* Tehran, IEEE, pp. 89-92.

Sarabdeen, J., 2013. Learning Styles and Training Methods. *IBIMA Communications,* 2013(2013), pp. 1-9.

Sarantakos, S., 2005. Principles of social research. In: *Social Research.* s.l.:Macmillan Education UK.

Sarantakos, S., 2005. Principles of social research. In: 3. Edition, a cura di *Social Research.* New York: Macmillan Education UK.

Saunders, M., Lewis, P. & Thornhill, A., 2007. *Research methods for business students.* 4th Edition a cura di Harlow [u.a.]: Prentice Hall/Financial Times.

Saunders, M., Lewis, P. & Thornhill, A., 2009. *Research methods for business students.* 5th Edition a cura di Harlow: Financial Times Prentice Hall.

Saunders, M., Lewis, P. & Thornhill, A., 2016. *Research methods for business students.* Seventh Edition a cura di Harlow u.a: Pearson.

Saunders, M., Lewis, P. & Thornhill, A., 2016. *Research methods for business students.* 7th a cura di Alma: Harlow : Pearson Education.

Saunders, M., Lewis, P. & Thornhill, A., 2019. *Research Methods for Business Students.* Eighth edition a cura di Harlow: Pearson Education, Limited.

Schade, M., 2024. *Data usage for consumer services FAQ.* [Online]
Available at: https://help.openai.com/en/articles/7039943-data-usage-for-consumer-services-faq
[Consultato il giorno 26 January 2024].

Schillewaert, N., Ahearne, M. J., Frambach, R. T. & Moenaert, R. K., 2005. The adoption of information technology in the sales force. *Industrial marketing management,* 1 May, 34(4), pp. 323-336.

Schreurs, J., Gelan, A. & Sammour, G. N., 2009. E-Learning Readiness in Organisations – Case Healthcare. *International Journal of Advanced Corporate Learning (iJAC),* 9 May, 2(2), p. 34.

Schwandt, T. A., 2007. *The SAGE Dictionary of Qualitative Inquiry.* 3rd Edition a cura di Thousand Oaks, CA: Sage Publications.

SchwandtThomas , A., Lincoln, Y. S. & Guba, E. G., 2007. Judging interpretations: But is it rigorous? trustworthiness and authenticity in naturalistic evaluation. *New directions for evaluation,* 2007(114), pp. 11-25.

Seale, C., 1999. *The quality of qualitative research: introducing qualitative methods.* 1st Edition a cura di London [u.a.]: Sage.

Secinaro, S. et al., 2021. The role of artificial intelligence in healthcare: a structured literature review. *BMC medical informatics and decision making,* 21(1), p. 125.

Seeber, I. et al., 2020. Collaborating with technology-based autonomous agents. *Internet research,* 27 April, 30(1), pp. 1-18.

Sefiani, Y., 2013. *Factors for success in SMEs : a perspective from Tangier,* s.l.: University of Gloucestershire.

Selwyn, N., 2022. The future of AI and education: Some cautionary notes. *European Journal of Education*, *57*(4), pp.620-631.

Setia, S., Tay, J. C., Chia, Y. C. & Subramaniam, K., 2019. Massive open online courses (MOOCs) for continuing medical education – why and how?. *Advances in Medical Education and Practice,* 1 September, Volume 10, pp. 805-812.

Shafie, N., Shahdan, T. N. T. & Liew, M. S., 2010. Mastery Learning Assessment Model (MLAM) in Teaching and Learning Mathematics. *Procedia, social and behavioral sciences,* Volume 8, pp. 294-298.

Shankar, P. R., 2022. Artificial intelligence in health professions education. *Archives of Medicine and Health Sciences,* 10(2), pp. 256-261.

Sharma, R. & Mohan, M., 2021. Artificial Intelligence and E-Learning: Best Practices Across the Globe. In: S. Singh, a cura di *Adoption and Implementation of AI in Customer Relationship Management.* Hershey: IGI Global, pp. 1-25.

Sheen, S.-T.H. et al., 2008. E-Learning Education Program for Registered Nurses: The Experience of a Teaching Medical Center. *The journal of nursing research,* September, 16(3), pp. 195-201.

Sheikh, H., Prins, C. & Schrijvers, E., 2023. *Mission AI : The New System Technology.* 1st ed. 2023. a cura di Cham: Springer International Publishing.

Shi, T. et al., 2019. Molecular image-based convolutional neural network for the prediction of ADMET properties. *Chemometrics and intelligent laboratory systems,* 15 November, Volume 194, p. 103853.

Shorey, S. et al., 2019. A Virtual Counseling Application Using Artificial Intelligence for Communication Skills Training in Nursing Education: Development Study. *Journal of Medical Internet Research,* 29 October , 21(10), p. e14658.

Silverman, D., 2000. *Doing qualitative research.* 1. publ. a cura di London: Sage.

Silverman, D. (2006). *Interpreting Qualitative Data.* 3rd ed. London: Sage

Singh, H. P. & Alshammari, K., 2021. Impacts of Digital Technology-Enabled Personalized and Adaptive Learning on Student Learning Performance: A TOE Framework for Saudi Arabia. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies,* 12(13), pp. 1-12.

Sinha, M., Fukey, L. N. & Sinha, A., 2021. AI in e-learning. In: R. Krishnamurthi, D. Yadav & M. Goyal, a cura di *E-Learning Methodologies - Fundamentals, Technologies and Applications.* s.l.:Institution of Engineering and Technology, pp. 107-131.

Smith, J.A., 2004. Reflecting on the development of interpretative phenomenological analysis and its contribution to qualitative research in psychology. *Qualitative research in psychology*, *1*(1), pp.39-54.

Smith, P. L. & Ragan, T. J., 2005. *Instructional design.* 3rd Edition a cura di Hoboken, N.J: Wiley.

Smith, Y. M. & Crowe, A. R., 2017. Nurse Educator Perceptions of the Importance of Relationship in Online Teaching and Learning. *Journal of professional nursing,* January, 33(1), pp. 11-19.

Smyth, S., Houghton, C., Cooney, A. & Casey, D., 2012. Students' experiences of blended learning across a range of postgraduate programmes. *Nurse education today,* May, 32(4), pp. 464-468.

Social Care Institute for Excellence, (SCIE), 2006. *E-Readiness in the Social Care Sector: Building the capacity for e-learning,* London: Social Care Institute for Excellence (SCIE).

Soflano, M., Connolly, T. M. & Hainey, T., 2015. An application of adaptive games-based learning based on learning style to teach SQL. *Computers and education,* August, Volume 86, pp. 192-211.

Song, L., Singleton, E. S., Hill, J. R. & Koh, M. H., 2004. Improving online learning: Student perceptions of useful and challenging characteristics. *The Internet and Higher Education,* 7(1), pp. 59-70.

Stake, R. R., 1995. *The art of case study research.* Thousands Oaks [u.a.]: Sage Publ.

Stehr, M. (2018, January 5). *Evrything you Need to Know about the Different Types of Patient Hoists.* Retrived from HLS Healthcare: www.hlshealthcare.com.au

Stevens, R. et al., 2020. *AI for Science: Report on the Department of Energy (DOE) Town Halls on Artificial Intelligence (AI) for Science,* United States: Argonne National Laboratory.

Strauss, A. L. & Corbin, J. M., 1990. *Basics of qualitative research: Grounded theory procedures and techniques.* 2nd Edition a cura di Newbury Park: Sage publications.

Subedi, S. et al., 2020. Impact of E-learning during COVID-19 Pandemic among Nursing Students and Teachers of Nepal. *International Journal of Science and Healthcare Research,* 5(3), pp. 68-76.

Sutherland, J., Belec, J., Sheikh, A., Chepelev, L., Althobaity, W., Chow, B.J.W., Mitsouras, D., Christensen, A., Rybicki, F.J. and LA Russa, D.,J., 2019. Applying Modern Virtual and Augmented Reality Technologies to Medical Images and Models. Journal of Digital Imaging, 32(1), pp. 38-53.

Sutoi, D. et al., 2023. The Learning Experience of Romanian Medical Students During the Online Teaching Imposed by the COVID-19 Pandemic. *Advances in medical education and practice,* 1 January, Volume 14, pp. 1077-1086.

Swailes, S. & Senior, B., 1999. The Dimensionality of Honey and Mumford's Learning Styles Questionnaire. *International Journal of Selection and Assessment,* 7(1), pp. 1-11.

Sweta, S. & Lal, K., 2017. Personalized Adaptive Learner Model in E-Learning System Using FCM and Fuzzy Inference System. *International journal of fuzzy systems,* 20 March, 19(4), pp. 1249-1260.

Tang, A. C., Wong, N. & Wong, T. K., 2015. Learning experience of Chinese nursing students in an online clinical English course: Qualitative study. *Nurse Education Today,* February, 35(2), pp. e61-e66.

Thapa, P., Bhandari, S. L. & Pathak, S., 2021. Nursing students' attitude on the practice of e-learning: A cross-sectional survey amid COVID-19 in Nepal. *PloS one,* 24 June, 16(6), p. e0253651.

The AHSN Network, 2018. *Accelerating Artificial Intelligence in health and care: results from a state of the nation survey,* Kent Surrey Sussex: The Academic Health Science Network (AHSN).

The Health and Social Care Information Centre, 2016. *Data and information strategy.* [Online] Available at: digital.nhs.uk [Consultato il giorno 3 June 2020].

The National Health Ssrvice, 2019. *NHS Long Term Plan.* [Online] Available at: https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/ [Consultato il giorno 06 December 2023].

Tian, Y.-h.et al., 2017. Towards human-like and transhuman perception in AI 2.0 : a review. *Frontiers of information technology & electronic engineering,* 18(1), pp. 58-67.

Tobin, G. A. & Begley, C. M., 2004. Methodological rigour within a qualitative framework. *Journal of Advanced Nursing,* November, 48(4), pp. 388-396.

Tornatzky, L. G. & Fleischer, M., 1990. *The process of technological innovation.* 1. print. a cura di Lexington, Mass. u. a: Lexington Books.

Turing, A. M., 1950. I.—COMPUTING MACHINERY AND INTELLIGENCE. *Mind,* October, LIX(236), pp. 433-460.

Tyson, C., Armstrong, B. & Parks, M., 2013. *ACCESS TO TRAINING AND STUDY LEAVE POLICY.* [Online] Available at: https://www.elft.nhs.uk/sites/default/files/2022-01/access-to-training-and-study-leave-policy.pdf [Consultato il giorno 12 March 2024].

Uma, G., Vartika, T. & Kumar, G. N., 2020. Perception about Online Learning among Medical Students in Northern India during Lockdown Period of Covid - 19: A Cross Sectional Study. *International Journal of Contemporary Medical Research,* December, 7(12), pp. L6-L10.

Vaona, A. et al., 2018. E-learning for health professionals. *Cochrane database of systematic reviews,* 21 January, 2018(8), p. CD011736.

Verhagen, A., 2021. Opportunities and drawbacks of using artificial intelligence for training. *OECD Social, Employment and Migration Working Papers*, 13 December, pp. 0_1-68.

Villena-Taranilla, R., Tirado-Olivares, S., Cózar-Gutiérrez, R. & González-Calero, J. A., 2022. Effects of virtual reality on learning outcomes in K-6 education: A meta-analysis. *Educational research review,* February, Volume 35, p. 100434.

Walliman, N. (2001). *Your research project: A step-by-step guide for the first-time researcher.* London: SAGE Publications

Warr, P. B., Bird, M. & Rackham, N., 1970. *Evaluation of management training: a practical framework, with cases, for evaluating training needs and results.* 2.impr. a cura di London: Gower Pr.

Webb, J., Stockwell, J. & Chavez-Ugalde, Y., 2017. The reach, adoption, and effectiveness of online training for healthcare professionals. *Public health,* 1 December , Volume 153, pp. 107-110.

Webster, R., 2016. Declarative knowledge acquisition in immersive virtual learning environments. *Interactive learning environments,* 17 August, 24(6), pp. 1319-1333.

Welch, M., 2011. The evolution of the employee engagement concept: communication implications. *Corporate communications,* 11 October, 16(4), pp. 328-346.

Wen, K.-W. & Chen, Y., 2010. E-business value creation in Small and Medium Enterprises: a US study using the TOE framework. *International Journal of Electronic Business,* 1 January, 8(1), pp. 80-100.

WHO, 2024. *Health workforce.* [Online] Available at: https://www.who.int/health-topics/health-workforce#tab=tab_1 [Consultato il giorno 11 January 2024].

Winkler-Schwartz, A. et al., 2019. Machine Learning Identification of Surgical and Operative Factors Associated With Surgical Expertise in Virtual Reality Simulation. *JAMA Network Open,* 2 August, 2(8), p. e198363.

Winter, G. (2000). A Comparative Discussion of the Notion of 'Validity' in Qualitative and Quantitative Research. *The Qualitative Report,* 4(3 & 4), March 2000

Wolfe, C. R. et al., 2016. Understanding genetic breast cancer risk: Processing loci of the BRCA Gist Intelligent Tutoring System. *Learning and individual differences,* Volume 49, pp. 178-189.

Wolff, J., Pauling, J., Keck, A. & Baumbach, J., 2021. Success Factors of Artificial Intelligence Implementation in Healthcare. *Frontiers in digital health,* Volume 3, p. 594971.

Wong, S., 2015. eLearning as good as traditional training for health professionals. *Imperial News*.

Wongwatkit, C., Panjaburee, P., Srisawasdi, N. & Seprum, P., 2020. Moderating effects of gender differences on the relationships between perceived learning support, intention to use, and learning performance in a personalized e-learning. *Journal of computers in education (the official journal of the Global Chinese Society for Computers in Education),* 12 February, 7(2), pp. 229-255.

Wongwatkit, C., Srisawasdi, N., Hwang, G.-J. & Panjaburee, P., 2017. Influence of an integrated learning diagnosis and formative assessment-based personalized web learning approach on students learning performances and perceptions. *Interactive learning environments,* 3 October, 25(7), pp. 889-903.

World Health Organization, 2016. *Global diffusion of eHealth: making universal health coverage achievable: report of the third global survey on eHealth.* [Online] Available at: www.who.int [Consultato il giorno 28 January 2024].

Wu, B., Yu, X. & Gu, X., 2020. Effectiveness of immersive virtual reality using head-mounted displays on learning performance: A meta-analysis. *British journal of educational technology,* November, 51(6), pp. 1991-2005.

Wu, I.-L., Hsieh, P.-J. & Wu, S.-M., 2022. Developing effective e-learning environments through e-learning use mediating technology affordance and constructivist learning aspects for performance impacts: Moderator of learner involvement. *The Internet and higher education,* October, Volume 55, p. 100871.

Xie, H., Chu, H.-C., Hwang, G.-J. & Wang, C.-C., 2019. Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017. *Computers and education,* October, Volume 140, p. 103599.

Xing, W. et al., 2018. Nurses' Attitudes toward, and Needs for Online Learning: Differences between Rural and Urban Hospitals in Shanghai, East China. *International Journal of Environmental Research and Public Health,* 1 July, 15(7), p. 1495.

Xing, W., Ao, L., Xiao, H. & Liang, L., 2020. Chinese Nurses' Preferences for and Attitudes About e-Learning in Continuing Education: A Correlational Study. *The Journal of continuing education in nursing,* 51(2), pp. 87-96.

Xu, J., 2017. Research on Application of BIM 5D Technology in Central Grand Project. *Procedia engineering,* Volume 174, pp. 600-610.

Xu, S., Zhu, K. & Gibbs, J., 2004. Global Technology, Local Adoption: A Cross-Country Investigation of Internet Adoption by Companies in the United States and China. *Electronic markets,* 1 April, 14(1), pp. 13-24.

Yang, J., Luo, B., Zhao, C. & Zhang, H., 2022. Artificial intelligence healthcare service resources adoption by medical institutions based on TOE framework. *Digital health,* Volume 8, pp. 205520762211260-20552076221126034.

Yekefallah, L., Namdar, P., Panahi, R. & Dehghankar, L., 2021. Factors related to students' satisfaction with holding e-learning during the Covid-19 pandemic based on the dimensions of e-learning. *Heliyon,* 1 July, 7(7), p. e07628.

Yi, M. Y. & Hwang, Y., 2003. Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International journal of human-computer studies,* 59(4), pp. 431-449.

Yin, R. K., 2009. *Case Study Research: Design and methods.* 4th Edition a cura di Los Angeles, Calif. [u.a.]: Sage.

Yin, R. K., 2018. *Case study research and applications: design and methods.* Los Angeles: Sage.

Yu, A., Fontana, G. & Darzi, A., 2016. *EVALUATION OF EDUCATION AND TRAINING INTERVENTIONS FOR PATIENT SAFETY,* London: Health Education England.

Yudiawan, A. et al., 2022. Factors Affecting the Success of E-Learning-Based Training using Learning Management System Platforms: Adaptations of Updated DeLone and McLean Models. *Journal of Education and e-Learning Research,* 5 October, 9(3), pp. 192-198.

Zaman, N. et al., 2021. The Relationship between Nurses' Training and Perceptions of Electronic Documentation Systems. *Nursing reports (Pavia, Italy),* 1 January, 11(1), pp. 12-27.

Zawacki-Richter, O., Marín, V. I., Bond, M. & Gouverneur, F., 2019. Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education,* 28 October, 16(1), pp. 1-27.

Zawacki-Richter, O., Marín, V. I., Bond, M. & Gouverneur, F., 2019. Systematic review of research on artificial intelligence applications in higher education – where are the educators?. *International Journal of Educational Technology in Higher Education,* 28 October , 16(1), pp. 1-27.

Zhang, Q., Lu, J. & Jin, Y., 2021. Artificial intelligence in recommender systems. *Complex & Intelligent Systems,* 1 February, 7(1), pp. 439-457.

Zhu, K., Kraemer, K. L., Gurbaxani, V. & Xu, S. X., 2006. Migration to Open-Standard Interorganizational Systems: Network Effects, Switching Costs, and Path Dependency. *MIS quarterly,* 1 August, 30(3), pp. 515-539.

Zhu, K., Kraemer, K. & Xu, S., 2003. Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European journal of information systems,* 1 December, 12(4), pp. 251-268.

Zhu, K., Kraemer, K. & Xu, S., 2003. Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European journal of information systems,* 1 December , 12(4), pp. 251-268.

Zlatkovic, D. et al., 2020. Analysis of adaptive e-learning systems with adjustment of Felder-Silverman model in a Moodle DLS. *Computer applications in engineering education,* July, 28(4), pp. 803-813.

Zywno, M. S., 2003. *A Contribution to Validation of Score Meaning for Felder-Soloman's Index of Learning Styles.* Toronto, American Society for Engineering Education.

Appendix A

Participant Consent Form

University of Wales Trinity Saint David (London Campus)
Winchester House
11 Cranmer Road
London – SW9 6EJ
Tel: +442075667600
Email: info.london@tsd.ac.uk
londonstudentservice@tsd.ac.uk

Project Title: To Explore Strategies of AI based E-Learning to Add Value through Training and Development for Healthcare Staff: A case Study of a care home in the UK.

Thank you for considering taking part in this research. If you have any questions, please ask a member of the research team before you decide whether to take part. You will be given a copy of this Consent Form to keep and refer to at any time.

	Please Initial
I confirm that I have read and understood the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. I understand that direct quotes may be used and the identity of the person making the quote will be anonymised**.**	☐
I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my legal rights being affected.	☐
If I withdraw consent, I understand that all data up to that date will be retained, but no direct attributable quotes will be used.	☐
I agree to take part in the study.	☐

Name of Participant (please print)
……

Signed …… Date …… /…… /……...

Name of Researcher (please print)
……

Signed …… Date …… /…… /……...

Appendix B

Participant Information Sheet

University of Wales Trinity Saint David (London Campus)
Winchester House
11 Cranmer Road
London – SW9 6EJ
Tel: +442075667600
Email: info.london@tsd.ac.uk
londonstudentservice@tsd.ac.uk

Project Title: To Explore Strategies of AI based E-Learning to Add Value through Training and Development for Healthcare Staff: A case Study of a care home in the UK.

Contact Details

If you have any queries about the research please contact: Faculty of Business, University of Wales Trinity St David, London Campus, Winchester House, 11 Cranmer Road, London SW9 6EJ United Kingdom

Tel: +44(0)20 7566 7600 www.uwtsdlondon.ac.uk

We would like to invite you to take part in our research study. Before you decide we would like to tell you why the research is being done and what it would involve for you. The researcher would be happy to go through the information sheet with you and answer any questions you have. Ask us if there is anything that is not clear.

What is the Research About?

The research wants to look at healthcare staff experiences of online training. The researcher wants to learn about this to inform a project, which will propose a way of making online training more personalised and takes into account the individual's learning style.

Why have I been Invited?

You are being invited to take part as you are a healthcare staff member in the UK. The researcher would like to interview a number of healthcare staff for this research.

Do I have to take Part?

We will describe the study and go through this information sheet with you. If you agree to take part, we will then ask you to sign a consent form. You are free to withdraw at any time, without giving a reason. This would not affect your professional life in any way.

What will happen if I Decide to Take Part?

The researcher will arrange a time that is convenient to you to conduct the interview in a public library, a quiet café or in the University of Wales Trinity St David - London Campus. The interview is informal; 'interview' is a research term. However, it will be a number of questions to prompt conversation with the researcher about your online training experience. You do not need to answer all of the questions, and if there is anything related to your experience of online training that you think is important, you can tell the researcher about it. There are no wrong or right answers, it is about how you perceive your online training. We expect that the interview / conversation will take no longer than 1 hour.

The researcher will record the interview. This will ensure that the researcher's review of the conversation is accurate.

The research will not affect your daily work. The interview will be arranged at a time convenient to you, when it does not interfere with your daily work.

What if I Have Questions or Concerns about taking part in the Research?

If you have any questions either before, during, or after the interview you can ask the researcher. If you want the researcher to stop the interview at any time, there is no problem with this.

If you do not want to take part in the study, you can tell the researcher before, or during the interview and they will not include any interview records relating to you.

The researcher will be happy to answer any questions you may have about the conducting of the study – please do not hesitate to ask. Declining to take part in the study in no way affects your work; it is your choice.

What are the Possible Problems and Disadvantages of Taking Part?

We do not anticipate any problems arising from participation in the study as your name will be anonymous. So, your participation and responds would not affect your employment. The interview will not interfere with your daily work as it will be arranged at a time convenient to you.

What are the Possible Benefits of Taking Part?

We hope that the outcomes of the study will support the researcher to make a framework that could be used in healthcare organisations in the UK, to support staff to receive training that is more personalised towards individual learning styles.

Who is Funding and Organising the Research?

The research is part of a project carried out at Doctorate level by Rokhsareh Kavian who is a student at the University of Wales Trinity St David, who are sponsoring the research.

Who is the Researcher?

Rokhsareh Kavian is a Business Administration Doctoral Student. Rokhsareh has a master's Degree in Artificial Intelligence and has experience of looking at how technology can help people in everyday situations to improve their experiences of work, and or, learning.

What will Happen to the Results of the Research Study?

The outcomes of the research will be used to support managers and training providers in their wish to understand how healthcare staff learn, and to suggest improvements in support, to develop better, personalised, timely, and cost-effective ways to facilitate online training.

The results of the study will be written up in a thesis as part of the researcher's Doctoral Level studies, and may be collated into a report for consideration for publications that will be read by health, training and social care professionals and other researchers. We would be happy to send you a free copy of a summary of the research if you would like one.

Who has reviewed this Study?

The research proposal has been reviewed by two academic supervisors and at the University of Wales Trinity St David and the University Research Degrees Committee.

Feedback about the Research

Once the research has been completed, the research feedback can be provided to participants. It is hoped that the research is an enjoyable experience and your participation will make a difference in contributing to our understanding about staff experiences of online training.

Confidentiality

The researcher will not tell anyone that you have taken part in this study. The people taking part in the research will be anonymised by using pseudonyms; this is the giving of names other than real names.

The research is undertaken as part of a Doctoral level study by the researcher and the only persons who will view the original data are the academic staff at the university who assess the collation of the data. The thesis anonymises participants and any further research conducted as a result of the outcomes of the study will also anonymise participants taking part in the study.

Data held by the university in relation to research undertaken is stored securely.
Everything you may say therefore in the course of the research is confidential; no one external to the study will know who said what. However, in the very unlikely event that the researcher is concerned that either you, or others, have been put at risk of harm during an interview, or if information has been disclosed that someone is being, or is at risk of harmed, the researcher would need to inform the proper authorities.

Approval to Carry out the Research

This study has been reviewed and given a favourable opinion by the Research Ethics Committee of the university. A Research Ethics Committee is a group of independent people

who review research to protect the dignity, rights, safety and well-being of participants and researchers.

Who can I contact if I have a Concern or Complaint about the Research?

You can contact the researcher, Rokhsareh Kavian, (details below) if you have any concerns about the research.

If you have a concern or a complaint about this study you should contact Postgraduate Research Committee, pgresearch@uwtsd.ac.uk

Contact Details:

If you have any questions about the study please contact the project leader, Rokhsareh Kavian, 1601702@student.uwtsd.ac.uk

Appendix C

Interview Questions

1. Demographic Questions:

1) What is your current position?
2) How many years have you been working in care? *if Yes:*

   3a: How many years have you been working in this organisation?
3) What is your age?
4) Do you use a computer at work?

   4b) if so, What do you use it for?

   4c) How frequently and for how long do you use the computer at work?
5) How do you look up or search for things related to work, such as patient's conditions?
6) How often do you do your online training?
7) How does your manager check that you have achieved the outcome aims of the courses you have undertaken online, do they use online tests, assessment of practice, or another method (exapnd on this)?

2. Questions covering research objectives:

2.1. Effectiveness of Current Online training/ E-learning System:

1) Was your training affected by Covid? If Yes/No, how? What has changed since pandemic? And how do you find it?
2) Can you please describe the online training package you have been provided?
3) Do you have the option to choose between online courses and course materials?

   3b) if so, what did you choose and why?

4) Did you receive training to use the e-learning system, for example how to switch between screens?If NOT how did you learn how to use computer and/or the online training system?
5) Can you tell me about your experience of online training / e-learning?
6) How do you keep youlself up to date with your online training courses?

   →Was there anytime you weren't updated? If NOT updated, what do you believe are the reasons for this?
7) Have you undertaken any online training with any other health care providers? If yes: What was your experience of the system?
8) How has online training impacted your decisions that you have made at work?

2.2. Advantages, Disadvantages & Challenges of Online training/ E-learning:

9) What are the other types of training you have done and how do you feel about them?(ex: What are the advantages and disadvantages of classroom-based learning for you?)
10) What are the advantages and disadvantages of online training for you?
11) Based on your answer to the previous questions, how do you prefer your training? Can you elaborate on reasons for your response?
12) What are the challenges of using online learning for you? *(ex: time, environment or cost or any other challenges)*?

2.3. Interviewee's suggestions for adopting personalised AI based e-learning:

13) What do other colleauges think of the engaging aspect of online training package?
14) How engaging do you find the current e-learning package and online materials for you?
15) What do you think of the difference between the mark you receive for online module you perceive to be engaging, versus modules you do not find engaging?

16) How do you describe your learning style? For example are you a visual learner, do you learn best doing tasks ‘hands on’, or reading text e.t.c.
17) How do you think your learning style has been considered in the online training package?
18) If you were advising the organisation regarding online training package they have provided for you, what are the main changes or improvements that you would recommend to make online training more engaging and personalised for you ?

Thank you for considering taking part in this research. That conclues the formal part of the interview, is there anything else you want to add? Or if you have any questions for me?

Appendix D

Sample Interview Transcript

Q. No.	Interview Scripts/ Actual Words	Interpretation	Coding/ Sub-themes	Themes
1.4	…I've got my obviously phone my favourite, so I use my phone for a lot of stuff that I do, so my training all I do on my phone that we do here... my kids have got laptops but cannot always access their laptops 'cause they use them for college and school and stuff. And so I did all my training for here on my phone and obviously for work we use these pod things. That's all on the computer....	Participant uses phone to do e-learning, check email and work-related stuff. She does her e-learning at home. Staff use electronic device at work and she is familiar with electronic devices.	• Difficulty accessing electronic devices. • Some online courses are not relevant to job description. • Lack of hands-on, and human interaction with other colleagues/ instructors. • Frustration with the assessment process in e-learning. • Lack of engagement with online courses as they are long winded and boring courses.	**Theme Three:** Issues and challenges that e-learning poses to healthcare staff can act as barriers toward adoption of AI based e-learning
1.6	There was basic first aid training on the online one and but then it's like CPR and stuff like that we did here face to face. I think it was very basic online and but the face to face was actually doing their compressions and choking and stuff so it's alright to learn about it online, but I think to do stuff like that you do need to actual physically do it to experience what it's like.... The hoist systems and stuff have changed, so to actually physically do it was much better for me to be able to learn than just watching a video of it. It was a lot of hours to try and fit in. Before I started of training, it was that I think each one was about between half an hour to	She needs to actually physically do it to experience what it is like. NHS training, more intense and more face to face compared to the care home. E-learning was time consuming for her.		

2.1.2	an hour long. Each actual bit of training Yeah, so it did take a long time to do....	
2.1.3	We would have load mandatory ones to do and they were quite vast to deal with specifically to deal with what we were doing with...	Complaining about the number of mandatory training she had to do before she starts working.
2.2.9	Training more enjoyable, which then for me I take it on board that rather than just looking at a screen all day, that's why I do care work 'cause I couldn't sit in front of the screen all day....	She mentioned she enjoyed the face to face training.

2.3.15	So although sometimes I think, oh God, I've done this like 15 times, I will make myself watch that video because stuff would have changed, as boring as it might have been.... They don't tell you which one you failed on, that's the thing. What's the point of that? You just say, well, tell me which one I've failed on so I can actually learn from it.... It wouldn't tell you which one you failed on, so you would just do the whole course again and you wouldn't specifically be picking out that one bit of information that you hadn't taken in, and you might fail it again, so you're not actually learning anything from it because you're still failing on the same thing, whereas it's surely it's better to do your online training and then do the thing and then say actually you failed on this one. Specific thing let's talk you through that bit more, so you understand it because just keep doing the watching it. You know doing the questions. Failing it yeah a few times. I don't see the point in that....	She said it can be boring when you know the topic and you have done for a long time but she would still watch the video. E-learning does not tell her which question she failed on. she feels if she was told which question she failed she would learn for it.		
2.3.18	…having to do it on my tiny little phone because I don't own a computer, might you know I could say my kids have got one, but I think that would be the only thing for me really....	she does not own computer and she does her e-learning on her phone.		
2.1.1 & 2.1.7	So the whole pandemic I worked for the NHS so it was really quite strict through the pandemic for the NHS with regard to PPE and visiting and stuff like that. And so we did have to do extra training that we got sent to do to be able to deal with patients. And their behaviour towards us if they don't want to wear a mask. Uhm, some of that was from like teams and stuff, so it was	she was working for NHS during Covid. She did extra training because of covid. Face to face training mostly changed to online. she did not have many	• The majority of face-to-face training was cancelled and became available online. • The number of people in group	**Theme One:** Knowledge and understanding of personalised AI based e-

	online but like face to face thing but on the computer. And so we did quite a lot of that. Uhm, to do training, join the pandemic for the NHS and then some of it was online. Some of it was just like pieces of paper that had guidance and stuff on. First aid we only did every so many years anyway, so I'd only just done mine before the pandemic started. And so I think we only had one face to face one during the pandemic for the NHS and that was I think 2 Of us in one room a big open ventilated room and before it would have been groups of us. But obviously we had to sit part I remember. Uhm, I can't remember what that was. It might have been, I think that might have been a first aid but using the AEDs because we had new ones that came into the NHS where I worked. So we literally one member of staff that was teaching us and then we would sit, they would sit one side of the room. We would sit the other side of the room and they would demonstrate and we would just sit and watch. We weren't allowed to touch anything like we would have done before. We would have been involved and had got to trying it out on a dummy and stuff, but it was proper quick. It wouldn't take very long. So before it would have been more intense, we would have been in a group and got to practise with the AEDs to make sure that we knew where to place the pads on. And you know to do the stand clear bit and everything like that. But we didn't. It was just us and a trainer and masks on, big room, ventilated windows. no, they just... We just watched that. So it wasn't a massive change of AED, it was literally, I think,	face to face to do as she did it before pandemic started. One face to face was done in a big ventilated room during Covid, in a small group and done very quickly to minimise the risk of spreading covid. she compares face to face trainings before and during Covid being more intense before covid but it was very brief during Covid. she described the procedure during pandemic for safty. she found it very sad and heartbreaking as dads could not attend their child birth because of covid (while she was working in hospital for NHS).	training was minimised. • Government's lock down policy for attending care homes. • Less involvement in hands-on activities in group sessions.	learning is not well understood amongst healthcare staff, during COVID-19 period

	the pads had changed because the pads had gone from having an adult pad and a child pad to them being combined. So you could place the same pad on either a child or an adult. That was the only change, so the rest of it hadn't changed very much. The rest of the process was exactly the same. I think personally, because we'd heard for me because I'd already had quite a few of those training sessions with the AED and stuff like that. It didn't really make a huge amount of difference not using it again because it was all the same placement of the pads and stuff. It was just literally the pads were different. That was the only difference, and it was a newer looking machine, but It's the same. Yeah, yeah It was alright, yeah didn't really bother me. It was worst doing like the fit mask test and that was the worst thing when we had to go and do that and was the worst thing really to be honest. It wasn't really nice, yeah, proper closed. cause the Birth centre was actually closed for birth and for postnatal ladies to keep all the ladies safe because there was an ambulance issue at the time so at the birth centre we would have to, if a lady had an issue they would be transferred by ambulance to the Princess Anne Hospital. So for that very reason to keep everybody safe, our births and our postnatal ladies couldn't come to us so we were just open for clinics and we didn't have any COVID cases that came in to us for the clinic so and they had to test every time they came in. In fact at the beginning of COVID when it first came around, only the mums and the babies were allowed in. The dads had to stay outside, which was really sad. 'cause it's a massive thing isn't, you know, birth, see baby so yeah it's. But it was really... Was really hard but yeah, like I said, we didn't	She mentioned that Healthcare support workers for the NHS would do a lot face to face. She said she did in groups and face to face before COVID in NHS.		

	have any covid cases. Yeah, I don't. I don't know. I think uh, like I say it's so quick and the room was massive so we were masked up and stuff, and we all had our vaccine. If you haven't ever vaccine, you weren't allowed to work, and people were shielded if they had any health concerns. And so not particularly specifically me. I would do basic, but like the healthcare support workers for the NHS would do a lot face to face. different procedures and stuff that they would get involved in. Mine was really basic because I was a housekeeper.....			
1.6	… I think you need to be experiencing it to, you know when you're handling residents And stuff. I think it's much more Works better for me if I'm shown how to do it in person rather than just watching the video....	she said hoists system changed, and she preferred to be shown at rather than watching videos online for patient safety.	• The various learning styles of individuals in online courses is not considered. • Face to face training is considered to be necessary along with e-learning. • Lack of personalised online courses relevant to job description. • Lack of required equipment and support for	**Theme Two:** Healthcare staff perceptions of adopting personalised AI based e-learning reflects lack of clarity
2.1.2	…I thought that was really good. I actually quite enjoyed.... ...Apart from I had to do it at home	She is happy with the e-learning provided; is very well done, very relevant, very good, really enjoyed it and access to more courses.		
2.1.3	you can't choose, It's all involved. It's all the same thing, so you would have a continuous video that would have like bits that flash up and different bits of writing.... The good thing is that you can actually go back And rewatch it before you actually do the like the question bit at the end so you	she mentioned e-learning was a mixture of videos, texts, pictures and etc.		

	can go in and out of it and it doesn't wipe out what you've already done, so you can start or from where you left off or you can redo it again, which is quite helpful when you're distracted.... …I've always done this one here all my training has been done at home. Apart from that first aid one....	she liked it because she could go back and rewatch it before doing the question at the end. the information does not get wiped out. So she could start from where she left off. there was an option to redo it again. she found it quite helpful because she gets distracted at home with kids. she does her online training at home. she did all her e-learning at work when she was working in NHS.	adopting new changes. • Lack of human interaction with other learners and instructor. • Various attitudes towards adopting personalised AI based e-learning. • Staff Learning style has not been considered resulting in a lack of staff engagement in e-learning.	
2.1.4	training on how to use it, no. just purely because I just got my logging things I went on to it....	She does not require extra support and training to use e-learning.		
2.1.5	Just for the distraction bit, I think it's easy to do at work... I think they're both about the same to be honest, I don't think there's much difference in them both. before obviously before came here for the NHS, a lot of it because of what it was. I suppose with babies. And for life support, especially, whereas a lot of our residents here have got a, you know do not resuscitate thing. Whereas when we have pregnant mummies and stuff, a lot of that we had to do in groups and stuff face to face before	she got confused as video worded differently the actual question. she googled it. she got the answer wrong and had to do it all over.		

	COVID.... but like the healthcare support workers for the NHS would do a lot face to face.... Uhm, the NHS one was more... It was just watch it and then answer questions at the end you couldn't go back through the course if you would do it, you would either pass it or fail it and then if you failed it, you just have to do the whole thing again. Uhm, because you couldn't stop it and go back to sort of rewind it, whereas this one you can rewind it back through so you don't have to look at the whole video again. You can rewind it from a certain point and then then do your course whenever you know the questions. Whenever you're ready whereas the other one you would just watch it. pass it or fail it... watch it.... yeah I did manage to do that for some of them. Which was helpful because the only thing I found is that a couple of the like what they said in the video. And then the quest specific question they answered that you would answer. The details were just a bit out, so I clicked on a few and got them wrong because. For instance. I can't remember it was now, but there was one and it said but something about between this and this. And then the actual question. It gave two different numbers and I got a bit confused and then when I googled it, it was a completely different number altogether, so that I found it quite difficult 'cause I couldn't get my head around the number bit because they were slightly very slight different... the way the video worded it and then the way the actual question worded it, the numbers were slightly out. So and I got that wrong, but I mean you could do it again....			
2.1.7	the NHS one was more... It was just watch it and then answer questions at the end you couldn't go back through the course if	She said with the NHS e-learning, she did not		

	you would do it, you would either pass it or fail it and then if you failed it, you just have to do the whole thing again. Uhm, because you couldn't stop it and go back to sort of rewind it, whereas this one you can rewind it back through so you don't have to look at the whole video again. You can rewind it from a certain point and then then do your course whenever you know the questions. Whenever you're ready whereas the other one you would just watch it. pass it or fail it... watch it....	have the option to pause, stop and rewind the course, she had to do it all from the start. The ones in care home are more flexible.		
2.1.8	Some of it comes a lot of it I would say come from training, then putting it into practise and listening to my colleagues and stuff and how they reacted to it because I was so new. you know, learning about each resident and the way they communicate. It was, yeah So it's a bit of both.... I think combined, I think combined. Yeah, definitely. I think you need both of those to be able to be an alert. For me anyway, I need that combined bit to be able to pick up stuff properly. It's all very well just watching it online, but sometimes I do need that face to face things.... I think it you would have to pick out ones that would work where they would they would work together and complement each other rather than just broad ones where I'm trying to think of an Example for instance. Fire, I don't think you would need to do online and face to face one for fire, because I think it's very self-explanatory fire. You either deal with it or you don't deal with it. This is the fire extinguisher. You either know how to use it and use it or you don't. It's quite basic, but I think for stuff to do with actual Residents and behaviours and stuff that it's got lots of grey areas. For me personally, I think a bit of online and a bit of face to face, and I think so more beneficial to me.... I think you can get a lot more from a person from facial	She found listening to her colleagues how to deal with situation helped her making right decision at work and her personal life. she put all the information together from different sources to make a right decision. she believes that in combined training in order to be alert and make a right decision. she prefers face to face as well as watching videos online. she believes some courses (such as fire training) are self-explanatory and can be		

	expressions from the way they speak in person body language, and I don't think you can get that all from VR Yeah, it's my opinion. I think in some cases VR would be really amazing. I'm trying to think of an example, but I can't, right this second, but I think it would be. Uhm, but for me personally, some things I think face to face. And I think stuff like... when people fall It's OK watching on a video, somebody helping somebody to get up but...however, to deal with somebody pretending to actually have a fall and their own emotions and all that side of thing. how scared they'd be. You can't learn that from just online. And I think when you are... 'cause you sometimes.... you would do that in groups and for you to be the person that's on the floor and people are lifting you about moving you how that actually makes you feel and how that might make the person that you're looking after feel. I think that's quite important for me.....	done online but some courses required face to face as well. facial expressions and body language are important in her learning and cannot be achieved via Virtual Reality.		
2.2.10	No, I think the only time, probably. Because it does take a lot of time to do it. Although they do videos and stuff for some of it, obviously some of it's also reading... and reading does take a lot of time, obviously. yeah, I think all training takes time. Anyway, it doesn't matter what you learned about to say it's always going to take varied amount of time. I suppose it depends on what it is. I find looking at a screen bores me to death. It gives me headaches... the concentration that I have to do on an online training is quite intent to me. So yeah, I find a concentrate more on there, which then would give me a headache... And you're very isolated when you're just doing it online. So although I don't like particularly like doing actual group stuff, you know we all have to get involved, and I don't really like that. It is beneficial so I will do it because I find it beneficial and you do have social interaction and you do have	time consuming. Gets bored looking at screen. she gets headache concentrating on screen. feeling isolated. Challenging, too many online training courses at the start to fit in 2 weeks. She does not like group training. She found the social interaction of face to face beneficial. different procedure to		

	that. you know you can have a laugh and it makes the training more enjoyable, which then for me I take it on board that rather than just looking at a screen all day, that's why I do care work 'cause I couldn't sit in front of the screen all day. I just don't like group stuff. I've never liked group stuff and you know that whole bit. Hi, I'm... [introducing herself], in front of the group it freaks me out ever since I was at school. I do it and like I say it's beneficial at the end of it for me. I just don't like. I just don't like it to start with.....	deal with situation in the care home compare to hospital(her previous job) so training would be different.		
2.3.13	I don't think I've ever spoken to anybody about it. That's how we do it in that. Yeah, online you just ….just done it. Never speak about again.....	never spoke about it with colleagues about e-learning.		
2.3.14	I find I'm able to concentrate on it better when it's a mixture of people doing stuff that you can watch. UM, say for instance.... They did do some moving and handling on one of the videos and they did show you what to do, which was great to be able to watch it. It was also great for them to be able to talk you through it online, so it was really helpful and it did engage me, and it kept my attention. And I think most of them were exactly the same. They had the talking and so it did keep you involved.... There's some stuff that's just boring. isn't it? for instance control of hazardous substances. I don't know how you can make that any more exciting, and because you've done it over and over, and you know, I've done it in all my jobs. And in parts of it here. I don't know how many times you can talk about chemicals and stuff. That make it interesting to be honest with you....	she found the e-learning engaging because of the different stimulus in the course, such as different people talking and presenting. She said it did keep her attention and kept her involved. She believes that some topics are just boring and not easy to make them interesting and engaging.		
2.3.15	Sometimes all I want to do is skip. If I think I know it and I've done it hundreds of times.	she deliberately watch all the videos just to		

	Sometimes I just want to skip the video and just do the questions. But then I might completely... so I deliberately watch all the videos just to make sure that I get the correct content that I'm going to need. Because stuff changes, doesn't it? You know rules and regulations change.....	make sure she gets the correct content that she need to know.		
2.3.16	my learnings is definitely watching people in person as well as reading stuff. you know, watching. I think I'm an all-rounder for learn and I think I need a lot of different stimuli to help it go into my brain and stay there for sure and also writing Stuff down, I find writing stuff down really useful. So if I'm learning I will take notes so I can flip back to them because That's just the way I've always learned, you know, even when I was doing my GCSE's, I would always use a mixture of different things to learn. I'll the notes for as long as I need them. Then I just discard them, but for a short while I will refer back to them for sure....	Prefer: watching people and reading. Need different stimulus to learn and retain the information. She takes notes and keep them to refer back to them when she needs them.		
1.6	…and then you can add on extra bits onto those if you wanted to learn extra stuff. There's different programmes on that system that we use so…. I'd say everything I've actually learned from the online training here. I think personally is relevant to the residents I work with and for that yeah and the environment I'm in.	She did her Mandatory training online. There is opportunity to do extra with optional courses online. e-learning is relevant to residence and environment in the care home.	• Learning and training are accessible from anywhere at anytime. • Opportunity to access various optional courses online, assisting with career progression. • E-learning courses are related to residents' needs and can positively	**Theme Four:** Factors influencing employee empowerment in adopting personalised AI based e-learning are at an immature stage
2.1.2	I thought it was very well done. How the actual training on there. As I said it's very relevant for here and there's also you can also access other stuff that you want to learn about within your healthcare setting. So I thought that was really good. I actually quite enjoyed....	participants have not done any extra (optional) training online.		

	No, I haven't gone into the library bit to do anymore yet, no. The various access there, yeah. So if I wanted to, yeah. you can just go onto it And just click on it. As far as I am aware....		affect staff confidence in acquiring knowledge and decision making. • Official certificates for e-learning courses should be available. • The entitlement to be paid for time spent on e-learning.	
2.1.3	and Then you could do extras for the NHS. But some of it if you want...If it was outside of your work remit and you would have to ask your manager whether to do it 'cause they might see it as just pointless if it's completely out of your job description, why would you particularly need it?.... here I got paid for my hours and for the NHS it would be done in your work time anyway. So yeah, so all my hours that I did before I started that training I got paid for. so when I first started here in April before I started, I had my however many hours It was 40 hours of training to complete by the time I started and they paid me for that training.... the NHS our training would be done While we're at work, We could access it at home and, but we would Have to ask a Manager whether we could be paid for it if we did it at home. yeah you would get paid for, as far as I'm aware....	there is an option to choose between the optional courses. she mentioned in NHS, if she was interested in an optional course and it was not relevant to her job she had to ask her manager. she got paid for the e-learning hours she did before she starts her job. she got paid for the face to face first aid.		
2.1.7	before obviously before came here for the NHS, a lot of it because of what it was. I suppose with babies. And for life support, especially, whereas a lot of our residents here have got a, you know do not resuscitate thing....	Different e-learning content, relevant to the environment.		
2.1.8	I'm just trying to think with regard to dementia, I suppose. The training for that I found really, really useful, not only for here about communication with dementia patients because my mum's got dementia and see, so I would speak to her in one way because she's my mum but actually from a professional point of view, certain things I wouldn't say to somebody in care. does	she found e-learning very useful. The knowledge she got impacted her personal life with her mum having dementia.		

	that make sense? And, Yeah I think just yeah, just communication. When I do find really helpful. Uhm, you know talking to people on their level and talking to them in a way they would understand and stuff. Uhm, that was really helpful for me because I think 'cause I've worked with so many different source people and dementia patients... residents can...They have their own issues and their understanding and the way they would go from past to present and stuff like that. I found that one really that really useful.... I suppose so, yeah, but it just gives you a broader, a broader range of things to pick bits out from. So you can, yeah gather different bits and knowledge.... Yeah, 'cause you know it's hard when it's your parent because you've got your own emotions attached to it. Yeah, trying to take away some of that motion to then deal with some of my mum's outburst, which she does have has been quite helpful....	She put the knowledge in practice, and she is enjoying it and found it helpful.		
1.4	all my training I've done at home so I had to complete it before I started And it was like quite a few hours worth of about 40 hours worth of online training I did before I even started it. It was it took me ages because every time I sat down the kids are like mum. What we've got for tea...	Restricted policy on completing e-learning. she had to complete 40 hours of e-learning before starting her job. time consuming because she did it at home and challenges with kids at home.	• The entitlement to be paid for time spent on completing personalised AI based e-learning. • Address difficulties in; managing work-life balance, encountering a lack of allocated time, and having a specific location for	**Theme Five:** Influencing factors required to drive the adoption of personalised AI based e-learning are not well defined
1.7	Because I think it's all online. I think they can, just they can just get into the system and flag up all what we've done so it gets checked every month... during my induction my managers talked to me. They haven't talked to me since my induction period as such. but every month before we get paid they would go through and say it's	managers have access to the record as everything is online. Restrict policy with completing e-learning, check every month that		

	just because it's the end of the month. That's all I think, and they would cheque what learning we've done and if we're up to date and stuff so and then they just e-mail us if we needed to update anything that's flagged up so. so the message when I've done my training, it's been [administrator] downstairs. UM, that has told me what I needed to do and got me onto the system and stuff to be able to do it when I first started and then through my induction, it was the head of care that I've had my interviews like my probationary interviews And just talk to me about what I've learned and stuff so.	staff completed and are up-to-date with their required e-learning. Email is one of the way of communicating with staff regarding their e-learning. Head of care had a meeting with staff after e-learning for feedback on their learning (organisational procedure).	completing online training. • Limited facilities and lack of electronic device compatibility for an effective outcome. • Clear guidelines and policies for adopting personalised AI based e-learning. • Staff with disabilities, and those with difficulties adapting to new changes in the system must be considered. • The lack of practical and hands-on aspect of e-learning can have a major impact on patient safety.	
2.1.2	So when we log into our learn and it will say which ones are mandatory and when they need to be done by so there's a set date that we need to do in by and how long they are. It states how long each one is, so yeah....	A lot of hours of online training before even starting the job, (organisational policy). restrict policy for completing e-learning in a designated time frame.		
2.1.4	They told me that they kept...I got emails constantly through of which ones were my mandatory ones. Yeah, and so when I went on to my training I knew exactly which ones I had to do and then when I'd completed them I would get another e-mail to say that It's completed. So I could literally tick them off. It is very... the login [administrator] downstairs. I got sent in my log in through an e-mail. So once I got my e-mail to say that I could how to log in. I could then log into the training and like I say, they sent me a list on via e-mail of which ones were my mandatory and also on the training, the online training page, the front page, it says	clear guidance was provided for online training. email was the way of communicating regarding online training. straightforward process to access assigned courses online. she found e-learning very basic and easy to		

	which ones are mandatory, which ones are extra.... no, no, I could just e-mail her if I had an issue or text her or whatever.... not further assist not for that system that we've got. No 'cause it's really simple....	access, quite self-explanatory. organisational support with issues and challenges with e-learning done one-to-one and/or via email.		
2.1.5	this one, as I said I did it at home I got distracted quite a lot because I have got quite busy household. I'm a single mum and I've got although they're older they still obviously require my attention. They want lifts everywhere and they're in and out, so it's I found it quite distracting and I haven't really got anywhere in my house To go where I can just lock myself away I've got my bedroom. But like my kids spend quite a lot of time just sat on my bed talking And stuff so they would come in and out. And although I'd say to them, I'm doing training if somebody knocked on the door or I don't know whatever they would they would knock on the door and and they wouldn't mean to be disturbing me, but it would for that few seconds. And that's the only thing I find with online learning at home. you can be distracted really easily. When I worked for the NHS because we did it at work, we could take ourselves to a separate office. Sit a computer and that's what we would do. We would just be doing online training, UM, so there weren't any distractions. So yeah. Distractions. My only thing I Think.... There's nowhere really to go to be honest. Not when we are on shift, no. No, we haven't got the staffing capacity to be able to do that here. No, no not on your shift....	she gets easily distracted at home as she has a busy household. even gets distracted at work with buzzer and work duty call. Struggle to find a quiet place to do online training at home. When she worked for NHS, she used separate office on a computer to do her e-learning with no distraction. In the care home, there is no dedicated office or computer for training and doing e-learning at work. staff are very busy during the shift and because of staff capacity it would not be possible to do e-learning in work time.		

	so if you're at work you haven't, you haven't got any chance unless you sat on your break, but We're already still sort of on call if we're on our lunch break in our break 'cause we get paid for them. So if an emergency happens, we would have to come off, operate to go and help. So yeah, you won't. You can do it in your in your break time. You certainly couldn't do it if you're actually at work, there's no opportunity to do it. It's too busy.... I mean if they said to me we'll pay you to come into work, but not actually be at work, you would just come in to do training. If there was somewhere to go, like if it was up here to do it or something, I don't. I haven't asked if I could do. But if that was an option, then yeah, I'd probably do that rather than do it at home.... it's just... there's just too much. It's not so bad if I'm off and the kids are at school. That's not an issue, or college or work or whatever. 'cause they are work in college and school. Uhm, but because it was, I think it was like Easter or something when I before I started It, they were all home apart from one, uh, because she works at the general so. Yeah, it's purely just distraction and you'll always get distracted at Home. I think I would probably prefer to do it on a bigger screen. My phone was just for convenience and because I haven't got the use of a laptop at home all the time. Like I say, my kids use it for college and college and school and my daughter sometimes takes it to college so it is not always available. So it was just my phone.... we would receive emails. ... We would have to go onto our training just to cheque all the time and then and we would get emails as well, it's sort of exactly the same, so there's no. No, we would for the NHS that we have specific training team	she lives near the care home, and if she gets paid for doing e-learning at work she probably rather coming into work (it would be only to do e-learning no work duty). she mentioned there was no dedicated place to go. she prefers to do her e-learning on a bigger screen but she does not have that facility and she uses phone for convenience.		

	and then they would e-mail you if Anything was coming up to be due. And but we had to go online anyway to cheque it so....			
2.1.8	I think combined, I think combined. Yeah, definitely. I think you need both of those to be able to be an alert....	she put all the information together from different sources to make a right decision. she believes that in combined training in order to be alert and make a right decision.		
2.2.10	You know my kids are all out and about anyway, generally. As long as it wasn't like a whole day. So when we've done first aid training here, it was half a day, which wasn't too bad. A whole day I think, would bore me to death by the end of it, and I've got a dog at home that I have to obviously look after. I've got my mum that I care. For so for me time I suppose is a massive thing. 'cause I would have to arrange other things to help with the whole day thing.... Oh no, I suppose the training here would if I went somewhere else it would be relevant. It wouldn't be accepted, but I would have to redo it again. Just like all the stuff I've done for the NHS of some of it I would have... you know... training doesn't really... Although you've done it, I suppose like first aid you could bring with you. If it's a proper certificate. Food hygiene you can bring with you if it's a proper certificate, but if it's not a proper certificate for a company...but I think you still need to do it to be honest...	e-learning can be relevant to another place but would not be accepted unless it is official certificate.		
	just for me, I think I would. There's nothing wrong with the training. the training I found has been actually really good, the online training The only thing for me is having to do it at home. On my on my phone so I don't know....	Her only problems are doing it at home and doing it on her phone.		

2.3.18	I just yeah, I think equipment wise. I suppose if I had a better equipment to be able to do it, whether that is a computer at work, to be able to specifically do it on rather than having to do it on my tiny little phone...	Doing it at home, she gets distracted. And she preferred to do it on a computer (bigger screen) at work as she does not own computer than on her phone.		