Informal Learning using Hybrid Social Learning Networks for Continuing Professional Development Amongst Dental Professionals in the UK

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Abstract

Background:

The background presents a comprehensive examination of how dental professionals in the UK integrate social networks into their daily practice. They rely on online resources for just-in-time learning, acquiring essential knowledge and skills when needed. The General Dental Council (GDC) oversees dental professionals, setting standards for practice and protecting patients' interests. The GDC's regulatory framework has historically undervalued informal learning, partly due to limited evidence of its effectiveness and the challenges in evaluating its outcomes. Nevertheless, dental professionals actively engage in self-directed learning, with social media playing a valuable role in their professional development. The complex nature of social media demands further research, necessitating the development of a comprehensive conceptual framework to explore the interconnected aspects of networks and informal learning and its complexities.

Objectives:

The primary aim of this research is to acquire comprehensive insights into the utilisation of Hybrid Social Learning Networks among Dental Professionals in the United Kingdom, specifically concerning their professional development. The study explores how these Dental Professionals engage in learning, exchanging information, and sharing their experiences through various networks, as well as their attitudes towards the adoption of technology.

Methods:

An online survey employing a fixed mixed methods design was utilised to gather both quantitative and qualitative data. The survey incorporated a combination of closed and open-ended questions to capture a comprehensive understanding of the research topic via the lens of complexity theory.

Results:

The data revealed a positive impact of personal use of social media on its professional application among dental professionals. They actively engaged with social media networks to collaborate with peers and experts, sharing knowledge and staying updated on professional developments. These dental professionals employed various resources for learning and shared their experiences across different domains. Notably, some variations were observed between age groups, with younger participants being more inclined to seek guidance from peers and experts. Additionally, Dental Care Professionals (DCPs) demonstrated a higher tendency to access and participate in professionally related Facebook groups compared to dentists.

Overall, both groups exhibited a preference for determining their own learning needs and believed in their ability to reflect on their learning requirements. While both groups found the internet to be a valuable source of information, they expressed concerns regarding the influence wielded by self-appointed experts within these online platforms.

Conclusion:

In the realm of continuing professional development (CPD) for dental professionals in the UK, a hybrid social learning network holds great promise as a platform that facilitates both informal and formal learning opportunities. The network can foster valuable informal learning experiences through peer-to-peer discussions and experience-sharing. Simultaneously, it can offer structured CPD opportunities through online courses and educational resources.

The integration of both formal and informal learning within a hybrid social learning network presents a unique opportunity to bolster the effectiveness of CPD and support ongoing professional growth for dental professionals. Regulators and CPD providers should embrace this approach and incorporate informal learning into their frameworks, thereby embracing all forms of learning and maximising the potential for professional development.

Keywords: Hybrid Social Learning Networks, informal learning, Dental Professionals, CPD, Social Media, United Kingdom

This thesis is dedicated to my wife Cathy who has supported my journey through this endeavour.

Declaration

This thesis has not been submitted in support of an application for another degree at this or any other university. It is the result of my own work and includes nothing that is the outcome of work done in collaboration except where specifically indicated. Many of the ideas in this thesis were the product of discussions with my supervisor Dr Janja Komljenovic.

Excerpts of this thesis have been published in the following conference manuscripts and academic publications.

Stanfield, W. J. (2020). Survey to Investigate UK Dental Professionals use of Social Media for Informal Learning. *Annual Clinical Journal of Dental Health*, *9*, 48-53.

Stanfield, W.J. (2022). Hybrid Social Learning Networks, a Survey of Dentists and Dental Care Professionals in the UK, Poster presented at BSDHT Oral Health Conference 2022.

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1. Introduction

This work endeavours to document the journey embarked upon to attain a Doctor of Philosophy degree, delving deep into the investigation of a topic situated within a dynamic and intricate subject area. The present chapter serves the purpose of outlining the background of the research and establishing the parameters that facilitate the interpretation of the ensuing results. Given the intricate nature of this study, it is my sincere hope that this introduction effectively explains the underlying rationales and the path I have chosen to traverse.

Following the submission of my proposal, I diligently engaged in an extensive array of readings, which have undeniably influenced the trajectory of my final research. While initially armed with a preconceived notion of the progression of my study, the exploration of ideas and concepts has fostered the emergence of novel perspectives, necessitating further in-depth exploration. This phenomenon is particularly pronounced in research involving technology, where advancements and modifications occur with remarkable rapidity, each bearing the potential to fundamentally alter the course of ongoing investigations.

Within this chapter, I embark upon the following tasks:

- Presenting an in-depth exposition of the research's background.
- Articulating a statement of the problem that this research seeks to address.
- Laying out the conceptual framework within which the research is firmly situated.
- Formulating the precise research questions that will guide and shape the investigation.

By undertaking this, I endeavour to establish a solid foundation for the forthcoming research, while simultaneously offering a comprehensive perspective that contextualises its significance within the broader academic landscape.

Organisation of this thesis

The next chapter (Chapter 2) reviews the literature, separating it into each of the areas pertaining to the different aspects of the research. Chapter 3 describes the methodology and the design of the research, with Chapter 4 reporting on the quantitative findings from the questionnaire.

Chapter 5 then describes the qualitative analysis along with the methodology of this phase. Chapter 6 reports on the integration of the quantitative and qualitative findings, bringing both aspects together to answer the research questions.

Chapter 7 sets out the conclusions to the research and how it will contribute to the dental profession in the UK.

1.1. Background

The author of this research is a Dental Professional, specifically a Dental Hygienist, working in the United Kingdom. Alongside their dental expertise, they possess a background in technology and education, which has influenced their perspective and approach to the research topic. This multidisciplinary background has provided the author with a unique lens through which to explore the intersection of dentistry, technology, and education. The author was also the owner of an online forum for Dental Hygienists, realising that these professionals were part of a Community of Practice and that they shared their knowledge between groups. This has given rise to the idea that has led to this research. The author, has during his career and in

furthering his education, had a positive experience of online learning. This may well be reflected in his positivity in aspects of the analysis of the data and in the use of social media itself. However, whilst having experience of social media, the author at the outset of this research only suspected that social media was contributing to informal learning in the dental profession, as it had added to his learning. As such the author has attempted to interpret the results with a neutral stance, however, acknowledges that there may well be an inherent bias.

In the United Kingdom, dental practitioners, akin to numerous other professionals, predominantly subscribe to a just-in-time model of learning (Lino et al., 2022). This entails garnering requisite knowledge and competencies at the exact moment of necessity or under particular situational imperatives. Such a learning strategy transcends mere compliance with regulatory stipulations; it represents an active endeavour by these professionals to augment both their conceptual grasp and technical acumen in daily practice.

In the United Kingdom, the regulatory body overseeing Dental Professionals is the General Dental Council (GDC). Comprised of six Dental Professional members and six Lay members, all appointed by the Privy Council[1], the GDC plays a vital role in safeguarding the public's interests. Dentists, dental therapists, dental hygienists, dental nurses, dental technicians, clinical dental technicians, and orthodontic therapists all fall under the purview of the GDC. The primary responsibility of the GDC is to establish and uphold standards of dental practice, ensuring that dental professionals adhere to these standards throughout their careers with the ultimate goal of protecting patients.

[1] The Privy Council is the mechanism through which interdepartmental agreement is reached on those items of Government business.

The establishment of the GDC can be traced back to The Dentists Act 1957, which was subsequently updated to The Dentists Act 1984. This regulatory body assumes various key functions, including:

- Registering dental professionals who demonstrate the required standards of education, training, and fitness to practice.
- Setting standards for dental education and training, thereby ensuring the quality and competence of future dental professionals.
- Investigating complaints regarding professional conduct or fitness to practice lodged against registered dental professionals.
- Taking appropriate action when a dental professional's conduct or fitness to practice falls below the required standards, including the imposition of sanctions such as removal from the register or suspension of practice.

Anyone wishing to carry out the business of dentistry in the UK must be on the GDC register as either a Dentist or a Dental Care Professional (DCP) (there are two registers, one for each group) and follow the rules to maintain that registration. As of 1st January 2018, regulatory changes have been introduced to the Continuing Professional Development (CPD) requirements to maintain a Dental Professionals' entry on the register (General Dental Council, 2017b). These changes have removed the requirement to record non-verifiable CPD (informal learning) and increased the number of hours of verifiable CPD. Added to this, is the requirement to have a Professional Development Plan (PDP) and the requirement to carry out a reflection on each learning experience (General Dental Council, 2017b)

1.2. Statement of the Problem

The regulator of Dental Professionals in the UK, the General Dental Council (GDC), has seemingly overlooked the value of informal and non-formal learning (discussed in Chapter 2) undertaken by registrants for their professional development. This omission can be attributed to several factors that have contributed to a lack of recognition of the importance of informal learning within the GDC CPD framework. Instead, they have embraced learning that is certificated by the learning provider, this can vary between short courses of one hour to post graduate credit bearing university courses. The author would contend that informal learning plays a large part in a dental professional's development, which will be expanded upon in Chapter 2.

A pivotal issue is the paucity of robust evidence affirming the efficacy and impact of informal learning among dental registrants. Research, such as the study undertaken by Eaton et al. in 2011, underscores the dearth of compelling empirical data in this domain. The elusive nature of informal learning, distinguished by its unstructured and impromptu characteristics, renders it problematic to quantify and assess its outcomes (Li, 2017). This evidentiary void may have precipitated the GDC's emphasis on more quantifiable and measurable avenues for professional development.

An additional hurdle pertains to the complexities associated with gauging and evaluating the ramifications of informal learning experiences. Contrary to formal education or regimented training programmes, which generally exhibit well-defined learning objectives and uniform evaluation protocols, informal learning is marked by its spontaneous and organic character. The absence of standardised evaluative metrics or instruments exacerbates the challenge of ascertaining the educational yield and impact of such informal endeavours (García-Peñalvo, Colomo-Palacios, & Lytras, 2012). Consequently, the GDC might have encountered difficulties in formulating a coherent

and reliable methodology for the accreditation and validation of informal learning within its regulatory framework.

Additionally, the evaluation and validation of informal learning experiences may involve significant costs and resource requirements. Conducting rigorous assessments and verifying the learning outcomes of informal learning activities can be resource-intensive and time-consuming. Allocating resources for the evaluation of informal learning may have been perceived as a significant burden by the GDC, leading to a lack of emphasis on this form of learning within their regulatory practices (Wallace & May, 2016).

However, empirical research has indicated that dental professionals actively engage in self-directed learning, leveraging their personal networks (Stone, Holmes, Heasman, & McCracken, 2014), communities, and the vast array of communication technologies available to them, including social media platforms (King, 2011). With the ubiquitous nature of social media which it is suggested has an impact on the learning of these dental professionals (McAndrew & Johnston, 2012) as well as other professionals (Prestridge, 2019), it is suggested this plays a valuable role in their professional development (Alsobayel, 2016; Ferguson, 2013; King, 2011; Schmitt, Sims-Giddens, & Booth, 2012) The collaborative approach to learning is embedded within social media where users are not only consumers of information but are engaged in the production, construction and sharing of their constructed knowledge (Davis, Ho, & Last, 2015) through sharing and participatory engagement in effective, multimodal learning communities (Cochrane, Antonczak, & Wagner, 2013; Sie & De Laat, 2014). Despite the recognition of the potential of social media for informal learning, there remain significant gaps in understanding its full scope and harnessing its benefits. Researchers such as Conole, Galley, & Culver (2011) have acknowledged the complexity of developing an overarching framework that comprehensively captures user behaviour patterns within social networks. They have called for further research to explore and comprehend the dynamics of online spaces.

Similarly, Sie & De Laat (2014) emphasise the need for more extensive investigations to unlock the potential of social media for learning, particularly in informal contexts. The multifaceted nature of social media, coupled with the absence of a dominant theoretical model or methodological approach, presents challenges to researchers in this field (Sawchuk, 2008). Masters, Ellaway, Topps, Archibald, & Hogue (2016) concluded that medical educators need to grasp the principles of the social and pedagogical uses of mobile technologies so that they may better prepare learners for a world where mobile technology use is pervasive and transformative. Insights into which may be achieved through the learners' perceived usefulness and perceived ease of use, which may be measured using the Technology Acceptance Model (TAM) (Davis, 1989a; Rauniar, Rawski, Yang, & Johnson, 2014a; Straub, 2009). However, this has been applied to institutional learning rather than informal learning but may give an indication of the use of technology.

Cilliers(2002) posited that "Connectedness requires a distributed knowledge system, in which knowledge is not centrally located in a command-and-control centre. Rather, it is dispersed, shared, and circulated throughout the system", see Figure 1. This representation captures the interconnections between nodes, which could be either actors, resources, or a confluence of both.

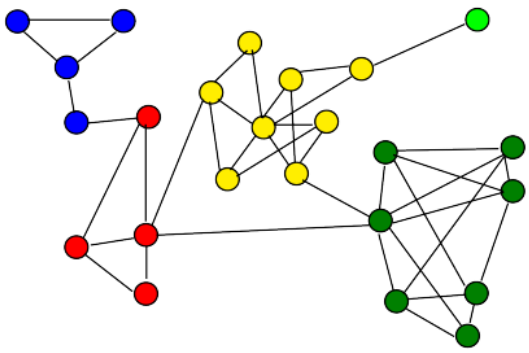

Figure 1- Network Connectedness – a visualisation.

In contemplating the multifarious networks utilised by learners in their interconnected world, existing research often isolates these networks for singular investigation (Cain & Policastri, 2011; Fewkes & McCabe, 2012; Greenhow & Lewin, 2019). This reductionist methodology neglects the intricacies of real-world interactions, where personal and professional networks intermingle both in analogue and digital spheres. This confluence gives rise to what has been recently conceptualised as a 'Hybrid Social Learning Network' (Cook et al., 2016).

> This type of network has many feedback loops: the output of a certain node can become the input to the same node, with or without passing through other nodes in the process. The activity of a node is therefore not only determined by its differences from other nodes, but also deferred until its own activity (and those of others) has been reflected back upon it. In this complex pattern of interaction, it is impossible to say that a certain sign (or node) represents anything specific. (Cilliers, 2002, p. 82)

Cilliers' explanation underscores the complexity of networks, which defy simplistic explanations and categorisations. Attempting to separate and isolate networks as distinct entities or studying them in reductionist ways disregards the holistic nature of their functioning. Thus, the development of a comprehensive conceptual framework becomes imperative to navigate the interconnected aspects and multifaceted complexities inherent in the study of networks and informal learning. Such a framework will enable researchers to visualise the intricate relationships, interdependencies, and flows of information within these networks, facilitating a deeper understanding of the phenomena under investigation.

To develop this thesis and the research conducted around it, there was a necessity to develop a conceptual framework. This conceptual framework would allow visualisation of the interconnected aspects of the study and the complexity involved.

1.3. Framework

"Complexity theory is a conceptual framework used for the purpose of analysing the behaviour of systems that consist of a large number of interacting components" (Semetsky, 2008, p. 79). It would be wrong to reduce each of the interacting components into their component parts, a reductionist approach, instead we need to consider the sum of the parts and ascertain the cumulative effects. "Conceived as an interpretation, complexity is a characteristic attributed by the observer to a phenomenon" (Alhadeff-Jones, 2008, p. 73), in this instance, the emergent phenomena are how dental professionals learn informally. It has long been acknowledged that we all learn informally and indeed it has been likened to an iceberg with only formal learning showing above the surface (ASTD, 2008) with informal and non-formal learning on a continuum beneath the surface. In 2016 Cook et al. presented a paper defining the notion of the Hybrid Social Learning Network (HSLN) in which they "proposed mechanisms for interlinking and enhancing both the practice of professional learning and theories on informal learning" (Cook et al., 2016). This notion of a hybrid professional learning environment suggests that people connect and interact through a network of physical and digital tools to construct and co-construct knowledge for their work (connectivism (Siemens, 2005)).

Many healthcare professionals, particularly dental professionals, work in isolation and have little chance for face-to-face meetings on a regular basis. Taking time out for formal learning can be problematic. It is suggested that these dental professionals have developed a HSLN, either consciously or subconsciously to learn what they need to at the time of need. However, what is not understood are the modifying factors that may be the drivers or catalysts that create the environment for learning to take place. These factors may well be their acceptance of technology and the applications which were developed not for learning but to facilitate communication. It could be that they are motivated, self-determined and self-directed learners, and it is more likely to be a combination of all of these. Therefore, we should not reduce each to its component parts, instead, we have to investigate them as a complex system. This complex system is constantly being modified by new or updated applications, people joining or leaving applications or Communities of Practices (CoP) etc., it is this evolution which makes it difficult to research and provides us only with a snap-shot at that time. However, any insight into how learners use these systems to aid their professional development can only be helpful for application developers, educationalists, and professional regulators both in dentistry and the wider healthcare professions.

The study of complex systems encompasses various models and concepts. Having a framework for making comparisons would be advantageous (Holland, 2014). However, it can be difficult to trace all of the agents involved and difficult to determine the changes in autonomy by the addition of new agents. These agents when first introduced may adapt and undergo improvements, becoming more specialised and able to exploit a particular source, alternatively something may happen that disrupts the trust in that agent, which can then influence if and how it is used. This shows all the signs of a Complex Adaptive System (CAS) and as discussed by Holland, (2014a), the diversity that results from continuing adaption presents a difficulty not easily overcome and the study of CAS is still in its early stages, thus only pieces of a theory exist. Although complexity theory is trans-disciplinary, it may be difficult to translate

the findings from dentistry/healthcare to other fields, particularly those grounded in mathematical abstractions can prove challenging (Walby, 2003).

Figure 2 illustrates a typical HSLN that a dental professional might employ. The utilisation of any aspect within this network may be modified by additional contributing factors such as an individual's acceptance of technology and their motivation to learn. Collectively, these factors determine how informal learning occurs. Recently, discussions surrounding networked learning have emphasised the integration of digital technologies into everyday life (De Laat & Dohn, 2019). Information and communication technology (ICT) is viewed as a means to an end by fostering connections, which aligns with the envisaged direction of this research.

This illustration at Figure 2 is not exhaustive but does illustrate the various aspects that the Dental Professional may utilise in their learning pathways both online and offline resources to combine formal and informal learning opportunities.

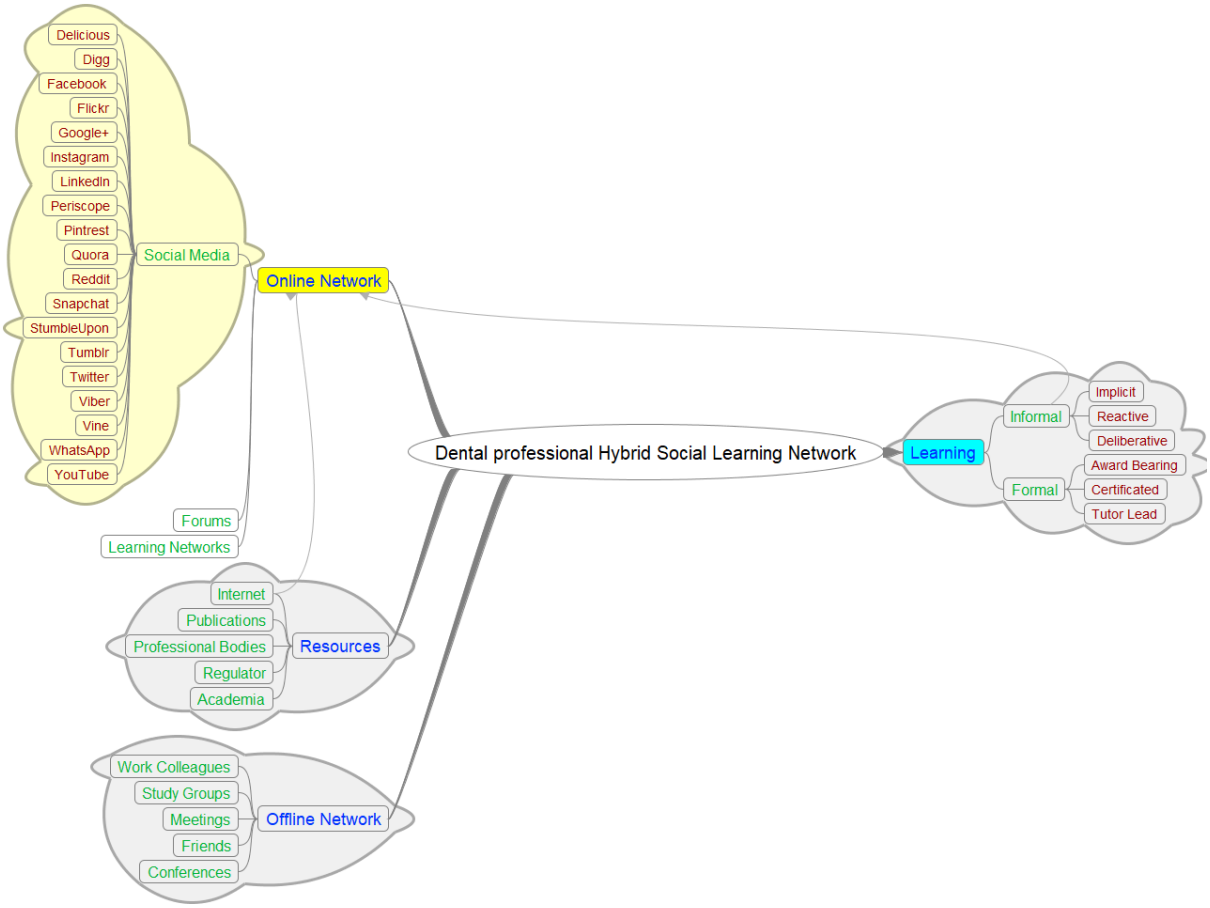

Figure 2 - HSLN graphical representation.

1.4. Research Questions

The overreaching research question is:

How do Dental Professionals in the UK use Hybrid Social Learning Networks for their professional Development?

The question emerges from an acknowledgment of the evolving landscape of professional development, where traditional learning structures intertwine with social networks. Within the framework of complexity theory, this query delves into the intricate interactions between dental professionals and hybrid social learning networks, recognising the nonlinear, emergent nature of knowledge dissemination and acquisition.

This is sub-divided into 8 areas: Together, these eight sub-questions form a comprehensive framework for understanding how Dental Professionals in the UK navigate the realm of Hybrid Social Learning Networks for their continuous professional development. By exploring each of these facets, we can construct a holistic perspective that enriches our comprehension of this crucial aspect of the dental profession.

- What, if any, are the differences in how Dentists and Dental Care Professionals use social media for professional use?

  The differences in how Dentists and Dental Care Professionals use social media for professional use may be influenced by a complex web of factors, including individual preferences, institutional context, and evolving technological landscapes. Whilst currently there is a move to joint training, this has not always been the case, therefore it is useful to establish current differences, in time, this may be revisited to view any changes between the groups. Complexity theory would view these differences as emergent outcomes of multiple interacting elements within the dental profession.

- What, if any, is the effect of age on the use of social media?

Age-related effects on the use of social media by Dental Professionals can result from a combination of generational values, digital literacy, and evolving social norms. These factors interact in intricate ways, leading to diverse patterns of technology adoption and usage.

- How does the Dental Professionals' use of social media for personal use affect professional use?

  The interplay between Dental Professionals' personal and professional use of social media can create complex feedback loops, where personal experiences may influence their approach to professional development, and vice versa. This dynamic relationship is a hallmark of complex adaptive systems.

- How do Dental Professionals prefer to determine their learning needs?

  Determining the learning needs of Dental Professionals involves navigating through a complex landscape of evolving knowledge, emerging best practices, and individual learning preferences.

- How do Dental Professionals collaborate with others in their learning?

  Collaboration is a central tenet of complexity theory, highlighting the collective intelligence and emergent outcomes stemming from interconnected interactions. Collaboration among Dental Professionals in their learning is an example of how the interactions between individuals can lead to emergent properties within the professional community. Complexity theory emphasises the importance of feedback loops and the co-evolution of interactions among agents in the system.

- What forms of networking do Dental Professionals use for their learning?

  The various forms of networking used by Dental Professionals for their learning represent a complex network of connections, where the flow of information and knowledge is dynamic and non-linear.

- What do Dental Professionals learn or share in their social networks?

  Complexity theory views knowledge sharing within social networks as an emergent property resulting from the collective actions of

individuals. It highlights the adaptive nature of these networks and how knowledge propagation can lead to novel insights and practices.

- What are the opinions of Dental professionals on the use of social networks and the Internet for professional development?

  The opinions of Dental Professionals on the use of social networks and the Internet for professional development are shaped by a myriad of factors, including perceptions of efficacy, concerns about privacy, and the influence of social norms. Complexity theory would recognise these opinions as the outcomes of complex interactions between individuals and their socio-technical environment.

1.5. Ethical Considerations

Ethical approval for this research was requested from and granted by the Faculty of Arts and Social Sciences and Management School Research Ethics Committee (FASS-LUMS REC) at Lancaster University (Appendix 2). Consideration was given to the anonymity of the respondents and to the security of the data. The informed consent of all respondents would be obtained before embarking on the survey.

2. Literature Review

As outlined in the introduction, the aim of this research is to explore Informal Learning using Hybrid Social Learning Networks (HSLN) for Professional Development amongst Dental Professionals in the UK, from the perspective of complexity theory. Consequently, this chapter will delve into the various concepts relevant to the research, offering a comprehensive understanding of the literature and presenting the definitions used in this study. Since the availability of literature specifically focused on HSLN is limited, this research will draw upon literature from other domains to establish connections and bridge the gap. This review will expand on the framework as posited in chapter 1. The following sectors will be examined in this chapter:

- **Professional Development:** This section will investigate the notion of professional development, encompassing the strategies and approaches employed to enhance the skills and knowledge of dental professionals within the UK.

- **Informal Learning:** Here, the focus will be on informal learning, exploring the process through which individuals acquire knowledge and skills outside of formal educational settings. It will consider the significance of informal learning within the context of professional development among dental professionals.

- **Heutagogy:** This section will explore the concept of heutagogy, which emphasises self-directed learning and the development of learners' capabilities to engage in independent and reflective learning. Its relevance to professional development within the dental profession will be examined.

- **Social Media:** The discussion will encompass the role of social media platforms in facilitating learning and professional development among dental professionals. It will investigate how social media can be utilised as a tool to support informal learning within the context of HSLN.

- **Hybrid Social Networks:** This section will explore the concept of hybrid social networks, which refers to the combination of online and offline interactions within a learning community. It will examine how HSLNs can contribute to the professional development of dental professionals in the UK.

- **Technology Acceptance Model:** This part will delve into the Technology Acceptance Model (TAM), which is a theoretical framework used to understand users' acceptance and adoption of technology. It will explore how TAM can be applied to examine the acceptance and utilisation of HSLNs in the dental profession.

- **Complexity Theory:** Finally, this section will discuss complexity theory, which provides a framework for understanding complex systems and their dynamics.

The application of complexity theory to the study of HSLN and its implications for professional development among dental professionals will be explored.

By exploring these sectors, this chapter aims to establish a comprehensive foundation for the research and lay the groundwork for the subsequent analysis and findings.

2.1. Professional Development:

Introduction:

Professional development is a lifelong learning process of enhancing and improving the knowledge, skills, and abilities of an individual in their chosen profession. It involves the acquisition of new knowledge, development of existing skills, and exposure to new ideas and best practices that enable individuals to perform their jobs more effectively and efficiently (Collin, Van der Heijden, & Lewis, 2012). In essence, the term "professional" in the context of learning underscores a focus on career-oriented development, aiming to enable individuals to excel in their chosen vocation.

Evans (2019a), interpreted professionalism into three main components, - practitioners behaviour, attitudes, and intellectuality, each incorporating more specific dimensions. From this she defined professional development as:

> the enhancement of individuals' professionalism, resulting from their acquisition, through a consciously or unconsciously applied mental internalisation process, of professional work-related knowledge and/or understanding and/or attitudes and/or skills and/or competences that, on the grounds of what is consciously or unconsciously considered to be its/their superiority, displace(s) and

> replace(s) previously-held professional work-related knowledge and/or understanding and/or attitudes and/or skills and/or competences (Evans, 2014, pg. 186).

From this it can be seen that, professional development is an ongoing process that occurs throughout an individual's career and involves both formal and informal learning experiences. Formal learning experiences may include attending conferences, workshops, and training programs, while informal learning experiences may include networking with colleagues, seeking out feedback, and engaging in self-directed learning either consciously or unconsciously.

The goals of professional development may vary depending on the individual's career goals and the requirements of their profession. In general, professional development aims to:

- Enhance job performance: By acquiring new knowledge, skills, and abilities, professionals can improve their performance on the job, leading to increased productivity, better outcomes, and greater job satisfaction (Lejeune, Beausaert, & Raemdonck, 2021).
- Meet professional requirements: Many professions require professionals to complete a certain amount of continuing education or professional development in order to maintain their registration or certification (Bullock et al., 2020).
- Stay up to date with industry trends and best practices: Professional development enables individuals to stay current with changes and advancements in their industry, ensuring they remain competitive and relevant in their field (Lejeune et al., 2021).

- Develop leadership and management skills: Professional development can also help individuals develop leadership and management skills, preparing them for more advanced roles in their organisation or field (Aguinis, 2009).

Professional Development in Dentistry in the UK:

For dental professionals in the UK, professional development is an essential component of their career progression and maintaining their professional registration.

The GDC, the regulatory body for dental professionals in the UK, requires dental professionals to engage in continuing professional development (CPD) activities to maintain their registration. CPD activities are any learning activities that are relevant to the individual's professional practice and contribute to their knowledge and skills, keep up to date with changes and developments in the dental profession, and provide the highest quality of care to their patients. The GDC expects dental professionals to take responsibility for their own professional development, and to maintain accurate records of their CPD activities.

The GDC define CPD as:

> Continuing professional development (CPD) for dental professionals is defined in law as “learning, training or other developmental activities which can reasonably be expected to maintain and develop a person’s practice as a dentist or dental care professional and is relevant to the person’s field of practice”. (General Dental Council, 2017a, p3)

The background to the CPD for Dental Professionals was discussed in Chapter 1, which covered the rules and the changes to the CPD system. As in many fields of healthcare,

the registrants have protected titles and in order to be able to continue to use such titles, are expected to maintain their registration via various models of CPD, much of which is governed by laws[2]. This also happens in other fields; however, many other professional bodies expect their members to carry out CPD, but it is not mandatory nor governed by laws (Boud & Hager, 2011; Kopelow, 2015; O'Loan, 2019; Ousey & Roberts, 2013).

If we take the definition provided by the GDC above at its word, then any form of learning that maintains and develops the professional practice of the registrant can be classed as CPD. If we look at the definition produced by the Health & Care Professions Council 'a range of learning activities through which health professionals maintain and develop throughout their career to ensure that they retain their capacity to practise safely, effectively and legally within their evolving scope of practice' (HCPC, 2014, p. 6) We can see that there is not a vast difference in the terminology, however, there is a difference in the implementation and verification of the CPD. The GDC have at least moved away from a prescriptive model of CPD, aligning with Grace (1999) in that individual dental professionals and practices are likely best equipped to identify and pursue training that suits their unique professional needs and objectives.

The General Medical Council defined CPD for their registrants as:

> CPD is any learning outside of undergraduate education or postgraduate training that helps you maintain and improve your performance. It covers the development of your knowledge, skills, attitudes and behaviours across all areas of your professional practice. It includes both formal and informal learning activities (General Medical Council, 2017pg. 7).

[2] https://www.gdc-uk.org/docs/default-source/enhanced-cpd-scheme-2018/enhanced-cpd-rules-order-of-council-2017.pdf?sfvrsn=33528a2d_2

There is however the question of how CPD is measured, either input (a number of hours or credits) or output (more about learning and developing). Cowpe et al. (2019) found in their review of the literature that many of the regulatory bodies had moved to an output-based measure of CPD activity, not specifying the number of hours of CPD. In their conclusion, they advised that the GDC in the future should move to an outcomes model of CPD. This had also been discussed by the GDC (General Dental Council, 2016b, para, 3.2) a view which is supported by other professions (Kopelow, 2015; Wallace & May, 2016). Boud & Hager (2011) considered this to be a challenge for professional bodies as it is easier to administer and record the number of hours of attendance, suggesting that it fostered compliance with procedures rather than development itself.

The review by Cowpe et al. (2019) however, were unable to take into account aspects of social networked learning, due in part to the lack of literature in the field of dentistry and social networking. The review identifies several key themes and recommendations for improving CPD. One of the key themes is the need for a clear and structured approach to CPD, which includes identifying learning needs, setting objectives, and evaluating the effectiveness of CPD activities. The authors recommend that healthcare professionals engage in self-directed learning and reflection, and that they work with their employers to develop structured and personalised CPD plans. This aligns with the concept of Heutagogy which is discussed in 2.3.

Another important theme discussed in the literature is the importance of relevance and evidence-based CPD (Alsop, 1997; Jeyakumar et al., 2022; Taylor, 1997). Healthcare professionals are advised to seek out CPD activities that are directly applicable to their practise and supported by the latest research and best practices (McColl, Smith, White, & Field, 1998). This ensures that professionals remain up to date with advancements in their field and can provide high-quality care to their patients. This is a view supported by other researchers, who see the role of evidenced-

based learning and teaching to be central to improving patient outcomes (Kopelow, 2015; Penz & Bassendowski, 2006; Rambur, 1999)

Mattheos, Schoonheim-Klein, Walmsley, & Chapple (2010) in their systematic review delve into the realm of dental education, specifically examining innovative educational methods. Their findings reveal a remarkable trend in scientific knowledge within dentistry, which is doubling every five years. This observation highlights the crucial importance of lifelong learning as the primary approach to deliver high-quality and effective healthcare.

The authors suggest that a 'non-linear' pathway may be the most suitable approach for achieving this goal. This approach empowers learners to select and prioritise their educational needs based on their individual perceptions. By allowing professionals to tailor their learning experience, the non-linear pathway enhances the relevance and effectiveness of continuing professional development (CPD) in dentistry.

Mattheos et al.'s (2010) work is intriguing, particularly the concept of a 'non-linear' learning pathway. It's particularly pertinent given the information explosion in the medical sciences, which calls for a more adaptive, personalised form of learning. This approach can be further augmented through technology, as the paper suggests. The potential for leveraging online platforms, including as-yet-understudied social media, adds a contemporary spin to the discourse.

While the literature review touches briefly on the use of internet technologies, its primary focus lies in online courses and virtual learning environments, with only a fleeting mention of social media. However, considering the exponential growth of social media and its networking capabilities in recent years, this facet of dental education remains relatively unexplored. Therefore, further investigation into the

potential benefits and implications of social media for professional development in dentistry holds promise for uncovering innovative and effective learning methods.

Overall, Mattheos et al.'s systematic review underlines the necessity of lifelong learning in dental education to keep pace with the rapidly advancing scientific knowledge. The authors advocate for a non-linear learning pathway, which allows individuals to tailor their educational journey to their specific needs. Furthermore, they highlight the potential of online learning platforms in overcoming barriers to education, making it more accessible and flexible for dental professionals. While the review briefly touches on internet technologies, it underscores the need for future research to explore the untapped potential of social media in dental education. Such investigations can shed light on novel and effective methods for professional development in dentistry.

Conclusion:

Theoretical constructs like Evans (2014) multidimensional model of professionalism offer nuanced interpretive frameworks. They serve as analytical scaffolds that allow dental professionals to make sense of their regulatory commitments. These frameworks can lead to transformative learning experiences that evolve over time. They also provoke critical inquiry into the daily experiences and ethical dimensions of dental practice, converting what would otherwise be rote, compliance-driven activities into vehicles for meaningful professional development.

On the other side, regulatory guidelines from bodies like the GDC serve as the governing architectures that structure the expectations and obligatory dimensions of CPD. While often critiqued for being prescriptive, these guidelines can be perceived as a "hard shell" around the "soft core" of theoretical constructs. Their prescriptive nature can, interestingly, offer a sort of epistemic flexibility within those boundaries,

allowing dental professionals to adapt and integrate the nuanced aspects of theoretical frameworks like that of Evans into their practice.

The emergence of evaluative strategies such as output-based metrics offers a potential harmonising element between the theoretical and the regulatory. Whereas traditional input-based evaluation may reduce CPD to a checklist exercise, output-based evaluation measures the tangible and intangible outcomes of educational engagement. Such an evaluation model becomes particularly significant when viewed through the lens of non-linear learning pathways, as suggested by Mattheos et al (2010). It allows for the quantification and qualification of the otherwise abstract benefits that theoretical frameworks propose, thereby providing empirical evidence that can feed back into the regulatory guidelines themselves. This could lead to a more adaptive and dynamic regulatory environment.

The synergy between these elements could be operationalised in a myriad of ways. For instance, adaptive learning platforms could be developed, incorporating both the theoretical frameworks and output-based evaluative strategies. These platforms would allow for CPD that is not only personalised but also aligned with regulatory mandates, thus achieving a balance between personal development and professional compliance. Dental professionals would have the ability to traverse their own learning journey while producing measurable outputs that can be directly correlated with improvements in clinical practice.

In essence, the dynamic interplay between theoretical constructs, regulatory guidelines, and evaluative strategies has the potential to catalyse a paradigm shift in dental professional development. Such a synthesis offers the possibility of an educational experience that is simultaneously compliant, personalised, effective, and ethically grounded. The challenge lies in integrating these elements in a coherent and synergistic manner to forge a new pathway in the professional development of dentistry.

2.2. Informal Learning

Introduction:

Theoretical Underpinnings of Informal Learning:

Informal learning, an integral facet of the educational landscape, contrasts sharply with structured and formalised learning approaches which are well researched. Unpacking its theoretical foundations aids in comprehending its significance, intricacies, and broader implications.

Situative Perspective: This approach posits that learning is inherently a social process and is deeply interwoven with the context in which it takes place. Lave and Wenger's (1991) seminal work on communities of practice emphasises that learning is a by-product of social participation. In this construct, knowledge is not just acquired but is co-constructed through interaction, making informal learning settings, such as workplace discussions or casual conversations, pivotal arenas for knowledge acquisition.

Constructivist Theory: Rooted in the works of Piaget (1929) and Vygotsky (1980), the constructivist theory suggests that learners actively construct knowledge through experiences. Informal learning, being largely experiential, aligns with this theory, wherein learners actively engage with their environments, extracting and assimilating knowledge in an organic manner, rather than being passive recipients.

Self-determination Theory (SDT): Deci and Ryan's (1985) SDT underscores the importance of autonomy, competence, and relatedness in fostering intrinsic motivation. Informal learning, often characterised by its voluntary nature, taps into

this intrinsic motivation. When learners perceive a sense of autonomy in their learning journey, engagement and knowledge retention are amplified.

Connectivism: Introduced by Siemens (2005), connectivism purports that learning resides not just within the individual but across a network. In an age dominated by digital technology, informal learning often happens by connecting to diverse nodes of information, be it through online forums, blogs, or social media, underscoring the decentralised nature of knowledge.

Transformative Learning Theory: Mezirow's (1977) transformative learning theory explains how critical reflection on one's experiences can lead to deep-seated changes in worldviews. Informal learning, often driven by reflection on personal experiences or unexpected challenges, can trigger such transformative shifts in perspective.

Experiential Learning: Kolb's (1984) model emphasises learning as a cyclical process, transitioning from concrete experiences to abstract conceptualisation. Informal learning environments, replete with direct experiences, provide fertile ground for such cyclic learning processes, fostering both reflection and application.

In conclusion, the theoretical underpinnings of informal learning offer a multifaceted lens through which the dynamism of unstructured knowledge acquisition can be viewed. As the boundaries between formal and informal learning continue to blur, especially in contemporary digital landscapes, understanding these theoretical bases becomes paramount for educators and researchers alike.

In the realm of healthcare education and practice, informal learning assumes a pivotal role, representing a fundamental aspect of professional growth and competence. Informal learning within the healthcare domain refers to the acquisition of knowledge,

skills, and attitudes that transpire outside the boundaries of formal educational settings and become intricately woven into the fabric of daily work activities for healthcare professionals (Mann, Gordon, & MacLeod, 2009). This form of learning is a continuous and dynamic process, empowering healthcare practitioners to enhance their performance and deliver superior healthcare services to those they serve. In this literature review, we embark on an exploration of the current landscape of research concerning informal learning in healthcare, examining its implications for healthcare education and practice, with a particular focus on its significance in the context of dentistry within the United Kingdom.

The significance of informal learning in healthcare cannot be overstated. While formal educational institutions undoubtedly play a pivotal role in shaping the foundational knowledge and skills of healthcare professionals, it is the informal learning experiences that transpire throughout their careers that infuse their practices with real-world application and experiential wisdom (Chivers, 2006). As healthcare professionals engage in the day-to-day challenges of their roles, they continually assimilate new information, refine their abilities, and develop a nuanced understanding of the intricacies that define their profession (Torunn Bjørk, Tøien, & Lene Sørensen, 2013).

Central to the essence of informal learning in healthcare is its intrinsic adaptability and responsiveness to the ever-evolving demands of the field (Manuti, Pastore, Scardigno, Giancaspro, & Morciano, 2015). In a fast-paced and dynamic healthcare landscape, where advancements and innovations emerge constantly, healthcare practitioners must remain agile and receptive to ongoing learning opportunities. Informal learning provides them with the flexibility to acquire relevant knowledge and skills as situations demand, ensuring that they stay abreast of cutting-edge practices and best serve their patients' needs (Kelly & Hager, 2015; Marsick & Watkins, 2001).

What is learning?

Firstly, it is useful to know what is meant when we discuss ‘Learning’. Don Passey's (2014) description of learning presents a multifaceted approach, recognising that learning is not a singular or straightforward process, but rather an intricate interplay of various dimensions. Here we look into each of these perspectives:

- **Neurobiological Perspective:** This viewpoint emphasises the biological mechanisms behind learning. It pertains to the physical and chemical processes occurring within the brain and other parts of the nervous system that facilitate the acquisition, storage, and retrieval of information. It's the most foundational aspect of learning, as it looks at the hardwiring of our brain and how neural connections form and adapt in response to new information.

- **Cognitive Perspective:** Focusing on the internal mental processes, this approach delves into how individuals perceive, think, remember, and solve problems. Cognitive processes are the steps our brain takes to process and understand information. This can include anything from understanding a simple fact to processing complex problem-solving strategies.

- **Emotional Perspective:** Emotions play a significant role in how we learn. This lens explores our personal feelings towards learning, our motivation, and our interests. For instance, our emotional state can influence our ability to absorb and retain information. Moreover, our long-term interests can either enhance or impede the depth of our learning.

- **Social Perspective:** Learning doesn't occur in isolation. The social context, interactions with peers, teachers, and the broader community, can deeply influence the learning process. Group dynamics, collaborative learning, and interpersonal communication all fall under this category.

- **Societal Perspective:** Beyond immediate social interactions, the larger societal context also shapes our learning. Societal values, opportunities, and long-term interests drive our dedication and commitment to learning. This might be seen, for instance, in how societies prioritise certain types of education or professions, or how societal needs shift educational focuses over time. (Passey, 2014, p. 9)

In essence, Passey's comprehensive description acknowledges that learning is a holistic process influenced by the interplay of our biology, internal thought processes, feelings, interactions, and the broader societal context. This multidimensional view underscores the complexity of learning and its deeply interconnected nature and why it should not be researched in a reductionist approach.

This description by Passey does not preclude informal learning, which is considered next.

As referred to above in chapter 1, Eaton et al. (2011) in their systematic review, found a lack of research into informal learning for CPD carried out by Dental Professionals in the UK (as did this researcher). This was also found to be the case for informal learning in other fields of professional development (Evans, 2019b). However, they

acknowledged the value of self-directed and informal learning, as reported by Schostak et al. (2010). Several studies have explored the nature and characteristics of informal learning in healthcare. For instance, Mann, Gordon, & MacLeod, (2009) conducted a qualitative study of informal learning among nurses in the UK. They found that informal learning among nurses was a continuous and ubiquitous process that occurred in various forms, including self-directed learning, peer learning, and learning from patients, as did other researchers (Bjørk, Tøien, & Sørensen, 2013; Brammer, 2006). The authors noted that informal learning in healthcare was influenced by several factors, including the workplace culture, the availability of learning opportunities, and the motivation of healthcare professionals to learn. Tim Swanwick (2005), examined Informal Learning in postgraduate medical education and concluded that as medical education undergoes inevitable evolutions, there is an urgent need to strike a delicate balance between structured formal learning and the invaluable socio-cultural facets of informal learning. Informal learning is undeniably pivotal within the scope of postgraduate medical education (Attenborough, Abbott, Brook, & Knight, 2019; Chapman, 2006). Historically, the primary focus of informal learning models has been grounded in cognitive reflections on experiences and modelling. These traditional frameworks, while effective, might only represent a singular dimension of the learning spectrum (Watkins & Marsick, 2021).

"How professionals learn in practice: an investigation of informal learning amongst people working in professions" by Cheetham and Chivers (2001) examined the informal learning practices of professionals in various fields. The study explored the nature of informal learning among professionals and the factors that influence it.

Employing a qualitative approach, Cheetham and Chivers engaged in in-depth semi-structured interviews with 23 professionals from diverse domains, encompassing doctors, lawyers, engineers, accountants, and more. These interviews served as windows into the rich experiences of these professionals, shedding light on their

encounters with informal learning both within the confines of their workplaces and beyond.

The study brought to the fore a multitude of informal learning practices embraced by professionals. Their pursuit of knowledge extended beyond the traditional boundaries of formal education, encompassing a rich tapestry of learning opportunities. Engaging in dialogues with colleagues, immersing themselves in academic readings, participating in conferences and seminars, and actively seeking out new experiences, all emerged as key avenues through which professionals nourished their thirst for knowledge and honed their skills.

In their analysis, the authors unveiled four significant factors that exert influence over informal learning among professionals. Foremost among these is the individual's intrinsic motivation to learn. This innate drive acts as a potent catalyst, propelling professionals to actively seek learning experiences and continually develop their expertise. Additionally, the culture prevailing within the workplace plays a pivotal role, shaping the ecosystem of informal learning. Organisational values that embrace a culture of learning and growth can foster an environment that nurtures and encourages the pursuit of knowledge among professionals (Attenborough, Abbott, Brook, & Knight, 2019).

Furthermore, the availability of learning opportunities emerged as a vital factor. Professionals are more likely to engage in informal learning when they have ready access to a diverse range of educational opportunities tailored to their needs and aspirations. Last but not least, the individual's prior learning experiences serve as a foundation for future learning endeavours. Informal learning often builds upon the knowledge and skills previously acquired through formal education and experiences, shaping a continuous trajectory of professional development (Kusaila, 2019; Littlejohn, 2021).

Drawing insights from their findings, Cheetham and Chivers arrive at the conclusion: informal learning assumes a pivotal role in the holistic development of professionals. It becomes evident that professionals must assume an active role in curating their learning journeys, embracing opportunities for growth and evolution. The authors highlight the significance of cultivating a learning-friendly organisational culture, wherein learning is both valued and encouraged. Organisations can support informal learning by providing accessible learning opportunities, fostering an atmosphere that fosters continuous growth, and facilitating knowledge-sharing among colleagues.

Understanding Informal Learning!

Informal learning also referred to as tacit learning, incidental learning, and experiential learning as well as other synonyms is described by the features that it lacks in relation to formal learning (Hager, 2012, p. 1557). Formal learning includes three necessary features:

- A curriculum.
- Taught by teachers.
- Learning is assessed and certified (in some way).

(Hager, 2012, p. 1557)

In a seminal work, Livingstone (2001) explained informal learning as activities characterised by the quest for understanding, knowledge, or skill, devoid of externally defined curricular benchmarks, suggesting that these endeavours typically manifest outside the conventional boundaries of educational institution curricula (Livingstone, 2001, p. 5). The American Society for Training and Development (ASTD, 2008) provides an apt metaphor, likening learning to an iceberg, with formal learning merely the

visible tip, whilst the substantial mass, representing informal learning, remains submerged and ostensibly elusive (ASTD, 2008, p. 4; Ehlers, 2010; Evans, 2019a) .

While the Organisation for Economic Co-operation and Development (OECD, 2016) concurs with this view, they expound on the nuanced dimension of intent within informal learning. They posit that, while informal learning isn't always rooted in deliberate intent, it occasionally exhibits characteristics that align it more closely with formal learning. This notion of blurred boundaries is further accentuated by Eraut (2000), who, apprehensive about the casual implications of the term "informal", offers a 'non-formal' typology, summarised in Table 1.

Time of Stimulus	Implicit Learning	Reactive Learning	Deliberative Learning
Past Episode(s)	Implicit linkage of past memories with current experience	Brief near spontaneous reflection on past episodes, communications, events, experiences	Review of past actions, communications, events, experiences. More systematic reflection
Current Experience	A selection from experience enters the memory	Incidental noting of facts, opinions, impressions, ideas Recognition of learning opportunities	Engagement in decision-making, problem-solving, planned informal learning
Future Behaviour	Unconscious effects of previous experiences	Being prepared for emergent learning opportunities	Planned learning goals Planned learning Opportunities

Table 1: A typology of non-formal learning, (Eraut, 2000, p. 116)

However, in a subsequent exploration, Eraut (2004) re-engages with the term 'informal', explaining its positioning along a spectrum of formality. Central to this spectrum is a rejection of the binary distinction between formal and informal learning, with mentoring exemplified as a midpoint activity (Eraut, 2004a, p. 250), thus removing the dichotomy of informal/formal learning, a view which Boud & Rooney (2018) concurs. This also brought about a modification to Table 1, as demonstrated in Table 2, thus demonstrating the everchanging landscape of informal learning. In this research, the author will use the term informal to denote all learning which is not formal but may reside on the continuum from informal to formal.

Time of focus	Implicit learning	Reactive learning	Deliberative learning
Past episode(s)	Implicit linkage of past memories with current experience	Brief near-spontaneous reflection on past episodes, events, incidents, experiences	Discussion and review of past actions, communications, events, experiences
Current experience	A selection from experience enters episodic memory	Noting facts, ideas, opinions, impressions. asking questions; observing effects of actions	Engagement in decision making, problem-solving, planned informal learning
Future behaviour	Unconscious Expectations	Recognition of possible future learning opportunities	Planning learning opportunities; rehearsing for future events

Table 2: A typology of informal learning (Eraut, 2004, p. 250)

Eraut's (2004) introduction of a 'non-formal' typology speaks to the current dynamism and the blurring lines between formal and informal learning realms. It raises questions about the practical implications of such a typology for healthcare professionals, who might shift from formal to non-formal to informal learning modes seamlessly within their practice. Greenhow & Lewin (2016), in their paper, highlight the multifaceted

nature of learning attributes, especially when viewed through the prism of emergent digital landscapes, leading to a synthesised model outlined in Table 3, which included the attributes of social media.

Category	Formal attributes	Informal attributes	Social media attributes
Purpose	Learning as primary purpose (intentional)	Learning as unintended outcome (or not recognized) Casual learning	Communication Creating Sharing Connecting Playing Consuming
	Externally determined (e.g., curriculum standard)	Self-determined community of interest	Self-determined socially determined
	Audience for student work is closed, known (teachers, parents, classmates)	Audience for student work may be closed/known or open/unknown or variation	Audience for user-generated content may be closed/known or open/unknown or variation
Process of Learning	Teacher-initiated	Incidental, experiential, spontaneous	Self-initiated Peer- or other-influenced
	Teacher-led (didactic)	Self-directed (negotiated) Individual agency	Self-directed Peer- or other-influenced Unintended network effects
	Teacher support	Peer/friend support	Network support
	Summative assessment Formative assessment Individual Accountability	Feedback	Community evaluation (rating, commentary, bookmarking)
	Teachers as Authority Students can provide input	Democratization of expertise	Expertise via participation
	Predominantly text-based, some multimedia	Varies	Multimodal (e.g., Images, videos, tags, ratings, hyperlinks)
Location/ context	Educational institution (e.g., school)	Home, community, museum, after-school club (e.g., out of school)	Online, ubiquitous (subject to internet access)
	Time-restricted	Open-ended	Open-ended

	Learning objective	No learning objective	Varies
	Certification	No certification	Individual recognition (e.g., badge) Social recognition
	Curriculum	No curriculum	Varies
Content	Knowledge acquisition	Everyday practice	User-generated, Re-mixed
	High status knowledge	Status of knowledge irrelevant/unacknowledged	Social construction and distribution Knowledge as collective agreement
	Specified outcomes rigid	Specified outcomes flexible or serendipitous	Outcomes vary Unintended network effects

Table 3: Greenhow & Lewin (2016) adapted model of learning attributes.

Conversely, Kind & Evans (2015) underscore the pertinence of self-direction in the context of lifelong learning, especially salient for the intrinsically motivated adult learner (Kind & Evans, 2015, p. 125). They argue that healthcare professionals, in their pursuit of up-to-date knowledge, often oscillate between formal and informal paradigms, suggesting an increasing gravitation towards digital and networked learning approaches, facilitated by the ubiquity and dynamism of social media platforms. This interconnected digital realm not only facilitates knowledge dissemination but also fosters collaborations, enhancing the breadth and depth of professional learning.

However, it is essential to approach these digital vistas with a critical lens, recognising potential pitfalls such as information overload, the prevalence of misinformation, and overarching concerns about digital privacy. Navigating the nuanced tapestry of lifelong learning in digital domains requires a judicious amalgamation of critical thinking, digital literacy, and the capability to discern authentic from fallacious. The discourse surrounding the role of social media in lifelong learning is evolving, necessitating a balanced perspective that weighs its transformative potential against inherent challenges.

Treasure-Jones (2017) stated:

> Lifelong learning is essential in today's fast-changing, knowledge-driven society. Healthcare is a clear example of this; research and innovation are rapidly changing how medicine is practised and how care is delivered, with new treatments, new technologies and new ways of working and managing conditions being introduced. (Treasure-Jones, 2017, p. 1)

In the research carried out by Treasure-Jones (2017) they were unsuccessful in understanding the adoption of the tools developed and why they were not taken up, this author would suggest that there was no use of the Technology Acceptance Model (TAM) (Briz-Ponce & García-Peñalvo, 2015; Davis, 1989b; Rauniar, Rawski, Yang, & Johnson, 2014b; Wallace & Sheetz, 2014) which may have given a better analysis of the problems of adoption. The TAM is discussed further in 2.6 of this chapter.

The use of technology is an area that has significant implications for informal learning in healthcare. Technology can be used to facilitate informal learning by providing healthcare professionals with access to educational resources, online communities, and other learning tools (Bullock & Webb, 2015; Davis, Ho, & Last, 2015; Tower, Latimer, & Hewitt, 2014; Ventola, 2014). For instance, social media platforms, such as Facebook, Twitter, and LinkedIn, can be used to create online communities of healthcare professionals who can engage in informal learning activities, share knowledge and experiences, and collaborate on projects (Arnett, Loewen, & Romito, 2013).

Conclusion:

The theoretical underpinnings—ranging from situative perspectives to self-determination theory and beyond—offer a multi-prismatic lens through which one can critically examine informal learning. What is notable is that these frameworks don't

merely function in isolation; rather, they operate in a synergistic manner. For example, the social dimensions of situative perspectives may facilitate the autonomous motives advocated by Self-Determination Theory. Furthermore, connectivism adds an extra layer to these models by emphasising the role of external networks, especially in the digital era.

From an educational policy standpoint, a nuanced understanding of informal learning could pave the way for more integrated, holistic approaches to healthcare education, ones that value experiential wisdom as much as curricular milestones. Healthcare institutions could more effectively harness the power of informal learning by creating cultures that facilitate it. Whether it is through structured mentorship programs that have informal components, peer review systems that capture experiential learning, or digital platforms that enable cross-disciplinary learning, the avenues are ripe for exploration.

To sum up, the literature makes a compelling argument for the multifaceted nature of informal learning, which is under-researched (Evans, 2019b), its significance within the healthcare sector, and the need for further nuanced research, especially within subfields like dentistry. It is an exciting field, with conceptual, empirical, and practical dimensions that are far from being fully explored.

Subsequently, we will delve into the concept of the self-directed and self-determined learner, placing it within the healthcare context, with a specific emphasis on dentistry.

2.3. Heutagogy

Introduction:

Learning is a lifelong process that is critical for personal and professional development. Heutagogy is a learning theory that focuses on self-determined and self-directed learning. It is a relatively new concept, which emerged from the field of adult education. The word "heutagogy" is derived from the Greek roots "heut-" meaning "self" and "-agogos" meaning "leading." So, "heutagogy" literally means "self-leading" or "self-directed learning." Heutagogy is based on the belief that people can develop their own competencies through a process of exploration, experimentation, and reflection. It recognises that everyone has different learning needs, styles, and goals, and that the most effective learning occurs when individuals are able to design their own learning experiences and make their own choices about what, when, and how to learn.

Theoretical Underpinnings:

The theoretical underpinnings of heutagogy can be traced back to several established learning theories, including constructivism, andragogy, and transformative learning.

The self-directed and motivated learner as described above by Kind & Evans (2015), is situated in heutagogy as posited by Hase & Kenyon (2000), which took the distinction made by Knowles (1970) between how adults and children learn, “Andragogy” – self-directed learner, and took this one step further to the self-determined learner (Hase & Kenyon, 2007). They recognised the changes in the world where information is accessible almost globally and the fact that students have as much access to information as their teachers (Blaschke & Hase, 2015). Therefore the self-determined learner may have no use for a teacher as we know it, rather they can learn for themselves, placing the learner at the centre of the learning process (Blaschke & Hase, 2016), this is particularly true in the case of the Dental Professional and many other healthcare professionals who are already skilled in reflective learning as it is an integrated part of healthcare education (Sandars, 2009). Reflection plays a large part in

heutagogy, promoting deeper learning, particularly self-reflection and double-loop learning (Argyris & Schön, 1996), Figure 3. According to Schön (1983), reflective practice supports learners in becoming lifelong learners, as 'when a practitioner becomes a researcher into his own practice, he engages in a continuing process of self-education'.

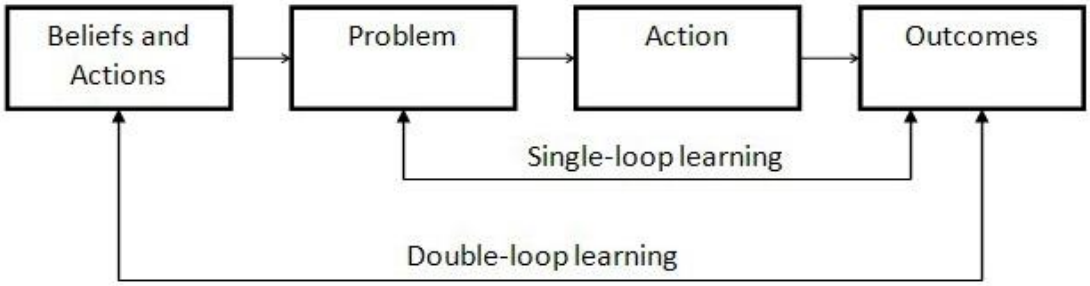

Figure 3 - Double-loop learning (Eberle & Childress, (2005), as shown in Blaschke (2012))

Social constructivists see the control of learning shifting from that of teacher led to one of learner centred, with the teacher as guide, these models came to the fore with the advent of many-to-many technologies. However, this model still places a requirement on teacher presence (Anderson & Dron, 2011) and as discussed previously, the self-directed healthcare professional may rely on their own direction, planning their own learning via mechanisms such as personal development plans (PDP). These plans may include any form of learning on the informal/formal continuum that suits their learning needs. This control of their learning is important for any healthcare professionals' professional development as they are the ones who are aware of what they need to carry out their tasks and improve their patient outcomes, through reflection. It is suggested that much of this learning is achieved using professional connections which may be viewed as a connectivist approach (Siemens, 2005). Transformative learning, on the other hand, emphasises critical reflection and the need for learners to transform their own perspectives and assumptions (Mezirow, 1997). Heutagogy incorporates all of these theories (Table 4), emphasising that learners must be able to construct their own knowledge, engage in self-directed learning, and critically reflect on their own learning experiences.

Learning Theory	Definition	Key Concepts
Constructivism (Vygotsky, 1980)	Learners construct their own understanding of the world through their experiences and interactions with their environment.	Learners actively engage in the learning process, use prior knowledge to make sense of new information, and build mental models to explain their understanding.
Connectivism (Siemens, 2005)	Learning is the process of creating and navigating networks of information.	Learners connect with others to share knowledge and ideas, use technology to access information, and use feedback to refine their understanding.
Self-determined learning (Hase & Kenyon, 2000)	Learners take ownership of their learning and set their own goals and objectives.	Learners are motivated by their interests and passions, choose their own learning activities, and reflect on their progress and achievements.
Sociocultural theory (Vygotsky, 1980)	Learning that occurs through interactions with others and participation in cultural practices.	Learners use language and tools to communicate and collaborate with others, participate in cultural practices to make meaning of their experiences, and are shaped by the social and cultural contexts in which they learn.
Transformative learning (Mezirow, 1997)	Learners transform their perspectives, beliefs, and values through critical reflection and a re-evaluation of their assumptions.	Learners experience a disorienting dilemma that challenges their current ways of thinking and develop new perspectives through critical reflection.

Table 4 - Key learning theories encompassed in Heutagogy.

Practical Applications:

Heutagogy has practical applications in a wide range of contexts, including higher education, workplace learning, and personal development. In higher education, heutagogy has been used to promote student centric learning, encouraging students to take ownership of their own learning experiences and develop the skills necessary

to succeed in a constantly changing world (Cochrane, Antonczak, & Wagner, 2013; Hase & Kenyon, 2001; Snowden & Halsall, 2016). In the workplace, heutagogy can be used to promote continuous learning, enabling employees to develop the skills and knowledge they need to succeed in an ever-evolving job market. Finally, heutagogy can also be used in personal development, empowering individuals to take control of their own learning experiences and develop the skills and knowledge they need to achieve their goals (Bhoyrub, Hurley, Neilson, Ramsay, & Smith, 2010).

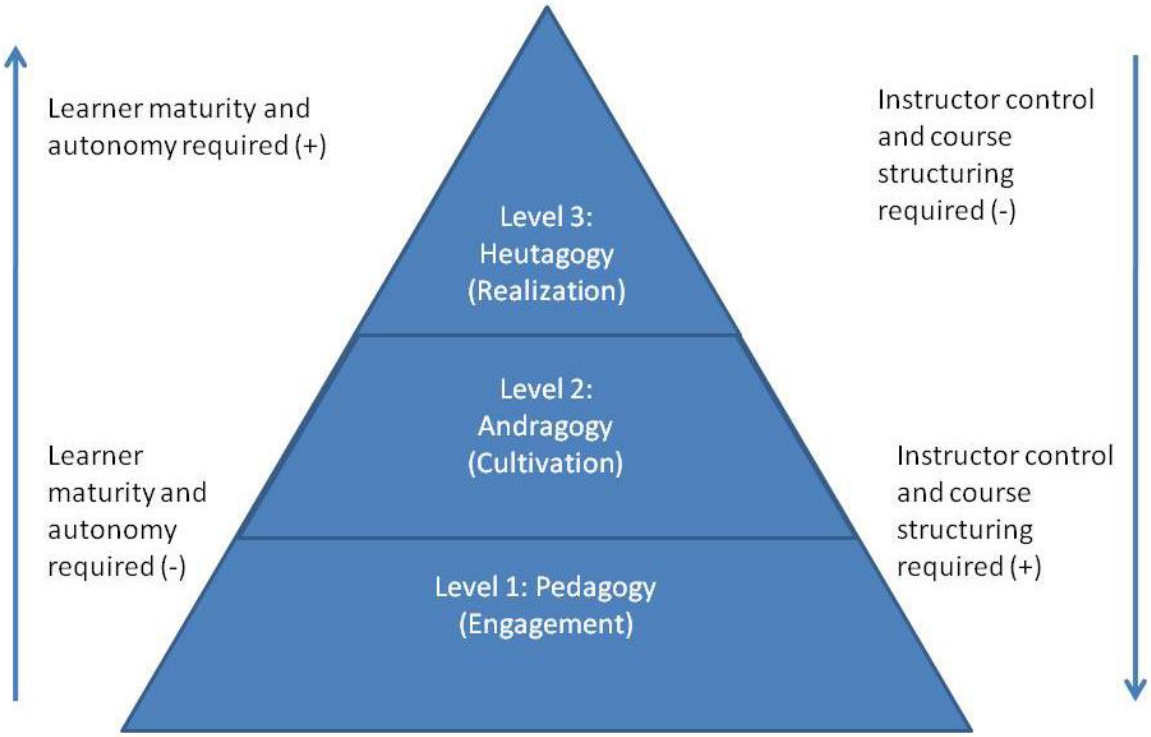

Figure 4 - Progression from pedagogy to andragogy then to heutagogy (Blaschke (2012) based on (Canning, 2010),

This move to learner maturity and control is central to how the dental professional takes charge of their own professional development moving through level 2 to level 3 (Figure 4) requiring less instructor control and greater autonomy. The interface between the technological and the social has come together, driven by globalisation and complexity to contribute to a revolution in the way institutions, teachers and individuals obtain information and share it. In these social networks the learner has

evolved from a passive recipient to analyst and synthesiser, which in Bloom's taxonomy (Bloom, 1956) are levels which are rarely reached in formal education(Blaschke & Hase, 2016).

The paper "Heutagogy: a holistic framework for creating twenty-first-century self-determined learners" by Blaschke and Hase (2016) presents a conceptual framework for self-determined learning in the twenty-first century. The authors argue that traditional models of education, such as pedagogy and andragogy, are no longer sufficient for preparing learners for the complex and rapidly changing demands of the modern world. Instead, they propose a new model of education called "heutagogy," which emphasises self-determined learning and lifelong learning skills.

One of the key strengths of the paper is the comprehensive and detailed discussion of the heutagogical framework. The authors provide a clear definition of heutagogy, as well as a range of examples and case studies to illustrate how the framework can be applied in practice. They also discuss the key components of heutagogy, including learner autonomy, self-reflection, and self-evaluation, and provide guidance on how these components can be fostered in learners.

Another strength of the paper is the emphasis on the importance of technology in supporting heutagogical learning. The authors argue that technology can provide learners with access to a wide range of resources and opportunities for collaboration and feedback, as well as support for self-directed learning practices such as goal setting and self-evaluation, a view supported by Green & Huntington (2017).

Heutagogy is a pedagogical approach that aligns well with the use of social media, as the affordances of social media support the development of cognitive and meta-cognitive learning skills, such as reflection, critical thinking and construction of knowledge (Blaschke, 2014; McLoughlin & Lee, 2008, 2010).

Heutagogy is not without its critics, due to the lack of empirical evidence and that most of the studies are qualitative (Agonács & Matos, 2019). Other challenges come from the implementation of its approaches, in that institutions have difficulty in assessment (Moore, 2020). However, Moore (2020) argues that traditional education models may not adequately prepare individuals for the rapidly changing landscape of work and life in the 21st century. In response, the author proposes the use of heutagogy, as a means of developing lifelong learning skills that can help individuals adapt and thrive in a constantly evolving world. Moore argues that heutagogy places learners at the centre of the learning process, empowering them to take ownership of their learning and develop the skills and knowledge they need to succeed in their personal and professional lives.

However, the paper also acknowledges several critiques and challenges to the implementation of heutagogy, including the potential for learners to become overwhelmed or disengaged without the guidance and support of an instructor or curriculum, and the need for learners to have a certain level of self-motivation and self-direction to effectively engage with heutagogical practices (Anderson, 2016).

Arguments against Heutagogy:

- Limited Guidance: With heutagogy, learners are responsible for setting their own learning goals and designing their own learning paths. However, some learners may struggle without guidance or may not have the necessary skills or experience to effectively manage their own learning.
- Overwhelmed with Options: With so many resources and learning options available, learners may feel overwhelmed and struggle to determine the most

effective learning path. Without clear guidance or structure, they may not achieve their desired learning outcomes.

- Limited Interaction: Heutagogy can be a relatively solitary approach to learning, which may not appeal to all learners. Some may prefer a more social and collaborative learning environment.

Conclusion:

Heutagogy emerges as a compelling framework for self-determined learning, stemming from a tapestry of established theories, from constructivism (Vygotsky, 1980) to transformative learning (Mezirow, 1997) (Table 4). It is intrinsically aligned with the age of the "information society," where the democratisation of knowledge has challenged traditional educational hierarchies (Blaschke & Hase, 2015). This is especially pertinent to professions like healthcare, where autonomous learning can be imperative due to the rapidly evolving nature of the field.

While heutagogy advocates for learner autonomy, it poses several challenges. The balance between autonomy and structure becomes a central theoretical concern. The literature does provide some counter-narratives, such as Anderson & Dron (2011), who argue for the need for teacher presence, implying that complete learner autonomy could lead to cognitive overload or inefficient learning. It's vital to consider if "too much freedom" can leave learners overwhelmed or aimless, particularly those not conditioned for self-directed learning.

Dental professionals in the UK can embrace heutagogy by identifying their own learning needs and goals, developing their own learning plans, and seeking out

resources and opportunities to support their ongoing learning and development. This might involve attending relevant conferences or courses, seeking out mentoring or coaching from more experienced colleagues, or engaging in online learning or professional communities.

For dental professionals and for many other professional groups, heutagogy is particularly rational due to their need for CPD and reflection. In a heutagogical approach, dental professionals can go beyond fulfilling CPD criteria to construct a rich and nuanced understanding of their practice. It aids not just in improving professional competence but also in fulfilling an ethical responsibility towards patient care by being abreast of advancements.

The current literature suggests a thematic convergence on the need for balancing learner autonomy with directed guidance. For healthcare professionals, a hybrid model combining aspects of andragogy (Knowles, 1970) and heutagogy (Hase & Kenyon, 2000) may be most effective, wherein structured professional development plans complement self-determined objectives.

The challenges of implementing heutagogy, as noted by Moore (2020), imply that further research is needed, particularly within specific vocational contexts like healthcare. The question of how institutions can authentically assess self-determined learning outcomes also remains largely unaddressed. Quantitative studies to measure the impact of heutagogical methods on learning efficacy and patient outcomes within healthcare contexts would also be beneficial.

In the next section we will discuss the literature around Social Media and its role in informal learning.

2.4. Social Media

First, we shall consider the concept of "Social Media" before delving into its role in informal learning for dental and healthcare professionals in a broader sense.

Introduction:

The advent of the original World Wide Web (WWW) in 1989 revolutionised the accessibility of information, invented by the British computer scientist Tim Berners-Lee. The early version of the WWW, often referred to as Web 1.0, primarily involved content creation by a limited number of individuals. In contrast, the subsequent evolution to Web 2.0 (O'Reilly, 2005) marked a shift towards collaborative content creation, largely facilitated by the advent of "Social Media." Social media refers to a programme or application that enables users to generate content on a specific platform, granting them the ability to choose the intended audience for their content. In other words, these platforms facilitate interactions among users, allowing them to create, co-create, and share content on a personal level, within defined groups, or as open publications. The rapid expansion of social media has been propelled by the widespread adoption of mobile technology and the continuous advancement of internet speeds, Figure 5 showing the reach of Social Media users 13 years of age and over in 2018 (Chaffey, 2019).

The most popular social network platforms count their users in the billions with the most popular being Facebook with over 2 billion active users worldwide, (Chaffey, 2019) (Figure 5). However, this is a rapidly changing landscape, as can be seen by comparing Figure 6 to Figure 7 (Dixon, 2022), in just 3 years Facebook messenger has lost over 300 million users whilst WhatsApp has gained 500 million users. Why this happens may be explained more in 2.7, where complexity theory is discussed.

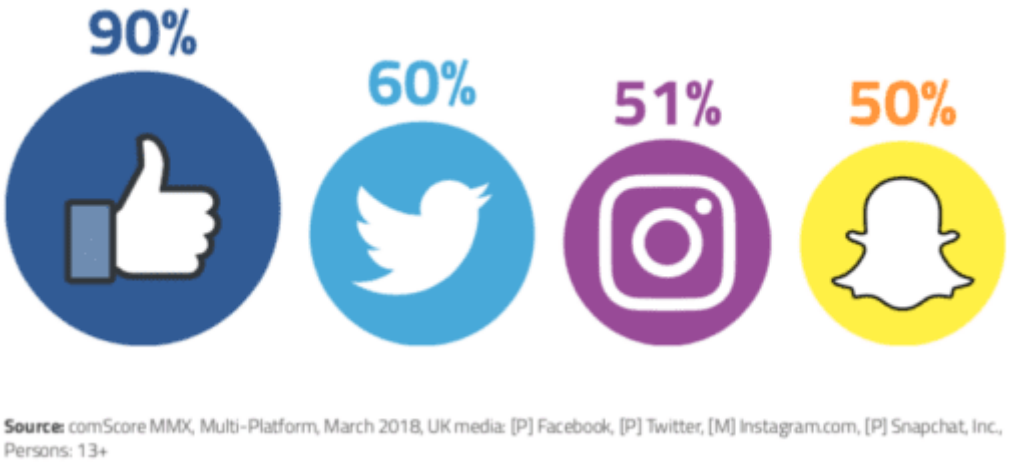

Figure 5 - UK Social media reach, by platform, age 13+, (Chaffey, 2019)

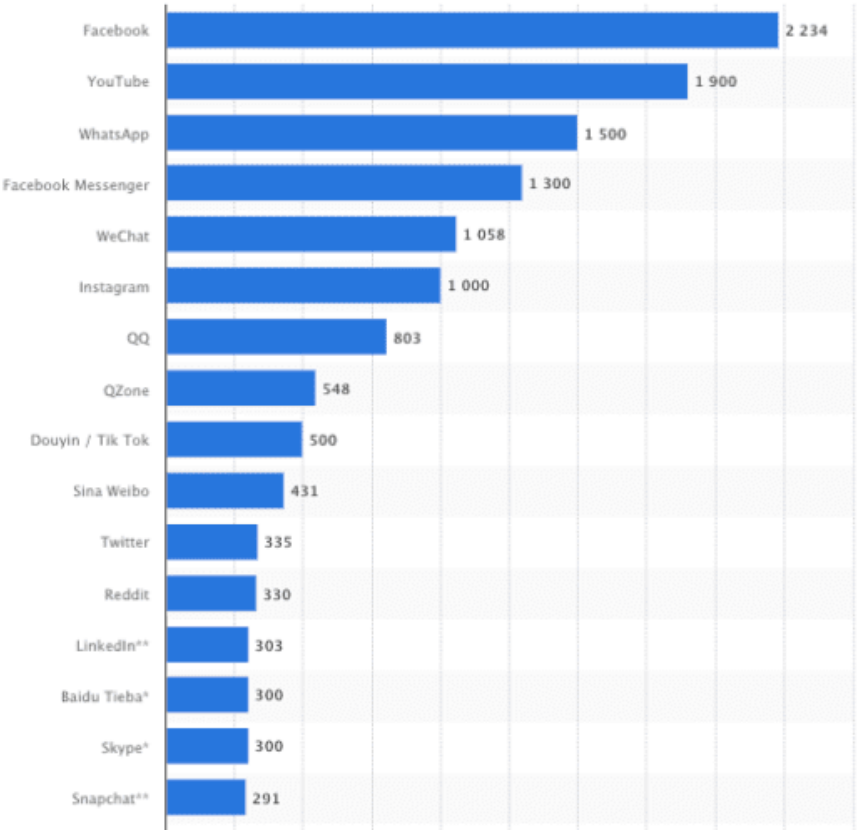

Figure 6 - Most popular social networks worldwide (October 2018)- prepared by Statista, (Chaffey, 2019)

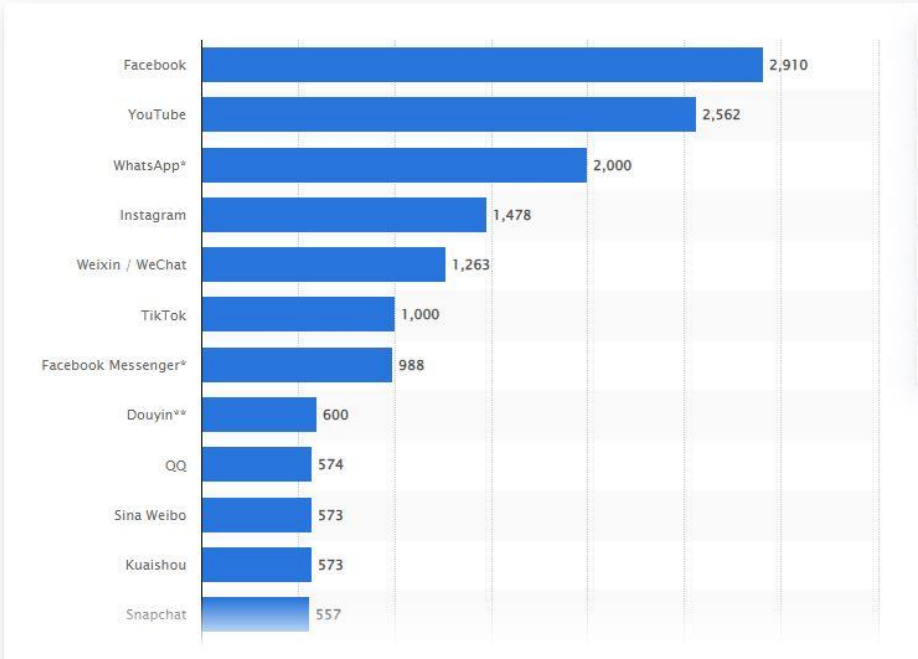

Figure 7 - Global Social Network Users 2022 (Dixon, 2022)

There is little doubt that social media has become a ubiquitous part of our social interactions, however, there is little research into how we use it to learn informally and in particular how informal learning has been affected by it (Greenhow & Lewin, 2016). The challenge of research in this domain is the measuring of outcomes, what learning has taken place, is this learning a surface learning, or does it involve deeper conceptual change and at what level changes take place. Reed et al. in their 2010 paper "What is Social Learning" identifies that attempts to assess social learning fail because they are unable to disentangle the effects of intervention from other mechanisms through which wider learning may have occurred. This author would suggest that it is not possible to separate out these wider causes and effects, just as it isn't possible to separate them out from any form of learning. Within social learning there is the concept of individual learning, however, there is also the concept of learning situated within wider social units or communities of practice which are abound within social media platforms(Lee, 2018; Wenger, 1999, 2015). This wider learning is achieved via cross fertilisation as boundaries are crossed within social networks of which social media is an intrinsic part.

Several studies have explored the use of social media for informal learning in healthcare (Alsobayel, 2016; Farsi, 2021; Flynn, Jalali, & Moreau, 2015; Neville & Waylen, 2015; Pizzuti et al., 2020). Cheston, Flickinger, & Chisolm (2013) conducted a systematic review of the literature on social media use in medical education. The authors found that social media is being used in medical education in a variety of ways, including to facilitate communication and collaboration among students, to supplement traditional teaching methods, and to promote professional development, this however, was in the context of formal learning. They also found the most commonly used social media platforms included Facebook, Twitter, and YouTube.

The authors also noted several potential benefits of using social media in medical education, such as increased engagement and interactivity, improved access to learning resources, and enhanced communication and collaboration among learners. However, they also identified several challenges, such as concerns about professionalism and privacy, and the need for faculty development and support.

Overall, the authors conclude that social media has the potential to enhance medical education, but its use must be carefully planned and supported to ensure that it is used effectively and appropriately. They recommend that educators consider the unique characteristics of social media when incorporating it into their teaching, and that they evaluate its impact on student learning and outcomes. Additionally, a study by McGowan et al. (2012) examined the use of social media by healthcare professionals for professional development. The article examines the use of social media by physicians to share medical information and aims to identify the factors that influence their adoption and meaningful use of such platforms.

The study found that physicians who were younger, more comfortable with technology, and had a greater understanding of the potential benefits of social media were more likely to adopt and make meaningful use of social media platforms to share medical information. The authors also identified the importance of having clear

guidelines and policies in place to ensure that the use of social media is consistent with professional and ethical standards.

Overall, the article provides valuable insights into the factors that impact the adoption and use of social media by physicians and highlights the need for clear guidelines and policies to ensure that these platforms are used effectively and ethically in the medical community. The authors found that social media was an effective tool for professional development, and that it facilitated informal learning, knowledge sharing, and networking among healthcare professionals.

In dentistry a qualitative study by Mondkar, Scambler, & Gallagher (2021) of 13 dentists practicing in London, found that social media platforms, such as Facebook, Instagram, Twitter, and LinkedIn, were widely used by dentists for both personal and professional purposes. The most common use of social media among dentists was to connect with colleagues and patients, promote their practices, and share information about new technologies and treatments. They also found that social media was used to access and share educational resources, such as webinars and online courses, and to engage in discussions and debates on professional topics. Moreover, the study found that dentists used social media to keep up to date with the latest research and developments in their field.

The study revealed that the dentists perceived social media as a useful tool for networking and building professional relationships, with many participants acknowledging that social media helped them establish new connections with colleagues and patients. However, some participants expressed concerns about the authenticity and reliability of information shared on social media and the potential risks of social media misuse, a view supported by Fleming & Ludwig (2023).

Moreover, the study revealed that social media use varied among dentists, depending on their age, gender, and specialty. For example, younger dentists were found to be more active on social media, while older dentists preferred more traditional methods of communication. The study highlights the need for future research to explore how social media is used by dentists in different age groups, genders, and specialties.

Risks:

It is important to acknowledge that, although not within the scope of this study, there are significant professional, ethical, and moral concerns associated with the use of social media in healthcare education. While many social media platforms offer the option to share information exclusively with selected individuals or groups, this does not prevent the possibility of that information being copied and pasted into other open groups by individuals who may mistakenly believe they are providing wider access to valuable information. Such actions can have severe repercussions within communities of practice when professional discussions, taken out of context, spread rapidly and gain traction among the general population.

In this era of widespread internet communication, the line between professional and personal spheres is becoming increasingly blurred, with individuals sharing a considerable amount of personal information in public domains. This merging of personal and professional aspects on social media platforms raises concerns about privacy, confidentiality, and the potential for unintended consequences (Neville & Waylen, 2015) . The dissemination of sensitive or confidential information, even with the best intentions, can undermine professional trust and compromise patient confidentiality. Additionally, the potential for online harassment, cyberbullying, and the spread of misinformation further compounds the ethical challenges associated with social media use in healthcare education.

Furthermore, the permanence and accessibility of information on social media platforms pose additional ethical considerations. Even after content is deleted, it may still be retrievable or archived by other users. This longevity of digital records necessitates heightened caution when sharing information, as it may have enduring implications.

In light of these concerns, healthcare professionals and educators must exercise caution and uphold ethical principles when engaging with social media platforms. It is essential to establish clear guidelines and educate individuals on responsible social media use, emphasising the need for discretion, respect for privacy, and adherence to professional codes of conduct. By fostering a culture of responsible online engagement, healthcare professionals can mitigate potential risks and maximise the benefits offered by social media in supporting informal learning and professional development. Thompson et al. (2008) found that:

> These self-created profiles may list personal information such as address or phone number and may include information such as sexual orientation and political views. Unfortunately, medical students, with their sense of medical professionalism just beginning to develop, and residents, as professionals still in training, may not understand that their publicly available content directly reflects their professionalism. Unknowingly, medical educators, colleagues, future employers, and even patients may have access to their content online. (Thompson et al., 2008, p. 954)

Implications for healthcare education and practice:

The use of social media in informal learning in healthcare has several implications for healthcare education and practice. One of the main implications is the need to develop guidelines and best practices for the use of social media in healthcare education and

practice. The regulators, healthcare organisations and educational institutions need to develop policies that provide guidance on the appropriate use of social media, including the use of privacy and security settings, the identification of reliable sources of information, and the management of online interaction (Elraggal, A. A. A. H. , 2021).

Conclusion:

Social media has transformed the way healthcare professionals engage in informal learning activities. Social media provides a platform for healthcare professionals to engage in discussions, share knowledge and experiences, and collaborate on projects. Social media has several benefits, including its ability to provide access to a wide range of educational resources, facilitate interaction and collaboration, and promote continuous learning (Mondkar, Scambler, & Gallagher, 2021). However, social media also poses several challenges (Haythornthwaite, 2022), including the lack of quality control and the potential for distraction and information overload (Ali, Yaacob, Al-Amin Bin Endut, & Langove, 2017)

The use of social media in informal learning in healthcare has several implications for healthcare education and practice, including the need to develop guidelines and best practices, and provide training and support for healthcare professionals (Green & Huntington, 2017).

The literature suggests that many healthcare professionals are ill prepared for the implications of social media on their professional domains (Cheston, Flickinger, & Chisolm, 2013; Mondkar, Scambler, & Gallagher, 2021; Neville & Waylen, 2015) and as such may find themselves before professional conduct committees due to their comments and posts, as has already been the case in the UK. This increase in the use of social media and its professional implication has prompted the GDC to produce guidance leaflets (General Dental Council, 2016a) in addition to their Standards publication (General Dental Council, 2013).

Next, we link this discussion to Hybrid Social Networks.

2.5. Hybrid Social Networks

Introduction:

Hybrid social networks are a combination of both online and offline social networks. They are designed to connect people both in the virtual world and in the real world. Hybrid social networks are becoming increasingly popular as they allow people to expand their social circles beyond their immediate friends and family (Hodgson & Reynolds, 2005). They also provide a way for people to connect with like-minded individuals and form new relationships in the real world. They are particularly useful for informal learning, as they enable the exchange of information and knowledge among individuals with diverse backgrounds and expertise.

Connections:

Siemens (2005) coined the term connectivism, due to the fact that everything we do is connected, people are connected through friendships, work, and social connections. Siemens defines connectivism as a learning theory that emphasises the importance of networks, connections, and nodes in learning. In this theory, knowledge is not located in individuals or even in the technology itself but rather in networks that individuals are a part of. Learning is viewed as the process of making connections between different nodes in a network. In connectivism, knowledge is not a fixed object but rather a dynamic and constantly evolving process.

Siemens argues that connectivism is different from other learning theories in that it emphasises the importance of social networks, technology, and the creation of knowledge. The author also highlights the importance of the ability to see connections and patterns as a crucial skill in the digital age. Many of us have heard cited, the term ‘six degrees of separation’, where we may be just six introductions away from any other person on the planet (Smith, 2008). These nodes of connections may bridge the

analogue and the digital, they can be people, communities, or resources, therefore delivering the symbiosis between connectivism and networked learning, they may not be totally aligned but there is enough similarity to make the links between them. In 2006 Siemens stated:

> The networked act of learning exists on two levels:
>
> 1. Internally as neural networks (where knowledge is distributed across our brain, not held in its entirety in one location)
>
> 2. Externally as networks we actively form (each node represents an element of specialisation and the aggregate represents our ability to be aware of, learn, and adapt to the world around). (Siemens, 2006)

In connectivism the teacher is seen more as a role model and perhaps a fellow node in a network and that perhaps the teacher role is in guiding how the learner can negotiate the social networks (Goldie, 2016). In other words, teaching the learner how to learn rather than the provider of information, which may be seen within a heutagogical paradigm. However, Bell (2011), believes that connectivism alone is insufficient as a theory but exists as an influential phenomenon.

HSNs facilitate informal learning through a variety of mechanisms. One of the key mechanisms is the creation of communities of practice, which are groups of individuals who share a common interest or profession (Lave & Wenger, 1991; Wenger-Trayner, Wenger-Trayner, Reid, & Bruderlein, 2023). These communities can be formed through both online and offline interactions, and they enable the exchange of knowledge and expertise among members. Lave & Wenger (1991) postulated their concept of Communities of Practice (CoP), summarised as “groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” and although first expressed about apprentice tailors, online communities

have flourished, such as Facebook groups. However, members of a community may be members of more than one community and so may be networks of communities (Haythornthwaite, 2022), each serving their own community but may feed into others, such as networking at conferences, membership of study groups and membership of professional bodies with their journals and meetings (Gobbi, 2010; Reed, Woodruff, Hopper, & Nicholls, 2017). Brindley & Sims (2021), noted students moving away from the secure confines of the academic institution to engage with the dynamic realm of the future workforce comes with its own set of challenges. These challenges often deviate from the anticipated ideals of professional practice, presenting difficulties that novices find daunting, while seasoned professionals view them as routine occurrences. Consequently, such encounters may cause students to perceive themselves as unsuccessful, generating tension and potential dissatisfaction with their chosen career trajectory. Furthermore, a gap may exist between the professed values related to professional practice within the educational framework and the everyday realities students face during their field placements.

This situation accentuates the potential advantages of cultivating professional communities of practice. These communities can serve as a valuable support network for burgeoning professionals, offering a safe space where they can openly discuss the misalignment between their personal expectations and the actualities of the real world. In doing so, these communities empower individuals by validating the significance of genuine experiences. A crucial aspect of this process is the inclusion of diverse group learning which facilitates the challenging of perceived norms. As highlighted by Eraut (2002), situated learning does not merely promote local conformity; instead, it fosters greater individual variation within one's career context.

Conole, Galley, & Culver, (2011) acknowledge the difficulty in developing an overarching framework to describe the patterns of user behaviour within social networks and that further work is needed to understand the online spaces. “Social network research has shown that having an extended network is crucial for personal

and professional development" (De Laat, 2011, p. 2; Haythornthwaite & De Laat, 2010; Li, Gray, Verspoor, & Barnett, 2017; Li, Verspoor, Gray, & Barnett, 2017) The paper "Bridging the knowledge gap: Using social network methodology for detecting, connecting and facilitating informal networked learning in organisations" by De Laat (2011) explores the use of social network analysis (SNA) as a method for detecting, connecting, and facilitating informal networked learning in organisations. The author argues that traditional approaches to workplace learning often focus on formal training and development programs, but that informal learning through social networks and communities of practice can be equally or even more valuable for knowledge acquisition and skill development.

However, one potential limitation of the paper is the relatively narrow focus on SNA as a method for informal networked learning. While the author provides a comprehensive overview of SNA and its applications, there is less discussion of other approaches or methods that could be used to support informal learning in organisations.

These connections between online and offline social networks and communities are not static, instead they grow and contract organically and are not the same for every actor or resource especially given the nature of technological growth, one only needs to look at how fast some of the social media has taken off and others have declined. This level of complexity requires self-determined learners to keep abreast of the developments and to maintain and develop their connectiveness.

Currently, there is an emergence of a concept – 'the postdigital' where the absence of digital is more noticeable than its presence and in 2013 a large group of researchers from Berlin came up with a working definition:

> Post-digital, once understood as a critical reflection of 'digital' aesthetic immaterialism, now describes the messy and paradoxical condition of art and media after digital technology revolutions. 'Post-digital' neither recognises the distinction between 'old' and 'new' media, nor ideological affirmation of one or the other. It merges 'old' and 'new', often applying network cultural experimentation to analogue technologies which it re-investigates and re-uses. It tends to focus on the experiential rather than the conceptual. It looks for DIY agency outside totalitarian innovation ideology, and for networking off big data capitalism. At the same time, it already has become commercialised. (Andersen, Cox, & Papadopoulos, 2014)

This concept is also considered by De Laat & Dohn(2019) in their question "Is Networked Learning Post-Digital Education?", highlighting the fact that in today's society, digital is an integrated part of our lives rather than the 'post' in 'postmodernism'. They explore the concept of post-digital education, which they define as "a new educational paradigm that goes beyond the idea that digital technology is a separate entity from the real world"(De Laat & Dohn, 2019, p. 1). They argue that post-digital education requires a shift in thinking from a focus on digital technology as a tool to enhance traditional teaching and learning practices to an understanding that digital technology is an integral part of the learning process.

In conclusion, the concept of post-digital describes the integration of digital technology into all aspects of our lives, including education. De Laat and Dohn (2019) argue that post-digital education requires a new approach that acknowledges the importance of digital technology in the learning process and emphasises social interaction, critical thinking, and the development of digital literacies. The early definition of networked learning emphasised technology enhancing learning through promoting connections. However, due in part to the openness of the definition, different understandings of

networked learning have developed, many of which are aligned with a view of learning as post-digital (Dohn, Sime, Cranmer, Ryberg, & De Laat, 2018).

Hybrid Social Learning Networks:

Hybrid Social Learning Networks (HSLN) combine the best of two worlds: informal learning and hybrid social networks. At their intersection, they become a powerful tool for people to learn from one another, share knowledge, and build communities of like-minded individuals or professionals with common interests (Cook et al., 2016). In exploring the two concepts we can see some of the potential benefits of their combination such as:

Diverse Learning Resources: Users can gain access to a vast array of learning resources, ranging from user-generated content, expert blogs, podcasts, webinars, and more.

Community Building: HSLNs can help to foster communities of practice where members can support each other, share their own insights and experiences, and collectively build upon their knowledge.

Personalised Learning: HSLNs can cater to individual learning preferences and needs, offering tailored content that suits each learner's unique requirements.

Networking Opportunities: Through the hybrid nature of these networks, learners can connect with others who share their interests or work in related fields, providing them with valuable networking opportunities.

Continuous Learning: HSLNs support lifelong learning by providing an easy way for people to continue updating their knowledge and skills in a rapidly changing world.

Quality assurance remains an underexplored facet in the burgeoning literature surrounding HSLN's, as noted, the absence of formal evaluation mechanisms leaves these networks susceptible to misinformation, a critical shortcoming that has not been sufficiently addressed. This omission is particularly vexing given that HSLNs rest at the intersection of informal learning and social networks—two domains where the veracity and efficacy of information are already contested.

Connectivism, as Siemens (2005) proposed, places much importance on the networks and connections wherein knowledge resides. Theoretically, the distributed nature of knowledge in networks should act as a self-correcting mechanism, where misinformation can be refuted, and accurate information can proliferate. However, this idealised view doesn't always hold in practice, partly due to the epistemological challenges posed by the 'postdigital' era, as articulated by Andersen, Cox, & Papadopoulos (2014) and De Laat & Dohn (2019).

The issue of quality assurance in HSLNs can be likened to a 'commons dilemma', wherein the value of the network is dependent on the quality of contributions from its participants. Poorly vetted or false information can act as a pollutant, depreciating the collective utility of the network. Social Network Analysis (SNA), as described by De Laat (2011), presents some utility in mapping key actors or nodes responsible for knowledge dissemination, but it falls short of evaluating the quality of this knowledge.

Moreover, Communities of Practice (CoP), a salient feature of HSLNs, bring together professionals or enthusiasts around specific topics (Lave & Wenger, 1991; Wenger-Trayner et al., 2023). Yet, the concept of 'community' in itself does not offer any inherent quality control. In professional settings, the stakes are higher: misinformation could lead to the dissemination of inaccurate medical information, outdated pedagogical techniques, or ineffective business strategies, among other repercussions.

One possible avenue for future research could be the incorporation of 'information stewardship' as a formal role within these networks. Individuals or algorithmic systems with this designation could be entrusted with the task of vetting and validating information before it becomes part of the shared knowledge pool. This, of course, brings with it its own set of ethical considerations surrounding censorship and the potential stifling of innovation. Nonetheless, some measure of governance appears necessary to maintain the integrity of HSLNs as reliable educational platforms.

Thus, while the concept of HSLNs offers considerable promise for reimagining educational paradigms, the academic discourse is yet to engage substantively with the concerns surrounding quality assurance (Ehlers, 2010). These concerns are neither peripheral nor inconsequential; they lie at the very crux of the network's utility and credibility. As HSLNs continue to evolve, addressing these gaps in the literature becomes increasingly imperative for their sustainable development.

In conclusion, Hybrid Social Learning Networks represent a compelling development in the realm of networked learning, merging the theoretical constructs of connectivism and Communities of Practice with the practical realities of a post-digital age. While they bring along a set of challenges, such as quality assurance and balance between social and professional content, their potential to revolutionise learning ecosystems is significant. Further academic inquiry in this interdisciplinary field could offer valuable perspectives to understand its complexities and harness its full potential.

2.6. Technology Acceptance

Introduction:

Technology acceptance is an area of research within the fields of information systems, technology management, and social sciences. It examines the factors that influence an individual's or organisation's willingness to adopt, use, and integrate new technologies into their daily operations. This concept is vital for understanding technology diffusion, innovation adoption, and the overall success of technology-driven initiatives. In an era characterised by rapid technological advancements and ever-changing consumer preferences, it is imperative to comprehend the factors that determine the acceptance or rejection of technology. The acceptance of technology is influenced by a variety of factors, including the perceived usefulness, ease of use (Davis, 1989b), and compatibility of the technology with existing systems, as well as the user's personal beliefs, attitudes, and social influences (Venkatesh & Davis, 2000). By understanding the complex interplay of these factors, we can create technology adoption strategies that promote successful technology integration, reduce barriers to adoption, and ultimately enhance the effectiveness of technological innovations in various settings. The use of TAM and factors influencing the use of technology in learning in healthcare and other spheres has been examined by researchers such as Lee & Lehto, (2013); McGowan et al., (2012).

Models:

Davis (1989a) determined that there needed to be a valid scale of measurement for predicting user acceptance of technological innovations. In this he developed and validated scales to measure two specific variables:

1. Perceived usefulness (PU) – Davis (1989) defined this as; “the degree to which a person believes that using a particular system would improve his or her job performance”.
2. Perceived ease of use (PEOU) – Davis (1989) defined this as; “the degree to which a person believes that using a particular system would be free of effort”,

claiming that an application perceived to be easier to use than another is more likely to be used.

Therefore, according to TAM, the more a person perceives that a technology will be useful and easy to use, the more likely they are to adopt and use that technology. Additionally, TAM suggests that a person's attitude towards a technology, and their behaviour towards it, are influenced by their perceptions of usefulness and ease of use.

The two variables were based on theoretical foundations from DeSanctis (1983) 'Expectancy-Theoretical' model and Bandura's (1982) 'Self-Efficacy' theory. Davis's Technology Acceptance Model (TAM) was validated in the research by Adams, Nelson & Todd (1992) by replicating his work. TAM is seen as a derivative of another theory that had been worked on in the field of technology acceptance, which is Fishbein's & Ajzen's (1975) 'Theory of Reasoned Action' (TRA) (Figure 8). This model is a well-researched intention model that has proven successful, it is however very general, whereas the adaption TAM is specifically designed to explain computer usage behaviour (Figure 9). TAM has come to be one of the most widely used models in Information Systems mainly due to its simplicity and understandability, however, it does have its imperfections (King & He, 2006). Thus others have sought to modify the original as can be seen below in Figure 10 & Figure 11, to better understand the potential use of systems (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000).

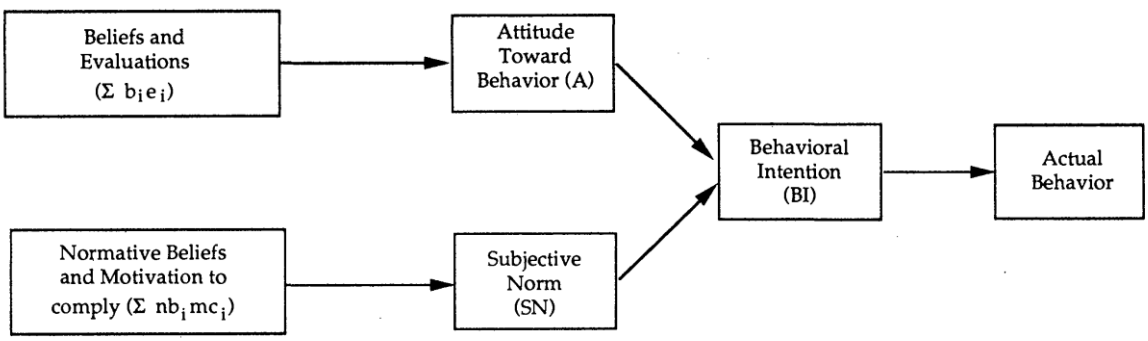

Figure 8 - Theory of Reasoned Action (TRA). (Davis, Bagozzi, & Warshaw, 1989)

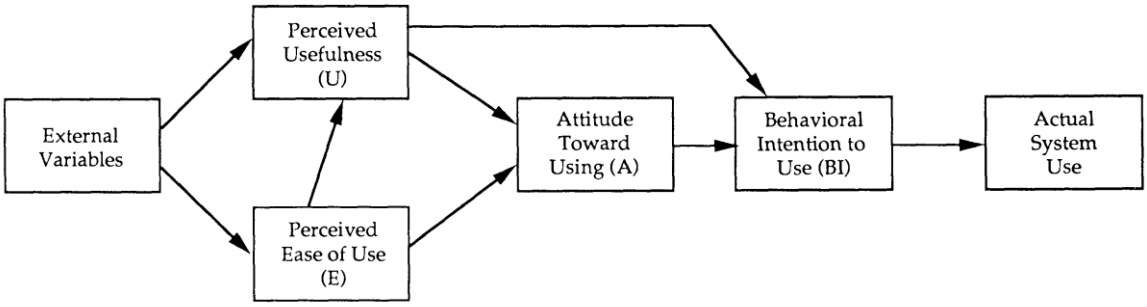

Figure 9 - Technology Acceptance Model (TAM). (Davis, Bagozzi, & Warshaw, 1989)

Venkatesh & Davis(2000), tested a theoretical extension of the original TAM and referred to it as TAM2 (Figure 10), incorporating additional theoretical constructs. These constructs spanned social influences as well as cognitive instrumental processes. The variations of TAM each look at the different external variables to modify the original model, which is clearly visible in Figure 10, Figure 11 & Figure 12 below and previous research studies have identified many factors that can affect users behaviour towards technologies (Abdullah & Ward, 2016; Taherdoost, 2018; Venkatesh & Bala, 2008; Wu, Chou, Weng, & Huang, 2011).

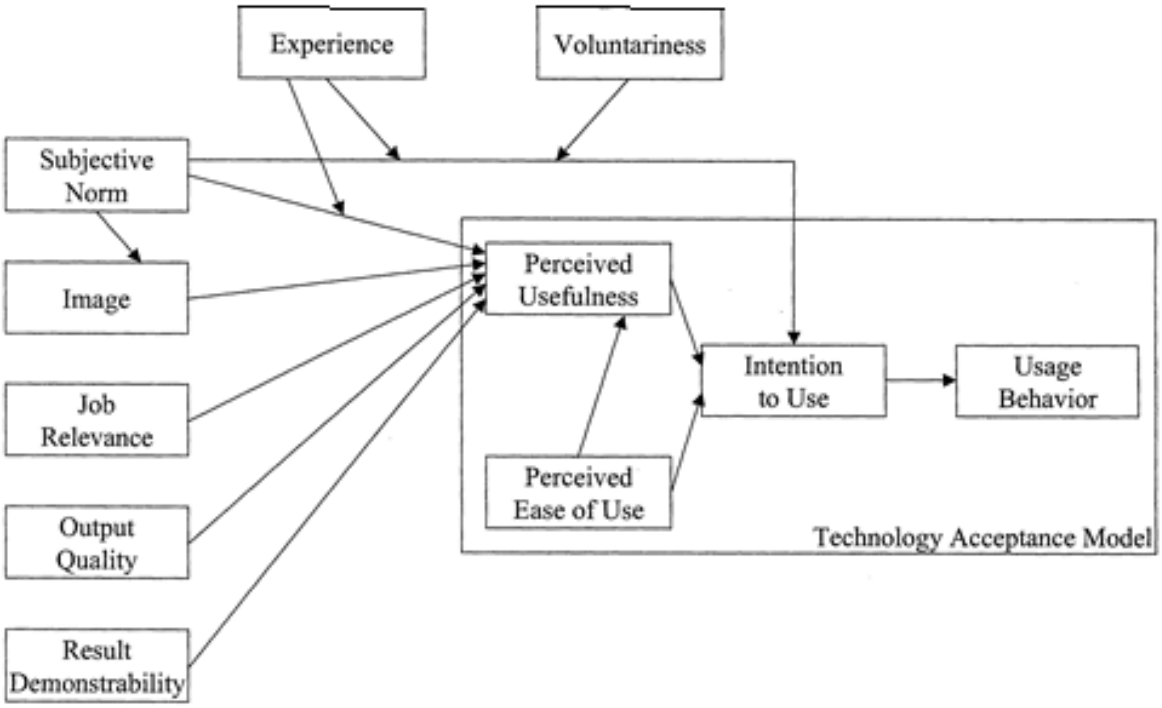

Figure 10 - TAM2 - Extension of the Technology Acceptance Model - Venkatesh & Davis (2000)

A meta-analysis study carried out by King & He (2006) incorporating 88 research papers presents TAM "to be a valid and robust model" (p.740). Abdullah & Ward(2016) developed a 'General Extended Technology Acceptance Model for E-Learning' (Figure 12)(GETAMEL) analysing commonly used external factors, by use of a meta-analysis of 107 papers over the previous ten years. The findings of which showed that the best predictors of PEOU are self-efficacy, enjoyment, experience, computer anxiety and subjective norm, in that order. The best predictors of PU were enjoyment, subjective norm, self-efficacy, and experience again in that order. This extension of TAM although created for E-Learning, simplifies some of the other extended models, in particular TAM3, through the use of correlation coefficient analysis. From all of the extended models we can see that the complexity of the interactions and modifying factors will vary from model to model with the original TAM as stable. Whist each of these models set out to measure the influences on use behaviour, they are all established around formal systems rather than personal use and social media. These models are included to show the variations in TAM rather than to use any in this research.

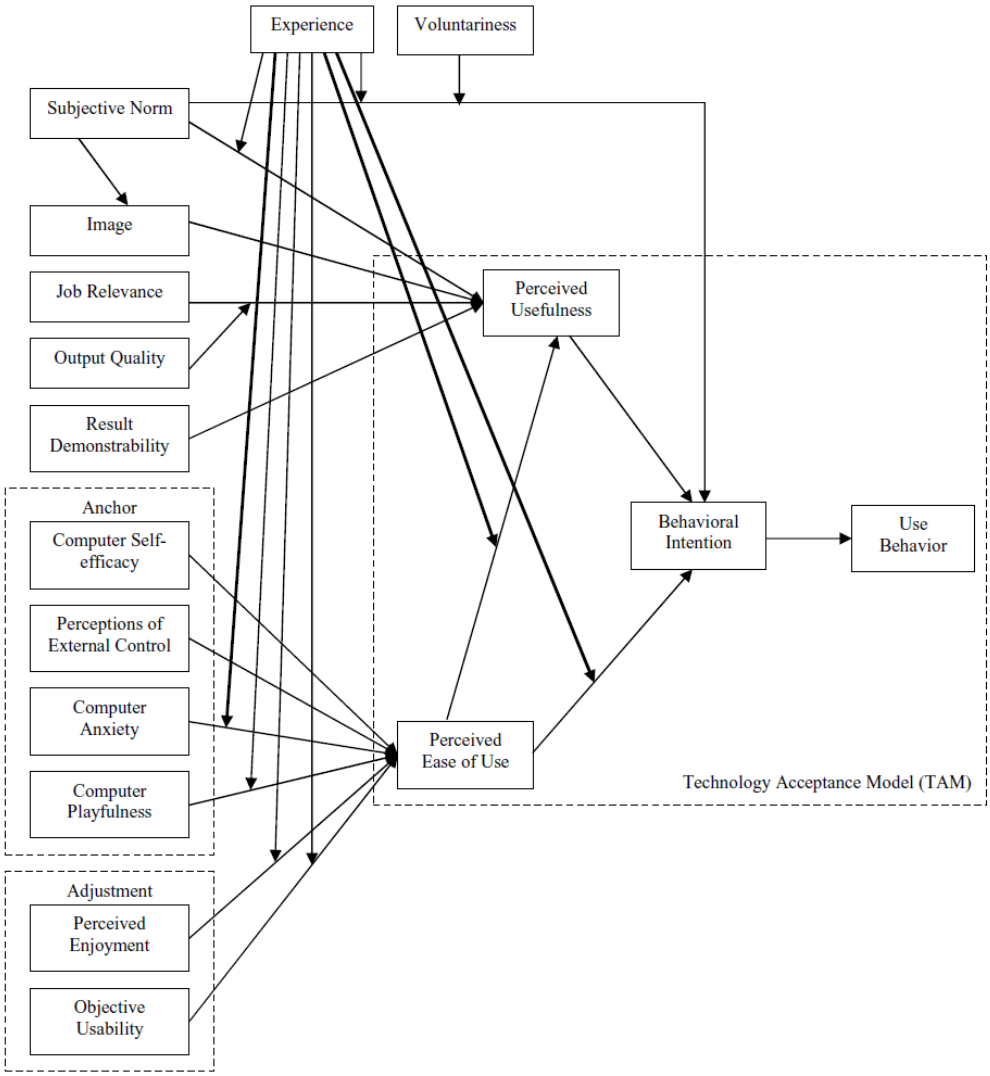

Figure 11 - Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008)

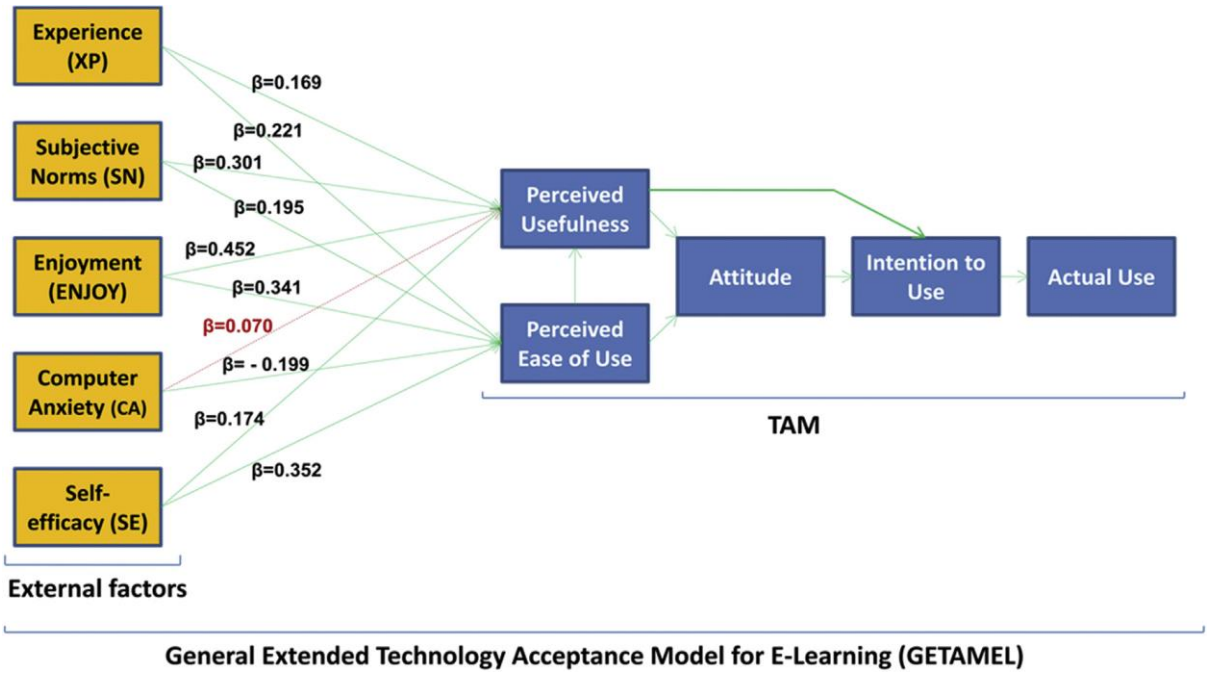

Figure 12 - GETAMEL with the average path coefficients (β) found between the 5 external factors and students' Perceived Ease of Use and Usefulness of e-learning systems. (Abdullah & Ward, 2016)

Limitations and Criticisms

While TAM models have been deemed robust in various meta-analyses, they aren't devoid of limitations. One of the significant criticisms, revolves around the limited factors considered. TAM's foundational elements—PU and PEOU—might be overly reductionistic, failing to encapsulate other crucial influencing factors such as cultural norms, government regulations, or economic conditions(He & Li, 2019).

Moreover, the assumption of rational decision-making in TAM is a point of contention. In a world influenced by the viral dynamics of social media and rapid technological shifts, rationality often takes a back seat to emotional or social imperatives. This, in turn, begs the question of the model's generalisability across different sectors, technologies, and cultural environments.

Toward a More Holistic Approach

Given these limitations, there's a growing argument for a more systems-oriented, possibly complexity-theoretic, approach to technology acceptance. Complexity theory could offer a non-linear, adaptive, and emergent framework that accounts for the multi-dimensional and dynamic aspects of human-technology interaction. Here, the focus would not be merely on individual variables but their interconnections and the emergent behaviours they spawn.

Conclusion

The Technology Acceptance Model and its variants offer indispensable but incomplete frameworks for understanding technology adoption. These models serve as the proverbial tip of the iceberg in an ocean teeming with complexities. As the pace of technological evolution continues to accelerate, refining or even overhauling these models may become imperative. Whether through the lens of complexity theory or other multi-disciplinary approaches, a richer, more nuanced understanding of technology acceptance appears both necessary and inevitable.

In the next section we will look into complexity theory itself and consider its use as a lens on this research.

2.7. Complexity Theory

Following on from the previous section of this chapter, it can be seen that TAM is a complex entity with many factors affecting actual use, which is one of the reasons to consider complexity theory as a lens to this research.

Introduction:

Much has been made of the comparisons between Complexity Theory and Chaos Theory, Network Theory, and Systems Theory (Byrne, 1998; Mason, 2008; Morrison, 2008) and whilst there are similarities, complexity theory seems to have emanated from chaos theory, developed in the fields of economics, chemistry, biology and physics, sharing chaos theory's concerns with larger systems. More recently complexity theory has become involved with the social sciences (Byrne, 1998; Hase & Kenyon, 2007; Hetherington, 2013; Mason, 2008; Morrison, 2008) including that of healthcare (Chandler, Rycroft-Malone, Hawkes, & Noyes, 2016; Walsh, 2000). The expansion of social media can be seen as a dynamic system with unforeseen expansions and contractions. Even as little as ten years ago, no one could have seen the explosion in social media, however, this was not down to social media alone. Alongside it was the ever-growing consumption of mobile technology, increasing mobile speeds and bandwidth, could any of these have happened without the other?

Complexity theory is a framework for understanding complex systems and their behaviour that has gained popularity in many fields, including healthcare education (Goh & Lim, 2022; James, Kia M. G., 2010; Mennin, 2010). Complexity theory is especially useful for understanding complex phenomena in learning and education (Davis & Sumara, 2006; Hase & Kenyon, 2007; McMurtry, 2010), such as how learners interact with each other and with the learning environment. In this section, we will

explore how complexity theory can be applied to learning and education, including how it can help us better understand the complexity of learning environments, the emergent properties of learning, and the implications for teaching and learning.

Complexity theory takes a holistic approach to understanding complex systems. Instead of reducing complex systems to their individual components, complexity theorists seek to understand the system as a whole, emphasising the interdependencies and interactions between the components. This holistic perspective acknowledges that the behaviour of a complex system cannot be fully understood by studying its parts in isolation.

Overall, the epistemology of complexity theory embraces a holistic and non-reductionist perspective, promotes interdisciplinary collaboration, and acknowledges the iterative and reflective nature of knowledge acquisition in understanding complex systems.

The key concepts and terminology of complexity theory include (Chandler, Rycroft-Malone, Hawkes, & Noyes, 2016; Thompson, Fazio, Kustra, Patrick, & Stanley, 2016):

- **Emergence:** Complexity theory emphasises the importance of emergence, which is the idea that the behaviour of a complex system cannot be understood simply by analysing its individual components. Instead, complex systems exhibit emergent properties that arise from the interactions between the components.

- **Nonlinearity:** Complex systems are typically nonlinear, which means that small changes in one part of the system can have large and unpredictable effects on

the system as a whole. This nonlinearity can lead to phenomena such as chaos and self-organisation.

- **Self-organisation:** Complex systems often exhibit self-organisation, which is the ability of the system to spontaneously organise itself into patterns or structures without external guidance. Self-organisation can lead to the emergence of complex structures such as fractals and networks.

- **Feedback:** Complex systems are characterised by feedback loops, in which the output of the system feeds back into the system as input. This feedback can lead to the amplification or damping of system behaviour.

- **Adaptation:** Complex systems are often adaptive, meaning that they can change and evolve in response to changes in their environment. This adaptation can occur through processes such as learning, evolution, and co-evolution.

Overall, the ontology of complexity theory emphasises the interconnectedness and unpredictability of complex systems, and the importance of studying these systems as wholes rather than simply analysing their individual components.

In their paper “Complexity, theory and praxis: Researching collaborative learning and tutoring processes in a networked learning community” De Laat & Lally(2003), acknowledged that no single theoretical model amongst those existing at the time,

was sufficient to provide a framework that takes into account key aspects of human agency. Instead, they acknowledge the complexity of the problems surrounding the research into theory and praxis and drawing on a plurality of theoretical perspectives.

Complexity science is still an emerging discipline and crosses the boundaries of natural, social and health sciences, explaining the behaviour of whole systems rather than the constituent parts and defined as the phenomena which emerge from a collection of interacting objects (Chandler, Rycroft-Malone, Hawkes, & Noyes, 2016, p. 2).

David Byrne in his book suggested 'complexity was defined as the domain between linearly determined order and indeterminate chaos' (Byrne, 1998, p. 1), the book provided a valuable insight and introduction to complexity theory.

The concepts of complexity regarding the education and training of healthcare professionals are due in part to the systems and their external environments which are not constant. This constant change is congruent within the various agents that make up a social network and because social media as an agent of that, has changed the way and the speed that knowledge is produced and shared. The individuals within these systems are independent and creative decision makers and that small changes can have big effects (Fraser & Greenhalgh, 2001). These small changes, such as the security issue surrounding 'Facebook' in 2018, when it was discovered that user's data had been used for political manipulation by Cambridge Analytica (Hern & Pegg, 2018). This potentially could have been the demise for the company and their billions of users which in turn would have affected how their user's shared information with each other, affecting many CoP's. Whilst it may seem that they managed to weather the storm, it has certainly made many users wary and still has the potential of allowing other platforms to fill in the gaps left.

The implications being that minor changes today can have unforeseen consequences in the future and the only certainty in complex systems is the uncertainty.

Complexity in Healthcare:

Walsh (2000) explained how when the United Kingdom Central Council (UKCC) for Nursing, Midwifery and Health Visiting[3], published the Scope of Professional Practice in 1992 that it may not have foreseen the dramatic growth of the nurse practitioner movement. In that nurses began to have a more liberated approach to expanding practice, which in turn opened the door to role expansion and increasing degrees of autonomous practice, unthinkable in the 1980s. Since then, the UKCC has seemed incapable of knowing what to do with it. Examples of these types of change in dentistry are commonplace, whether through poor planning, due to having to put policies into place, or from other regulatory changes. An example of this was the change in the CPD requirements in Dentistry in the UK (General Dental Council, 2017a), which removed informal learning and increased the number of hours of accredited course attendance. Thus, staying with an input-based requirement rather than as most regulators have done, an outcomes-based requirement. This is supported by the remarks in the report by (Bullock, Barnes, Jones, Bartlett, & Russ, 2023) where in their concluding remarks they point out "More radical change would be to introduce a scheme which is outcomes not hours-based." (pg. 60).

Systems:

Morrison (2008) explained how these complexity systems may be self-organising, being both autocatalytic and demonstrate autopoiesis (self-creation). Which enable the system to perpetuate and renew itself over time, constantly adapting through feedback, recursion, connectiveness and competition. Autopoiesis as self-production

[3] Now the Nursing & Midwifery Council, from 1st April 2002.

takes place through engagement with others in a system. The interaction of individuals feeds into the wider environment, which, in turn, influences the individual units of the network; they co-evolve, shaping each other. This co-evolution requires connection, cooperation, and competition: competition to force development, and cooperation for mutual survival (Morrison, 2008, p. 17). When we examine HSLNs, we can see how the system has grown and developed, moving from the analogue world of meetings, study groups and CoPs to merge with the digital due to its connectedness, a key feature of complexity theory. Within this system each part has expanded or contracted depending on how well connected it is and how the actors make use of each part. Connectedness requires a distributed knowledge system, in which knowledge is not centrally located in a command-and-control centre. Rather, it is dispersed, shared, and circulated throughout the system: communication and collaboration are key elements of complexity theory (Cilliers, 2002).

Given that 'Complexity Theory' is not yet a fully developed unified theory but a collection of theories and epistemological positions relating to complexity, which would suggest a range of methodological approaches to any research conducted in the field. It is suggested that despite this variability, complexity may offer an "emerging paradigm", providing a challenge to conventional approaches to educational research (Chandler, Rycroft-Malone, Hawkes, & Noyes, 2016; Hetherington, 2013).

The argument for complexity theory over that of a reductionist approach to this research is best explained as an analogy:

> "Boy meets girl, family intervenes, the couple dies" is a compression that falls far short of describing Shakespeare's Romeo and Juliet. The only way to enjoy the play is to go and see it yourself, not to read a review or synopsis (Coveney & Highfield, 1995, p. 38).

Ng, Kinsella, Friesen, & Hodges, (2015) posit that:

> Medical education's approach to competency-based education, with a focus on discrete 'knowledge, skills, and attitudes', may encourage reductionist mindsets that lead to implementing and assessing reflection in ways incompatible with the original theories that gave rise to reflection and reflective practice (p. 468)

They go on to conclude that the complexity of medical education is such that pedagogical innovations tend to come and go and without deeper considerations as to why they falter. They suggest that reflection has been modified to fit the mould of assessment by those dominant in medical education and regulation. It is this need to measure learning or participation that fails to identify how healthcare professionals learn. This links back to section 2.1 of this chapter on Professional Development.

Framework for Complexity Theory in Informal Learning and Social Learning Networks:

- **Emergent Properties of Learning Networks:**

Complexity theory suggests that learning networks are characterised by emergent properties that arise from the interactions between learners, teachers, and resources. These emergent properties can include self-organised learning communities, the evolution of knowledge, and the impact of social factors on learning outcomes (Melder, Robinson, McLoughlin, Iedema, & Teede, 2020).

- **Social Factors in Learning Networks:**

Social factors play a critical role in the emergence of self-organised learning communities and the evolution of knowledge in learning networks. These social factors can include trust, collaboration, feedback, and social presence. Research has suggested that social presence is particularly important in social learning networks, as it enables learners to connect with others and form a sense of community (Wei, Chen, & Kinshuk, 2012).

- **Technological Infrastructure of Learning Networks:**

The technological infrastructure of learning networks can have a significant impact on the emergent properties of these networks. Complexity theory suggests that learning networks are complex adaptive systems that are influenced by the interaction between learners and the technological environment. This interaction can be shaped by the design of the learning environment, the tools available to learners, and the incentives and feedback mechanisms in place (Hrastinski, 2008).

- **Evolution of Knowledge in Learning Networks:**

The evolution of knowledge in learning networks is a key emergent property that can be studied using complexity theory. This property is characterised by the continuous development and adaptation of knowledge as learners interact with each other and with resources. Complexity theory suggests that the evolution of knowledge in learning networks is influenced by social factors such as collaboration, feedback, and trust, as well as the technological infrastructure of the learning environment (Siemens, 2005).

Conclusion:

The framework presented in this section provides a valuable tool for studying informal and social learning networks using complexity theory. By focusing on emergent properties, social factors, technological infrastructure, and the evolution of knowledge, researchers can gain a deeper understanding of these complex systems and the factors that contribute to their success. This framework can help guide the design and support of social learning networks to optimise learning outcomes for learners.

2.8. Summary of Literature Review

Upon examining the existing literature, one can discern the presence of noticeable gaps in our comprehension of informal learning strategies adopted by Dental Professionals. Specifically, there is a dearth of research on how dental professionals harness social media platforms, the prospective impact of technology acceptance on such activities, and the role of self-directed learning initiatives within this professional role.

A comprehensive exploration of the informal learning methods of Dental Professionals would, inherently, require a simultaneous examination of these seemingly discrete areas. While each facet could be probed in isolation, obtaining a holistic understanding of the knowledge acquisition processes among Dental Professionals requires an integrated approach. This is underscored by the imperative to comprehend not only what knowledge is absorbed but also the awareness and acknowledgment of said learning by the respondents, be it intentional or inadvertent. This notion is succinctly captured by Eraut (2000), who underscores the challenge in quantifying learning that individuals themselves recognise.

One cannot ignore the prevailing academic discourse that predominantly links the usage of social media with formal learning structures. A pervasive trend in such studies seems to be a binary treatment of this relationship, which can lead to a reductionist viewpoint. Such a stance may not fully encapsulate the intricate nuances and complexities involved in the amalgamation of formal and informal learning via social media platforms, as illuminated by Greenhow & Lewin (2016).

To encapsulate, the interrelation of concepts such as professional development, informal learning, heutagogy, social media utilisation, hybrid social networks, the

technology acceptance, and complexity theory emerges as pivotal (Davis & Sumara, 2006). These intricate intertwining ideas provide a robust framework for comprehending how learners, in today's ever-evolving technological landscape, amass and refine their skills and knowledge. As described in section 1.3, there is a proposed framework that offers insight into the interconnectedness of these multifaceted concepts in our hybrid learning landscape. From the review of the literature, a framework has emerged (Figure 13) that encapsulates and synthesises the complex nature of the systems Furthermore, as technological advancements and social networks persistently reshape our educational and professional terrains, the intersectionality of these concepts is poised to become even more pronounced.

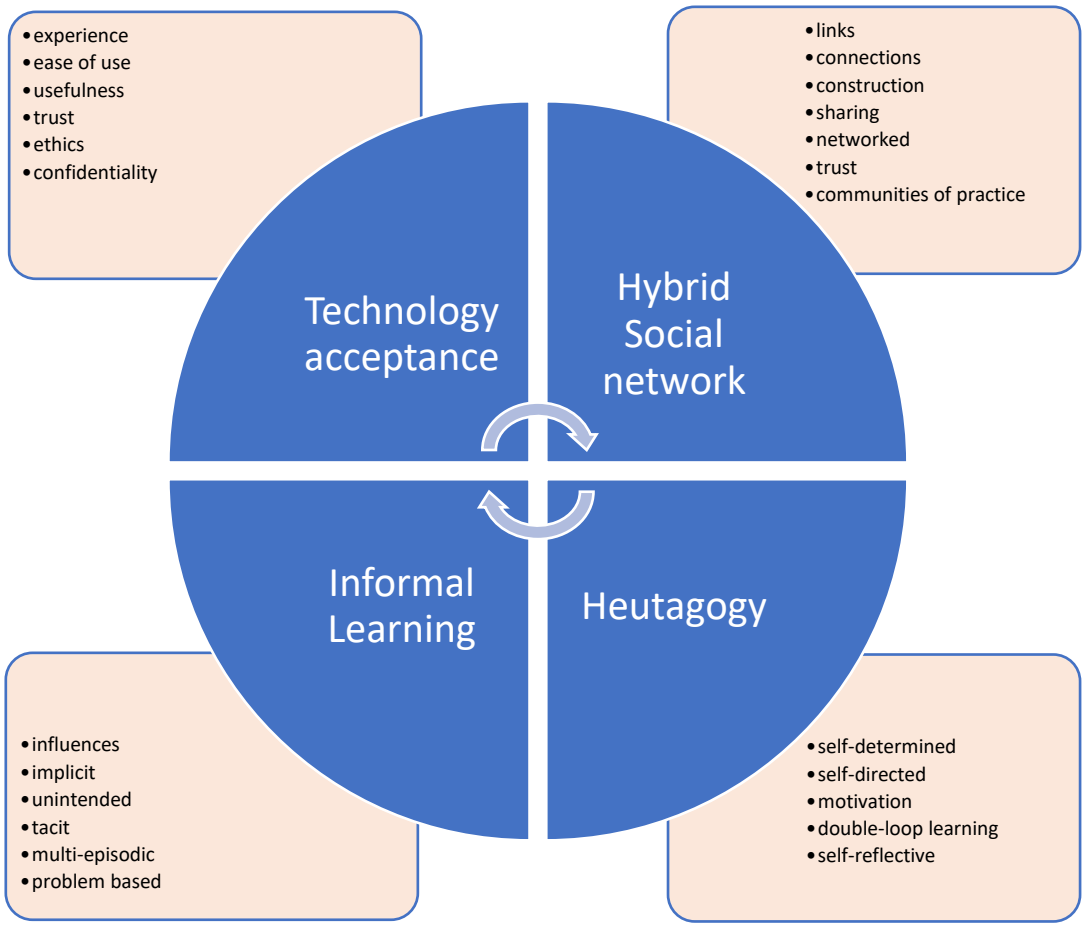

Figure 13 - Conceptual Complexity Framework

3. Research Design

The focus of this research endeavours to acquire comprehensive insights into the utilisation of Hybrid Social Learning Networks among Dental Professionals in the United Kingdom, specifically in relation to their professional development. In order to achieve this, an online survey was conducted among active Dental Professionals in the UK, with the purpose of establishing potential correlations between age, gender, profession, and their engagement with social media or other forms of informal learning. Furthermore, the study explores how these Dental Professionals engage in learning, exchanging information, and sharing their experiences through various networks, as well as their attitudes towards the adoption of technology. This is linked to the complexity as demonstrated by Figure 13, which was developed from the literature. This complexity resulted in the methodological choices that run throughout this research, which are elucidated within this chapter.

The subsequent sections of this chapter explain the methodology employed and the specific method utilised, the rational of the survey, the questionnaire, and its design. An analysis of the gathered responses is explained in Chapter 4, Chapter 5 and Chapter 6. These chapters shed light on the findings derived from the survey, offering valuable insights into the dynamics of Hybrid Social Learning Networks and their impact on the professional development of Dental Professionals in the UK.

3.1. Methodology

The methodology to be used is that of a mixed methods survey (Creswell & Plano Clark, 2007; Creswell, 2014; Johnson & Onwuegbuzie, 2004; Maxwell, 2016; Snelson,

2016). Functioning as the overarching heuristic structure is complexity theory. Although the traditional ontological position of complexity theory leans towards positivism, an interpretivist epistemology is also integrated to provide a more nuanced analysis of the quantitative survey data.

Ontological Complexities: Key Tenets of Complexity Theory

The ontological foundation of complexity theory posits several core assumptions that transcend traditional reductionist perspectives (Manson, 2001):

- Entities exist within intricate, interconnected systems that are both dynamic and adaptive.
- These systems are governed by non-linear relationships among constituents, resulting in unpredictable emergent behaviours.
- The systems are autopoietic, meaning they self-organise and adapt to contextual variables without necessitating external interventions.
- Systems frequently exhibit emergent attributes that are not reducible to their individual components.
- Complex systems are typically stratified across multiple scales and levels, necessitating a multi-scale analytic approach.

This ontology disrupts reductionist epistemologies by accentuating the unpredictable, self-organising, and interconnected nature of complex systems, thereby mandating a more integrative methodological approach.

Epistemological Intricacies: Generating and Validating Knowledge

The epistemology inherent in complexity theory promulgates a pluralistic approach towards knowledge generation. It not only accommodates but actively integrates a multiplicity of methodological paradigms, data types, and theoretical perspectives. Furthermore, this epistemological stance concedes that all knowledge is contingent, subject to re-evaluation and revision based on evolving contextual variables (Montuori, 1998).

Theoretical Framework Justification

The applicability of complexity theory to this research is reinforced by the dynamic and changeable characteristics inherent in technology and social media landscapes. For instance, even the slightest alterations in algorithms or user engagement can catalyse systemic changes, as observed in the public's fluctuating confidence concerning data privacy on platforms like Facebook (Hern & Pegg, 2018). Mason (2008, p.2) explains complexity theory thus: 'It concerns itself with environments, organisations, or systems that are complex in the sense that very large numbers of constituent elements or agents are connected to and interacting with each other in many different ways', and Morrison (2008, p. 18) adds, 'Connectedness, a key feature of complexity theory, exists everywhere'. The concept of connectedness is a central and recurring theme that permeates every facet of the research under consideration. However, it's important to note that this connectedness is not necessarily confined to any specific actor or resource. Instead, it operates as an overarching principle that interlinks various elements of the research.

To further illustrate this point, consider Figure 14, which provides a schematic representation of how a Dental Professional might cultivate a learning network. This learning network is characterised by its hybrid nature, seamlessly integrating various dimensions of learning. It encompasses both formal and informal learning pathways, which enriches the Dental Professional's knowledge base by exposing them to a wide range of educational resources and experiences.

In addition, the learning network represented in Figure 14 is not limited to just one mode of delivery. It incorporates both online and offline resources, giving the Dental Professional the flexibility to access information and educational materials through multiple channels. This multi-modal approach allows the Dental Professional to tailor their learning experience to their individual preferences and needs, making it a more personalised and effective educational journey.

Additionally, networking opportunities form an integral part of this learning network. These connections enable the Dental Professional to interact with other professionals in their field, sharing knowledge, insights, and experiences that can further enhance their understanding of their profession (Mackey & Evans, 2011). By engaging in such collaborative efforts, the Dental Professional can benefit from the collective wisdom of their peers, expanding their horizons and enriching their professional practice.

In conclusion, the notion of connectedness is a crucial thread that runs through the entirety of this research, providing a unifying theme that ties together various aspects of the learning network depicted in Figure 14. By leveraging the interconnectedness of formal and informal learning, online and offline resources, and networking opportunities, the Dental Professional can construct a comprehensive and versatile learning network that fosters their professional development and growth.

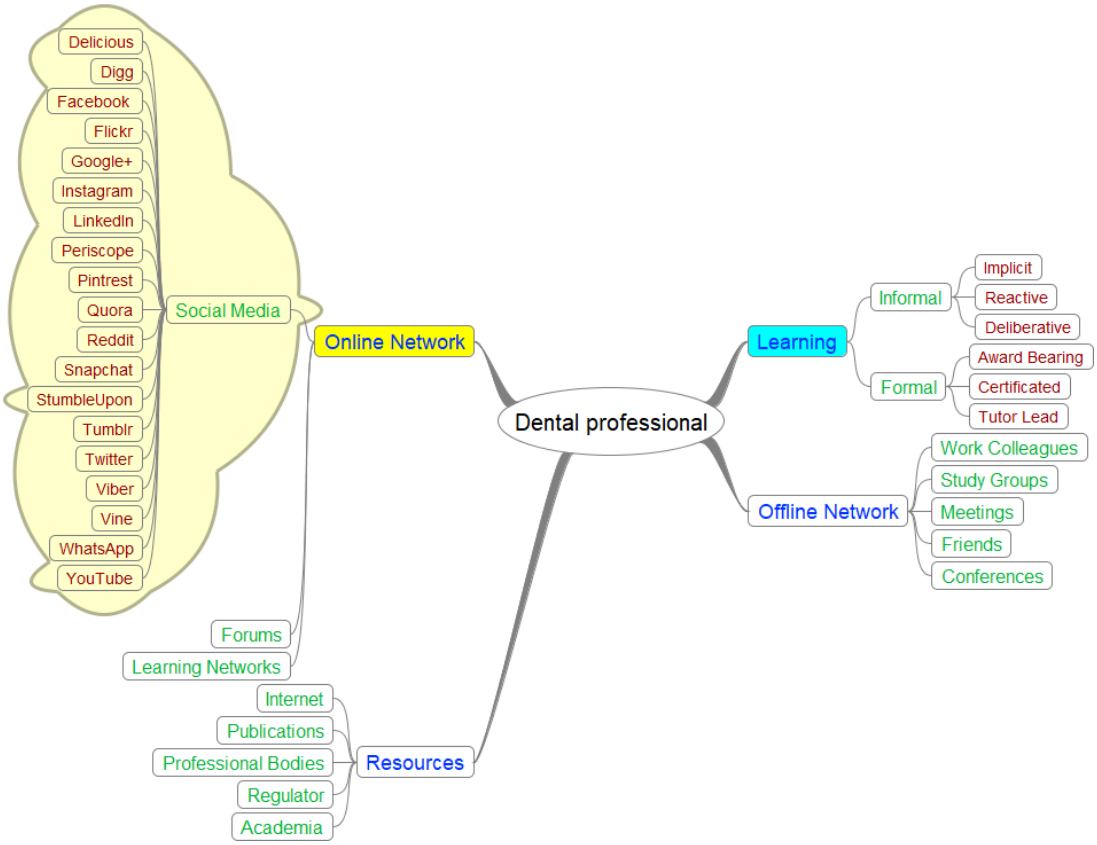

Figure 14 - Learning Network

Barabási (2011) has commented:

> The daunting reality of complexity research is that the problems it tackles are so diverse that no single theory can satisfy all needs. The expectations of social scientists for a theory of social complexity are quite different from the questions posed by biologists as they seek to uncover the phenotypic heterogeneity of cardiovascular disease. We may, however, follow in the footsteps of Steve Jobs, who once insisted that it is not the consumer's job to know what they want. It is our job, those of us working on the mathematical theory of complex systems, to define the science of the complex. Although no theory can satisfy all needs, what we can strive for is a broad framework within which most needs can be addressed (Barabási, 2011, p. 15)

Qualitative Inclinations: A Descriptive Phenomenological Approach

In the qualitative phase, a descriptive phenomenological methodology is implemented (Sundler, Lindberg, Nilsson, & Palmér, 2019). This approach aims to delve into the lived experiences of individuals, thereby providing an enriched interpretation of quantitative findings. The thematic analysis method is one of the most frequently used in health professions education research and is not bound to a particular paradigmatic orientation (Kiger & Varpio, 2020). The methodology and the findings of the qualitative dimension will be described in Chapter 5.

3.2. Method

This section of the chapter explains how the survey of Dental Professionals (Dentists, Dental Hygienists and Dental Therapists) was conducted. In essence, while all dental health professionals share the common goal of promoting oral health and providing quality dental care, their training, scope of practice, and professional interests may vary, leading to differences in their experience and use of social media. Therefore, comparing dentists, dental hygienists and dental therapists in the context of their social media engagement can provide valuable insights into their professional dynamics and how they leverage digital platforms to interact with colleagues and patients alike. The similarities between dental hygienists and dental therapists (most dental therapists are also registered as dental hygienists) allows them to be grouped together as Dental Care Professionals (DCPs).

3.3. Survey

Data was gathered via an online survey using Qualtrics via Lancaster University this will give demographic data along with quantitative data and qualitative data using a small number of open questions in a fixed mixed methods design(Creswell & Plano Clark, 2007; Dawadi, Shrestha, & Giri, 2021; Johnson, Onwuegbuzie, & Turner, 2007).

The recruitment of participants for this study was carried out through a convenience sampling approach. Various strategies were employed to ensure a diverse range of participants, beyond those who actively engage in social media and online networks. One method involved leveraging social networks (Facebook & Twitter), including a forum overseen by the author (hygienist.co.uk), where direct emails were sent to potential participants. Additionally, memberships of dental associations were targeted through their publications and websites (GDPUK), requesting participants with links to the survey. This approach aimed to achieve a comprehensive cross-section of the demographic population, encompassing a wide range of Dentists, Dental Hygienists and Dental Therapists.

By employing a convenience sample, it is important to acknowledge that the conclusions drawn from this study may have limitations in terms of their representativeness (Fricker, 2016). The online nature of the survey inherently excludes individuals who do not have internet access or are not active online. To mitigate this limitation, efforts were made to encourage participants to share the survey with their colleagues via email, thus widening the potential pool of respondents. However, it is crucial to recognise that the conclusions drawn from this study cannot be assumed to fully encapsulate the entire demographic due to the inherent complexities associated with the application of complexity theory. The same set of circumstances or events may yield different outcomes, making it essential to approach the findings with an understanding of the nuanced nature of the research framework.

3.4. Questionnaire

Choudrie & Dwivedi (2005) found that the survey method is the most frequently used to determine technology adoption, whilst surveys have also been used in collecting qualitative data in health services research (Jahner, Penz, Stewart, & MacLeod, 2020). Questionnaires have also been used to determine learning for CPD for different groups

of DCPs (Eaton, Harris, Ross, & Arevalo, 2012; Gough & Bagnall, 2012; Lambert-Humble, 2012) and Dentists (Bullock et al., 2003).

To streamline the process of data collection and analysis, a self-administered online questionnaire was utilised in this study. This method offered notable advantages, as it eliminated the need for manual data input, which is not only time-consuming but also entails associated costs. By adopting an online format, the questionnaire facilitated efficient data gathering while minimising financial implications (Minto, Vriz, Martinato, & Gregori, 2017).

The distribution of the survey was executed through multiple channels, aiming for cost-effectiveness and wide reach. Email distribution proved to be a particularly effective and economical approach. The survey links were sent via email to a targeted group of 1362 individuals, representing a direct and personalised outreach. To ensure maximum participation, a follow-up email was sent two weeks later to those who had not responded to the initial email, thereby increasing the overall response rate. This concerted effort yielded a total of 226 valuable responses.

Furthermore, the survey links were shared on various professional forums, social media platforms, and professional journals. This strategy, known as snowball sampling, encouraged participants to share the survey links with their colleagues and professional networks. The viral nature of online sharing facilitated wider dissemination of the survey, resulting in an additional 90 responses from social media and 110 responses from an anonymous link. This resulted in a total of 381 responses to the survey, giving a confidence level of 95% with a margin of error of 5% with the population size of 50,000 (Qualtrics, 2020).

By leveraging the advantages of online distribution and harnessing the power of electronic communication, this study achieved both efficiency and cost-effectiveness in

data collection, while successfully reaching a diverse pool of respondents from the targeted professions within the dental profession.

The utilisation of self-administered questionnaires in this study offers several advantages. Firstly, it provides respondents with a sense of anonymity, enabling them to answer the questions at their own convenience and in a location of their choosing. This feature fosters a comfortable and non-threatening environment, encouraging participants to provide more candid responses (Minto, Vriz, Martinato, & Gregori, 2017). Additionally, the questionnaire format allows for broader geographic reach compared to methods like interviews, which are constrained by physical proximity. This aspect ensures a diverse representation of participants, thereby enhancing the generalisability of the study's findings.

Self-administered questionnaires mitigate the potential for interviewer bias, as the questions are standardised and administered in an identical manner to all respondents. This approach promotes consistency and reliability in data collection (Gillham, 2000). When implemented in an online format, the questionnaire data can be seamlessly imported into software for analysis. This automated process not only reduces costs but also minimises the likelihood of inputting errors, thus ensuring the accuracy and integrity of the collected data.

However, it is important to acknowledge certain limitations associated with self-administered online questionnaires. One significant concern is the potential for a low response rate, particularly if participants lack interest or motivation in the study. This could compromise the representativeness of the sample and limit the generalisability of the findings. Additionally, there is a risk that respondents may answer the questions in a manner they believe is expected rather than providing genuine responses. To address this, some questions can be cross-checked or rephrased to mitigate response bias and encourage more accurate data.

Also, self-administered questionnaires lack the opportunity for prompt and probing follow-up, thereby limiting the depth and breadth of responses. This constraint restricts the possibility of obtaining additional data or clarifying ambiguous answers" (Walliman, 2006). Despite these drawbacks, the advantages of self-administered online questionnaires, including anonymity, convenience, standardised administration, and streamlined data analysis, outweigh the potential limitations, making them a valuable tool in this research.

Questionnaires can consist of two distinct types of questions: closed questions and open questions, each serving different purposes in data collection. Open questions allow respondents to provide free-form responses, offering an opportunity to express their thoughts and perspectives in a more comprehensive manner. The provision of ample space for such responses enables the capture of richer insights compared to closed questions. However, it is important to note that open questions require greater thought and effort from the respondent and also demand additional time from the researcher for reading and analysing the responses.

On the other hand, closed questions provide respondents with a predetermined set of response options to choose from. These options can vary in nature and structure. For instance, a closed question may restrict the response to a binary choice such as yes/no, allowing for an either-or answer. Alternatively, respondents may be presented with a list of choices, from which they can select any or all options that are applicable to them. In some cases, closed questions incorporate a scale format, such as the widely used Likert scale, which allows individuals to indicate their level of agreement or disagreement with a statement. Most Likert scales typically offer 5 or 7 choices within the range, ensuring an odd number of options to include a neutral midpoint (Gillham, 2000). In this particular study, a combination of closed and open questions was employed, with Likert scales comprising 5 choices.

The utilisation of a mix of closed and open questions in the questionnaire design enabled the researcher to gather both specific and detailed responses through closed questions, as well as more expansive and nuanced insights through open questions. This balanced approach enriched the data collection process and provided a comprehensive understanding of the participants' perspectives within the study's scope.

The next section describes the process of designing the questionnaire and the testing.

3.5. Questionnaire Design

A self-administered online questionnaire was designed with the aim of capturing the demographics, attitudes and behaviours of Dental Professionals practising in the UK, to their use of Social Media, informal learning, connections, and their use of technology, unearthing the relationship between variables.

Questionnaires have been used to determine technology acceptance (Briz-Ponce & García-Peñalvo, 2015; Rauniar, Rawski, Yang, & Johnson, 2014b) and the use of social media for informal learning (Alsobayel, 2016; Stanfield, 2020) Self-directed informal learning (Song & Bonk, 2016), and CPD in Dentistry (Eaton, Harris, Ross, & Arevalo, 2012; Faigenblum, Eder, & Louca, 2013).

This study used a correlation explanatory design (Creswell, 2014, p. 206), as this study aimed to discover if relationships exist between the variables. Other designs were excluded as the study does not attempt to relate cause and effect, nor is it experimental as it doesn't have a control group.

The questionnaire was designed with the following sections:

- Qualifying Criteria Assessment:
    - The initial segment was dedicated to confirming the eligibility of respondents. It was imperative to ascertain that participants met the

predetermined criteria to ensure the integrity and relevance of the survey responses.

- Demographic Information:
    - This segment focused on collecting demographic data from the participants. The intent was to analyse any potential correlations or patterns within the demographic context of the respondents.
- Social Media Engagement:
    - The purpose of this section was to delve into both personal and professional social media usage patterns of the participants. It explored aspects such as content sharing, learning from others, and overall engagement on social media platforms.
- Alternative Networking Channels:
    - This portion of the questionnaire was designed to investigate the participants' involvement in other networking forums outside of social media. It aimed to understand the diversity and extent of their networking practices.
- Learning and Information Validity Perspectives:
    - Here, the focus was on gathering opinions regarding both formal and informal learning processes, as well as the credibility of professionally relevant information available on the internet. Additionally, this section sought insights into the participants' views on using the internet for their professional development.
- Technology Utilisation and Perceptions:

- The final section was aimed at understanding the participants' usage of various technologies. It also sought to capture their perceptions regarding their engagement with technology in both personal and professional contexts.

The questionnaire instrument is detailed in Appendix 1.

The survey was first distributed to five testers to ascertain if the wording of the questions were understandable and how long the survey would take. The five users in a usability study were considered to be the optimum to get as close to testing's maximum benefit (Nielsen, 2012). From this distribution it was found that all users understood the questions and therefore no alterations were necessary, each reported on the time taken to complete the survey which was then indicated to the respondents.

Finish:

On completion, respondents submit their responses and can no longer alter them, nor may they then withdraw. As the responses are submitted anonymously this precludes them from being able to withdraw consent.

In the next chapter the results of the quantitative data will be presented.

4. Findings

In the preceding chapter, we meticulously explained the research design, methodology, and method employed in this study. In the present chapter, we shall now proceed to unveil the outcomes of the quantitative findings. To facilitate a comprehensive understanding, the findings are organised into distinct sections, grouping together related insights and observations:

- Demographics
- Computer Use
- Learning Needs
- Reflection
- Collaboration
- Other Networking
- Social Media Usage

The word cloud at Figure 15, shows the responses to subjects learnt or shared between respondents. A word cloud is a visual representation of text data, where words are displayed in varying sizes and colours. The size of each word in the cloud corresponds to its frequency or importance within the text. Word clouds are often used to quickly identify the most prominent words in a document, helping to visualise patterns and themes within the text.

Figure 15 - Word Cloud - Learnt or Shared via social media or forums.

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4.1. Demographics

4.1.1. Geographical Distribution

To gain insights into the geographical spread of the survey participants, the study utilised IP address information. This method allowed for an estimation of the areas from which respondents accessed the survey, contributing to an understanding of participant dispersion throughout the United Kingdom, as illustrated in Figure 16. It is important to note that this approach is not entirely precise, owing to the potential use of Virtual Private Networks (VPNs), which can obscure actual IP addresses. However, this method still offers a general overview of the geographical distribution of respondents. In research practices, it is crucial to ensure that any data collected, including IP addresses, is processed in a way that upholds the confidentiality and anonymity of the participants. This often involves aggregating data or using it in a manner that makes it impossible to trace back to an individual. For this reason, the IP addresses were separated from the main data in the analysis to maintain the anonymity.

The data revealed a remarkable dispersion of respondents throughout the United Kingdom, with clusters notably concentrated in major urban areas, as anticipated by previous research conducted by Brunton et al. (2012, p. 12). These regions, encompassed by the darker circles in Figure 16, indicate a higher concentration of respondents, highlighting the significance of these areas in shaping the survey results.

This geographical insight contributes to the generalisability and applicability of the research findings, as they reflect a diverse range of perspectives and experiences across different areas within the United Kingdom.

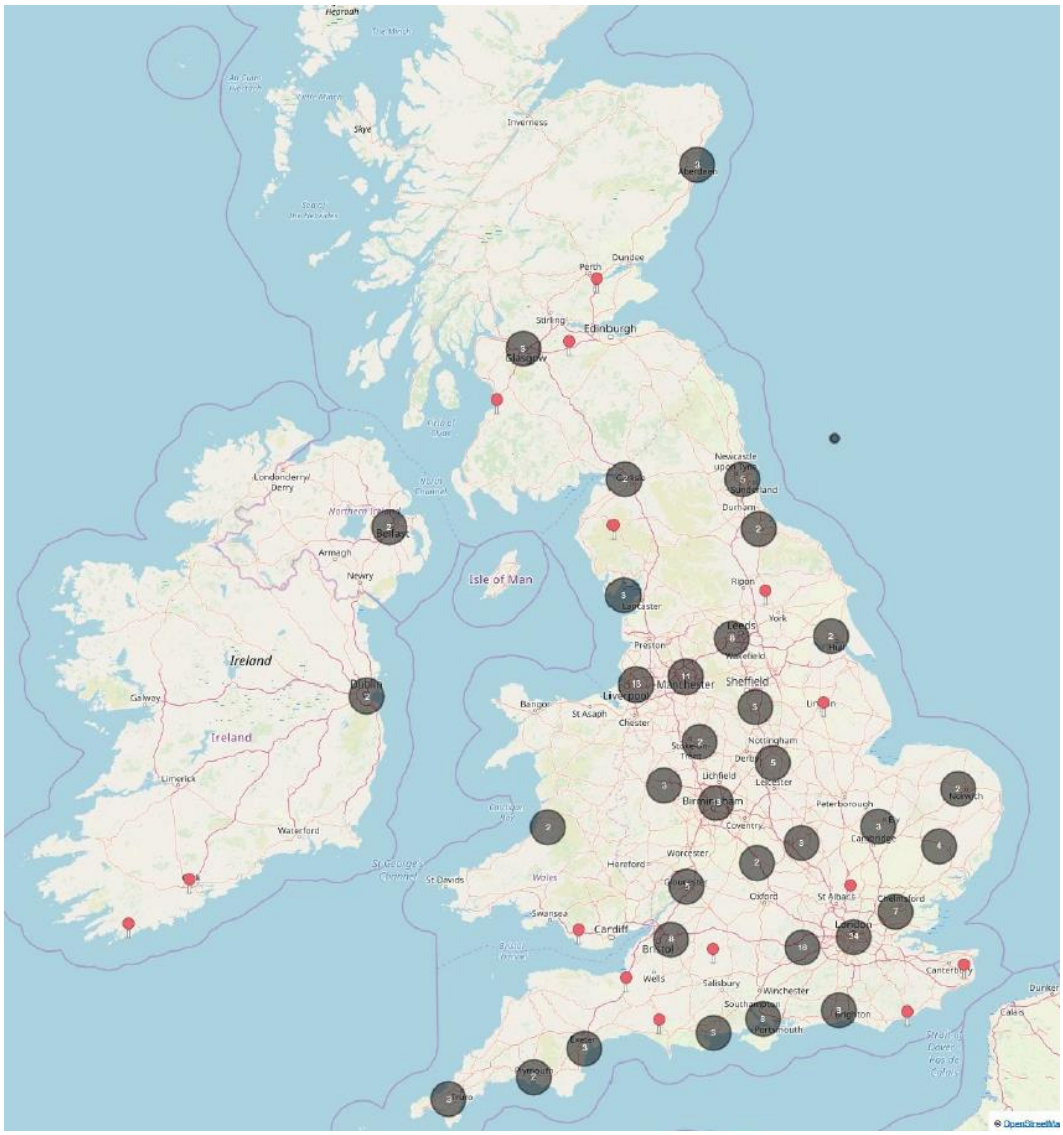

Figure 16 - respondent distribution map.

4.1.2. Age

The ages of both groups are as would be expected for each group with the under 30 groups being a little higher for the DCP group (6.5% DCP – 2.3% Dentist) and the over 60 groups higher for the Dentist group (13.8% Dentist – 8.8% DCP), this data

corresponded with the data held by the GDC (General Dental Council, 2019). Overall Dentists were a higher proportion of the older groups, as can be seen in Figure 17 and Table 5, typically Dentists tend to qualify later due to the length of their training being longer than that of Dental Hygienists and Dental Therapists . There is no statistically significant relationship between the two groups *P=0.0711 (Effect Size (Cramér's V) 0.136).*

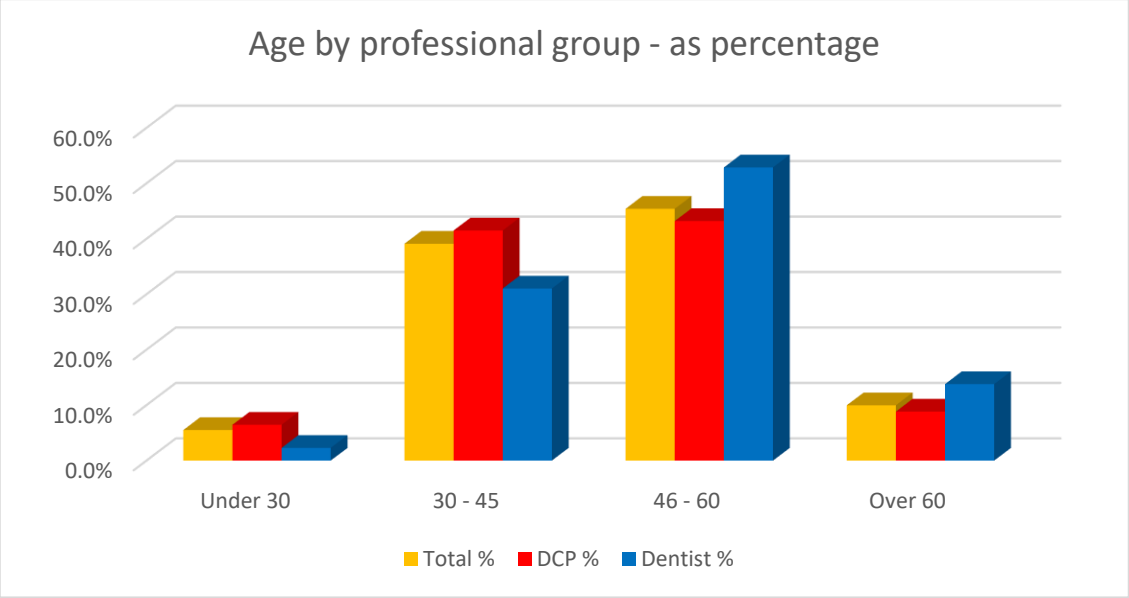

Figure 17 - Respondent age by a professional group, as a percentage of the group

		Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
In which age group are you?	Under 30	2	2.3%	19	6.5%	21	5.5%
	30 - 45	27	31.0%	122	41.5%	149	39.1%
	46 - 60	46	52.9%	127	43.2%	173	45.4%
	Over 60	12	13.8%	26	8.8%	38	10.0%
Total		87		294		381	

Table 5 - Respondent age by a professional group

4.1.3. Gender

Overall, more DCPs responded to the survey; therefore, the quantity of females in each group is higher and corresponds to a normal distribution of age groups Figure 18. To clarify, respondents were given 4 options on gender identification grouping (Appendix 1, Q5), all responded either male or female, despite the other options of 'Other' and 'Prefer not to say'..

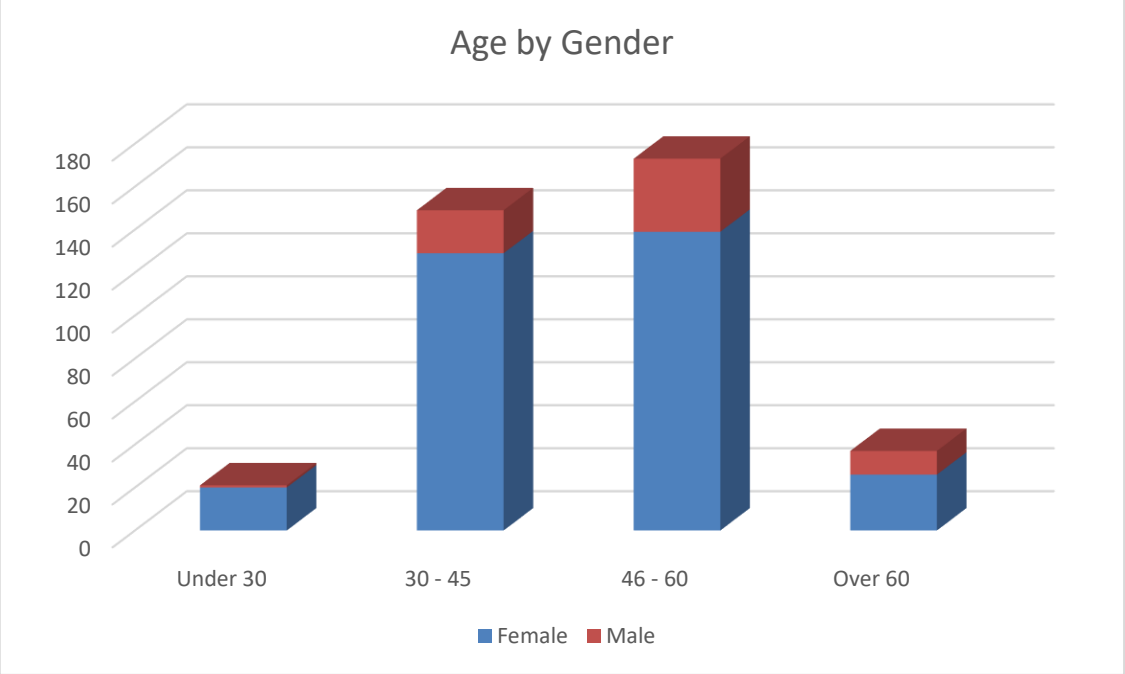

Figure 18 - Respondent Age by gender.

Of the DCP group, 95.6% (n=281) identified as female and 4.1% (n=12) identified as male, the distribution of females is similar to the distribution found on the GDC register (Table 6), however, this was not so for dentists, they enjoy a 50/50 distribution of males/females (Figure 19), whereas in the responding dentist group 62.1% (n=54) identified as male and 37.9% (n=33) identified as female (Figure 19). *P< 0.00001 (Effect Size (Cramér's V) 0.643).* However, due to the small size of dentist respondents, it was decided not to weight the data as this could greatly affect the accuracy.

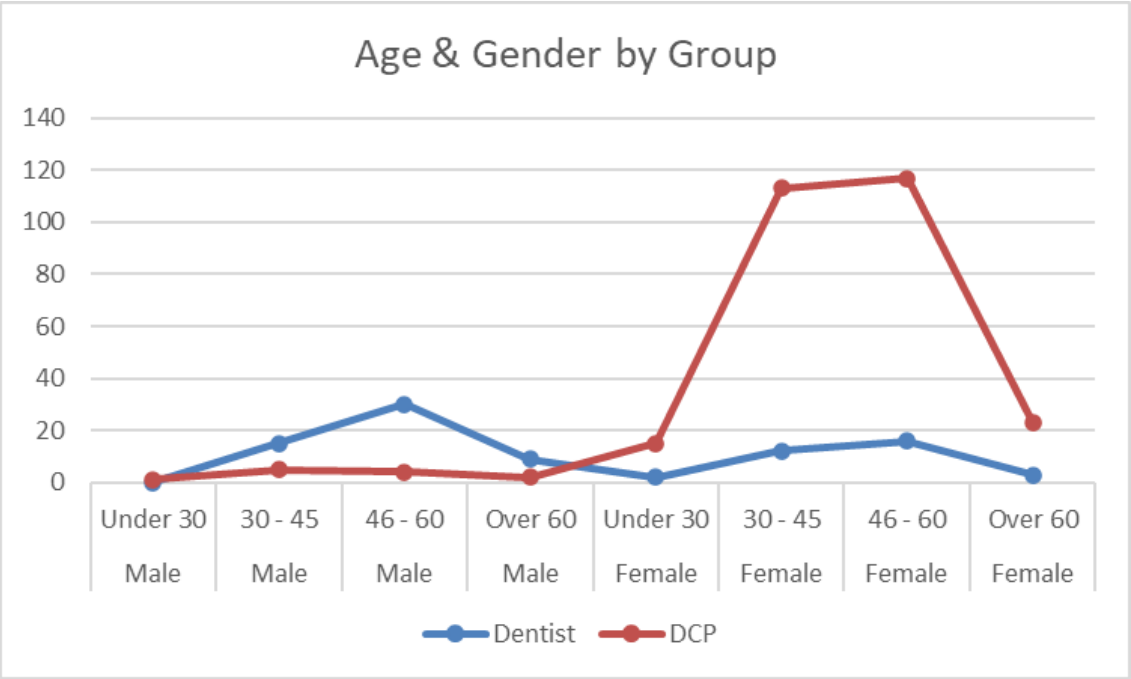

Figure 19 - Respondent Age & Gender by Group

	Male	Female	Gender unknown	Total
Dentist	21130 (50%)	21296 (50%)	0	42,426
DCP	326 (4%)	7,432 (96%)	0	7,758

Table 6 - Numbers and Gender GDC Register December 2019, (General Dental Council, 2019)

4.1.4. Length of time qualified

Of the respondents who reported their year of entry onto the GDC registry (Figure 20), 10.6% (n=45) did not report a year of entry. Table 7, shows the mean = 1997 and the median year as 1998. The data was compiled into 5-year groups to even out the highs and lows, showing a normal distribution curve (Figure 21).

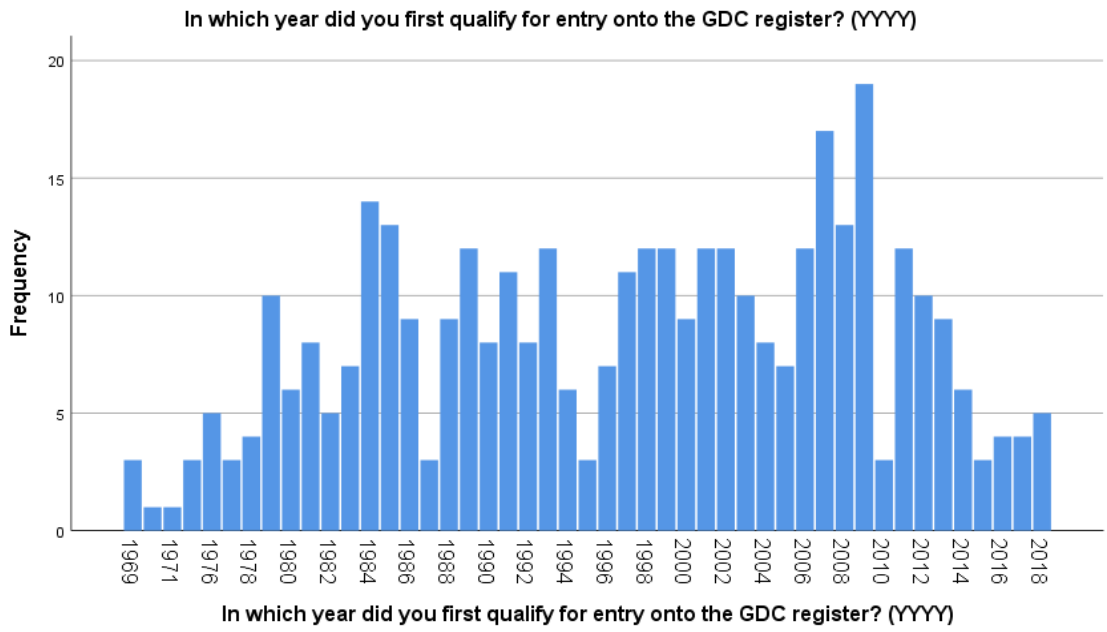

Figure 20 - Respondents' year of entry onto the GDC register.

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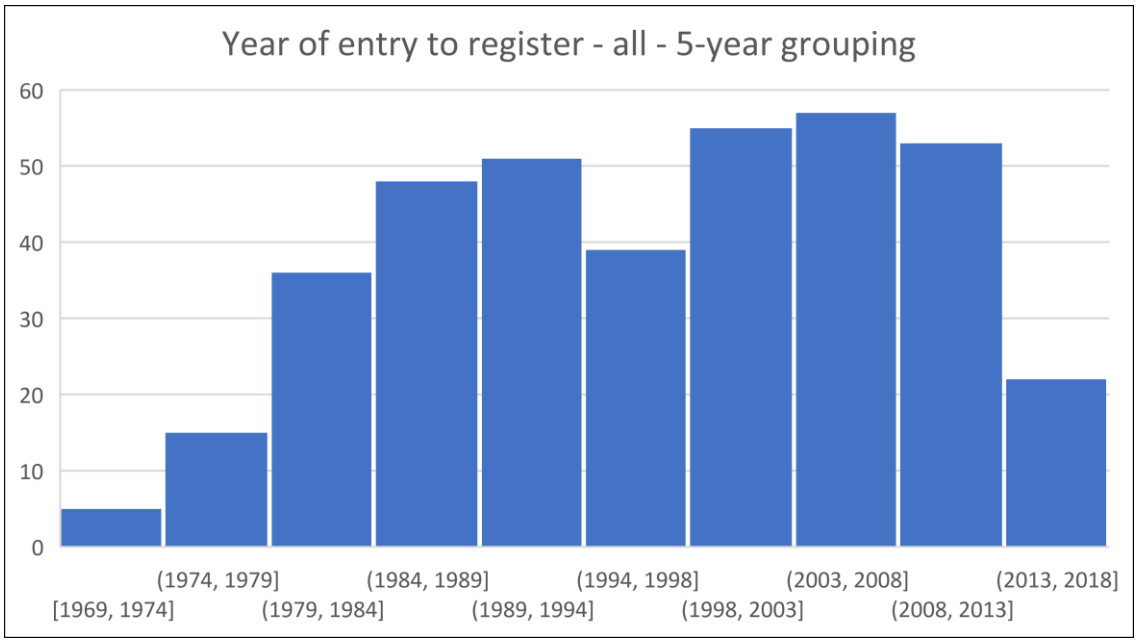


Figure 21 - Respondent year of entry onto GDC register as a 5-year grouping.

Statistics

10.6 % did not report the year of joining (n= 45)

Mean	1997
Median	1998
Mode	2009
Range	49
Minimum	1969
Maximum	2018

Table 7 - Year of joining Dental Register – Statistics

The dip between 1994 and 1998 reflects the reduction in intake occurring in 1996 (Ross, Ibbetson, & Rennie, 2005).

4.2. Computer Use

In this section the 'Perceived Usefulness', 'Perceived Ease of Use' and the 'Attitude Towards Using' were examined with both groups of respondents to establish any differences between the groups (Davis, 1989b). The underlying assumption is that individuals are more likely to embrace and use a technology if they perceive it as highly useful and user-friendly. These positive perceptions are believed to foster a favourable attitude towards using the technology, which, in turn, is expected to drive actual usage behaviour. On the other hand, negative perceptions of the technology's usefulness and ease of use may lead to a less favourable attitude, consequently reducing the likelihood of widespread adoption and usage.

4.2.1. Perceived usefulness (PU)

This refers to the extent to which a person believes that a particular technology will enhance their job performance, make tasks easier, or provide benefits that align with their goals and needs. When users perceive a technology as useful, they are more likely to have a positive attitude towards it and are, therefore, more inclined to adopt and use it .

Table 8 and Figure 22 show that 77.3% (n=58) of dentists and 85.4% (n=216) of DCPs agree that the resources they use for information are reliable. This reliability would be important for any healthcare professional when researching for information. There is no statistically significant relationship between the two groups (*P= 0.111) (Effect Size (Cramér's V) 0.151).* The small effect size suggests that while the relationship is not statistically significant, there may still be some association between the two groups in their perceptions of information reliability.

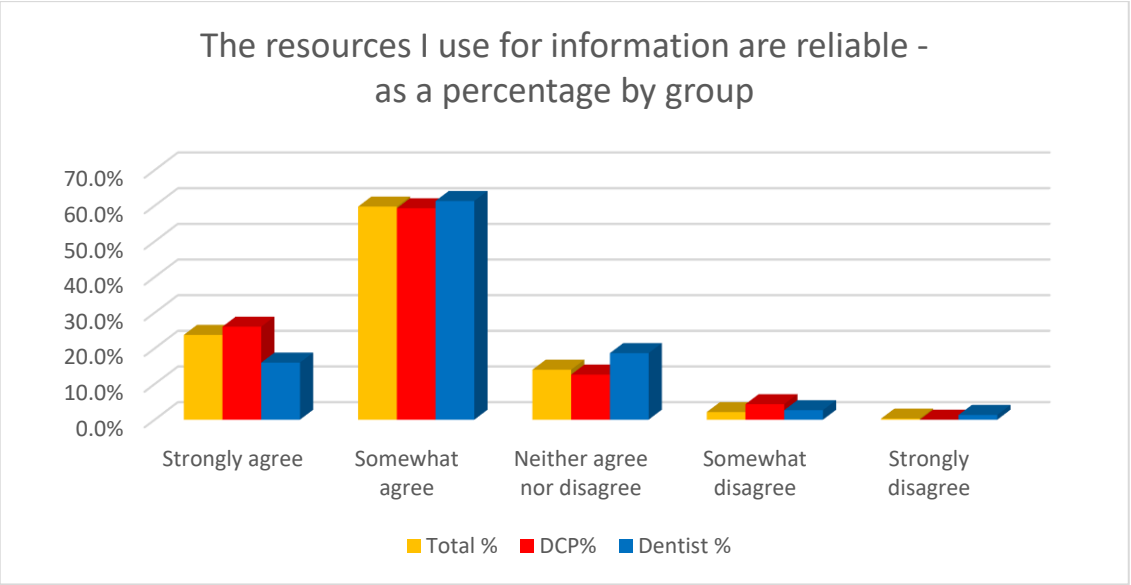


Figure 22 - Resources used for information are reliable – as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	12	16.0%	66	26.1%	78	23.8%
Somewhat agree	46	61.3%	150	59.3%	196	59.8%
Neither agree nor disagree	14	18.7%	32	12.6%	46	14.0%
Somewhat disagree	2	2.7%	5	2.0%	7	2.1%
Strongly disagree	1	1.3%	0	0.0%	1	0.3%
Total	75		253		328	

Table 8 - -Resources used for information are reliable – as a percentage by group.

This use of reliable information would then relate to finding information on the internet which is demonstrated in Table 9 and Figure 23. 85.4% (n=64) of dentists and 94.9% (n=240) of DCPs agree that they can usually find the information they are looking for on the internet. There is a statistically significant relationship between the two groups, (*P= 0.0312*) (Effect Size (Cramér's V) 0.164).

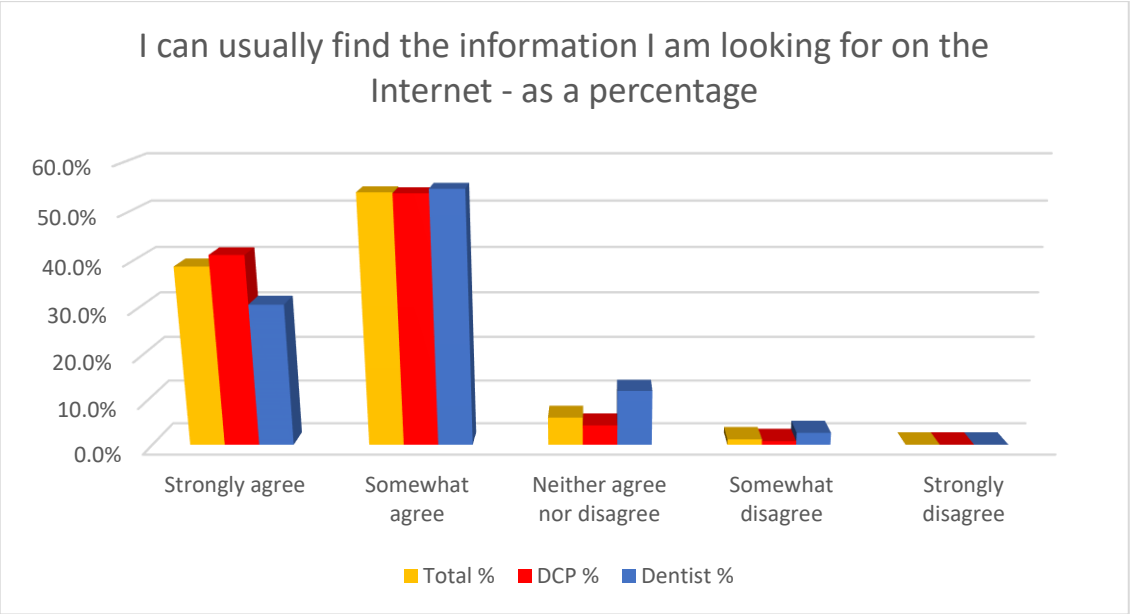


Figure 23 - I can usually find the information I am looking for on the Internet - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	23	30.7%	104	41.1%	127	38.7%
Somewhat agree	41	54.7%	136	53.8%	177	54.0%
Neither agree nor disagree	9	12.0%	11	4.3%	20	6.1%
Somewhat disagree	2	2.7%	2	0.8%	4	1.2%
Strongly disagree	0	0.0%	0	0.0%	0	0.0%
Total	75		253		328	

Table 9 - I can usually find the information I am looking for on the Internet - as a percentage by group.

Despite being confident in the information they find and their ability to find such information, users still find that they cross-check the information found. Table 10 and Figure 24 show that 78.4% (n=257) of dental professionals agree that the cross-checking the source of information is needed. There is no statistically significant relationship between the two groups (*P= 0.284*) (Effect Size (Cramér's V) 0.124).

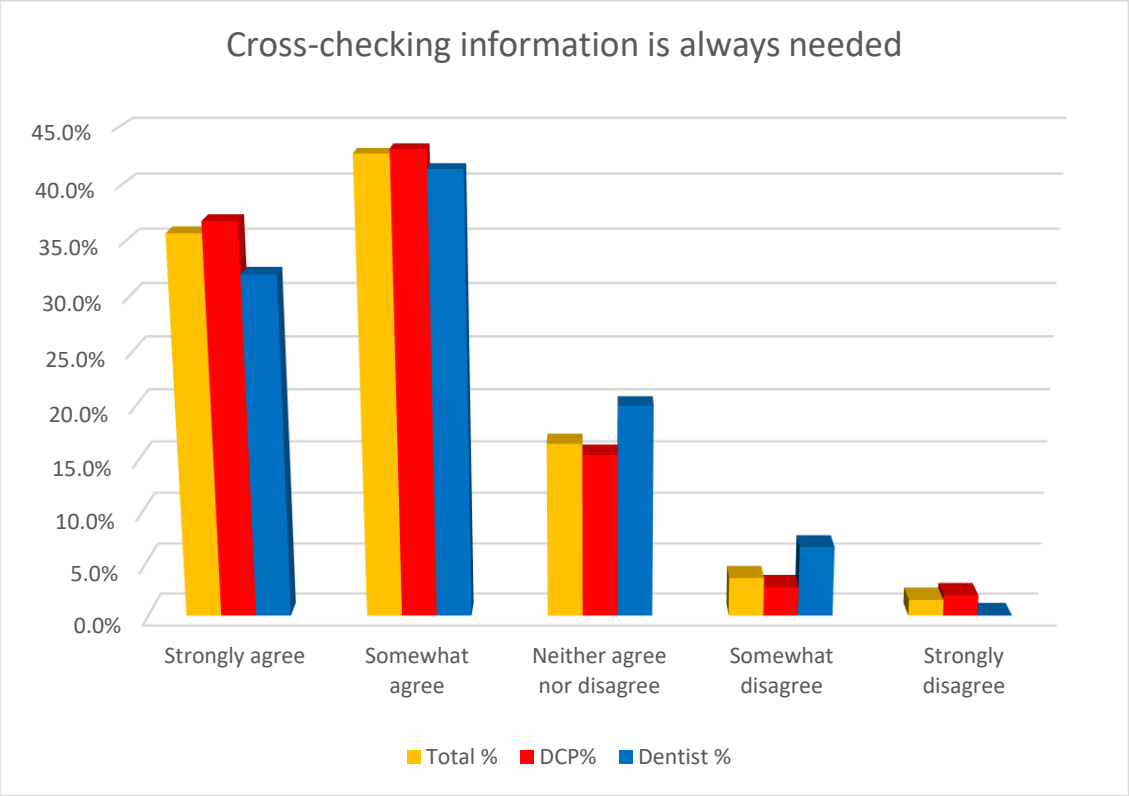


Figure 24 - Cross-checking information is always needed by group.

	Dentist count	Dentist %	DCP count	DCP%	Total	Total %
Strongly agree	24	32.0%	93	36.8%	117	35.7%
Somewhat agree	31	41.3%	109	43.1%	140	42.7%
Neither agree nor disagree	15	20.0%	39	15.4%	54	16.5%
Somewhat disagree	5	6.7%	7	2.8%	12	3.7%
Strongly disagree	0	0.0%	5	2.0%	5	1.5%
Total	75		253		328	

Table 10 - Cross-checking information is always needed by group.

Table 11 and Figure 25 show that 33.4% (n=25) of dentists and 52.6% (n=130) of DCPs agreed that they believed using social media improved their performance in their jobs. Dentists were not as sure as the DCPs with 40% (n=30) neither agreeing nor disagreeing that it improved their performance. There is a statistically significant relationship between the two groups (*P= 0.0233*) (Effect Size (Cramér's V) 0.187) indicating that there is a moderate association between the groups. However, it is crucial to reiterate that these findings are based on participants' subjective perceptions, and the data does not offer concrete evidence either supporting or refuting the actual impact of social media usage on their job performance. As such, any conclusions drawn from this study should be interpreted with caution, and further empirical research may be necessary to establish a more definitive understanding of the relationship between social media use and job performance in the dental profession.

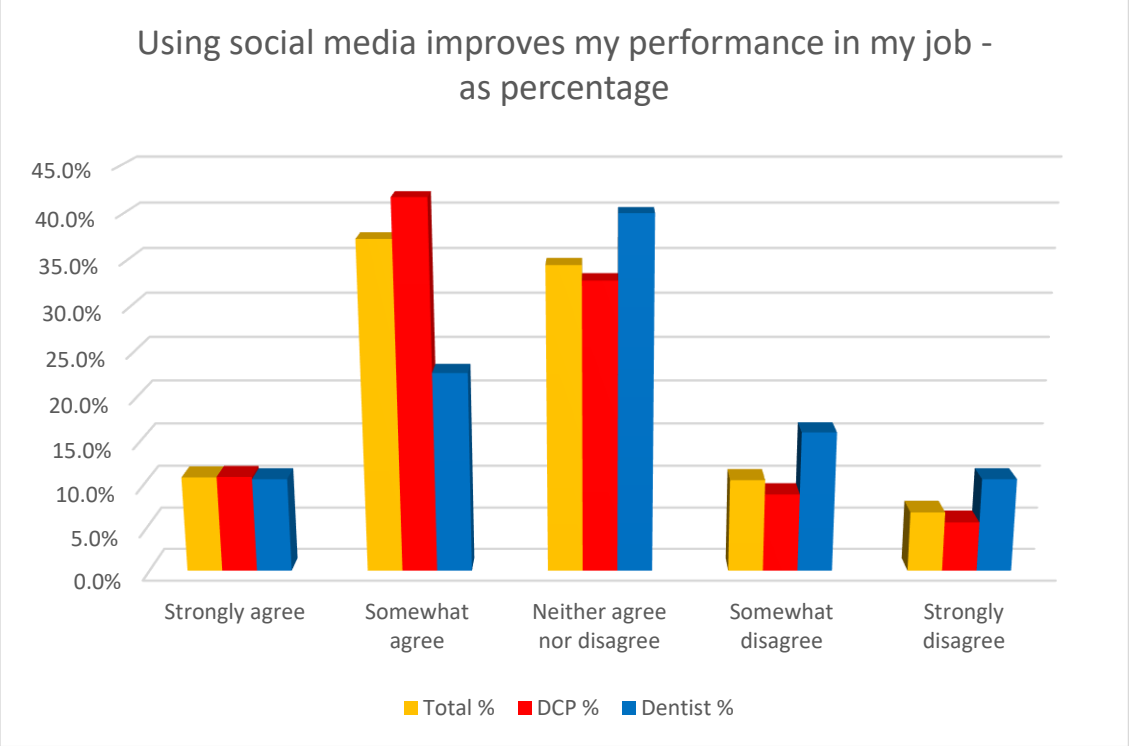


Figure 25 - Using social media improves my performance in my job - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	8	10.7%	27	10.9%	35	10.9%
Somewhat agree	17	22.7%	103	41.7%	120	37.3%
Neither agree nor disagree	30	40.0%	81	32.8%	111	34.5%
Somewhat disagree	12	16.0%	22	8.9%	34	10.6%
Strongly disagree	8	10.7%	14	5.7%	22	6.8%
Total	75		247		322	

Table 11 - Using social media improves my performance in my job - as a percentage by group.

4.2.2. Perceived Ease of Use (PEOU)

This refers to the extent to which a person believes that using the technology will be effortless and straightforward. If a technology is perceived as easy to use, it lowers the perceived barriers to adoption and increases the likelihood that users will have a positive attitude towards it.

Table 12 and Figure 26 show that 84.9% (n=277) of dental professionals believe that they are confident in their use of computers. It is important to note that this does not constitute empirical evidence of their actual skill as computer users; rather, it reflects their level of confidence and perception regarding their computer proficiency. Nonetheless, a user who possesses confidence in their ability is more inclined to use the technology. There is no statistically significant relationship between the two groups (*P= 0.242*) (Effect Size (Cramér's V) 0.130).

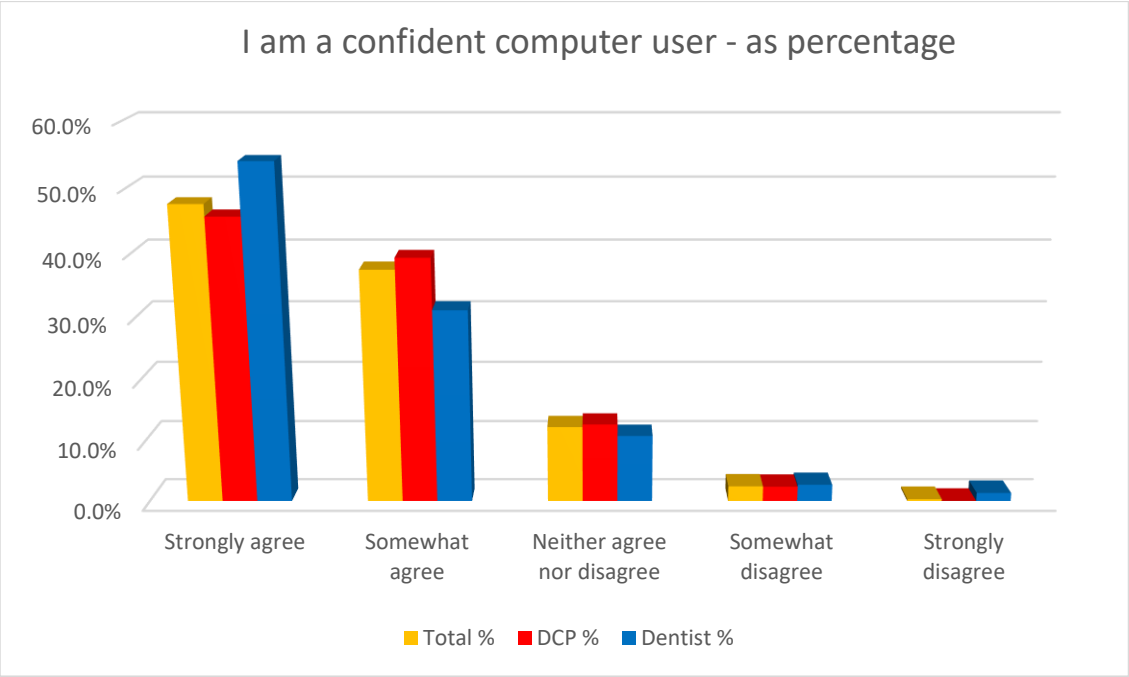


Figure 26 - I am a confident computer user - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	40	54.1%	115	45.6%	155	47.5%
Somewhat agree	23	31.1%	99	39.3%	122	37.4%
Neither agree nor disagree	8	10.8%	32	12.7%	40	12.3%
Somewhat disagree	2	2.7%	6	2.4%	8	2.5%
Strongly disagree	1	1.4%	0	0.0%	1	0.3%
Total	74		252		326	

Table 12 - I am a confident computer user - as a percentage by group.

Respondents were asked if they found computers easy to use, thus indicating that they felt comfortable with their use, as they perceived it. Overall, 78.9% (n=253) agreed that they did find computers easy to use (Figure 27 & Table 13). There is no statistically significant relationship between the two groups (*P= 0.189*) (Effect Size (Cramér's V)0.138).

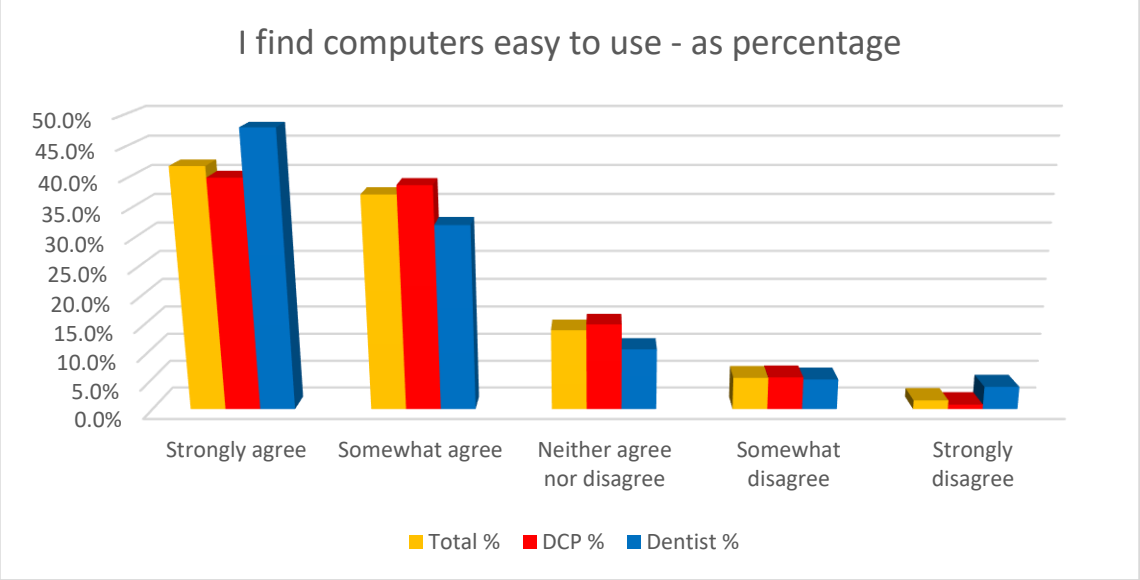


Figure 27 - I find computers easy to use - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	36	48.0%	98	39.8%	134	41.7%
Somewhat agree	24	32.0%	95	38.6%	119	37.1%
Neither agree nor disagree	8	10.7%	37	15.0%	45	14.0%
Somewhat disagree	4	5.3%	14	5.7%	18	5.6%
Strongly disagree	3	4.0%	2	0.8%	5	1.6%
Total	75		246		321	

Table 13- I find computers easy to use - as a percentage by group.

Whilst respondents felt comfortable in their use of computers, the same could not be said for showing others how to use a computer. Both groups gave a similar response in that 41.8% (n=134) agreed they tended to show others how to use a computer (Figure 28 & Table 14). There is no statistically significant relationship between the two groups (*P= 0.704*) (Effect Size (Cramér's V) 0.0823).

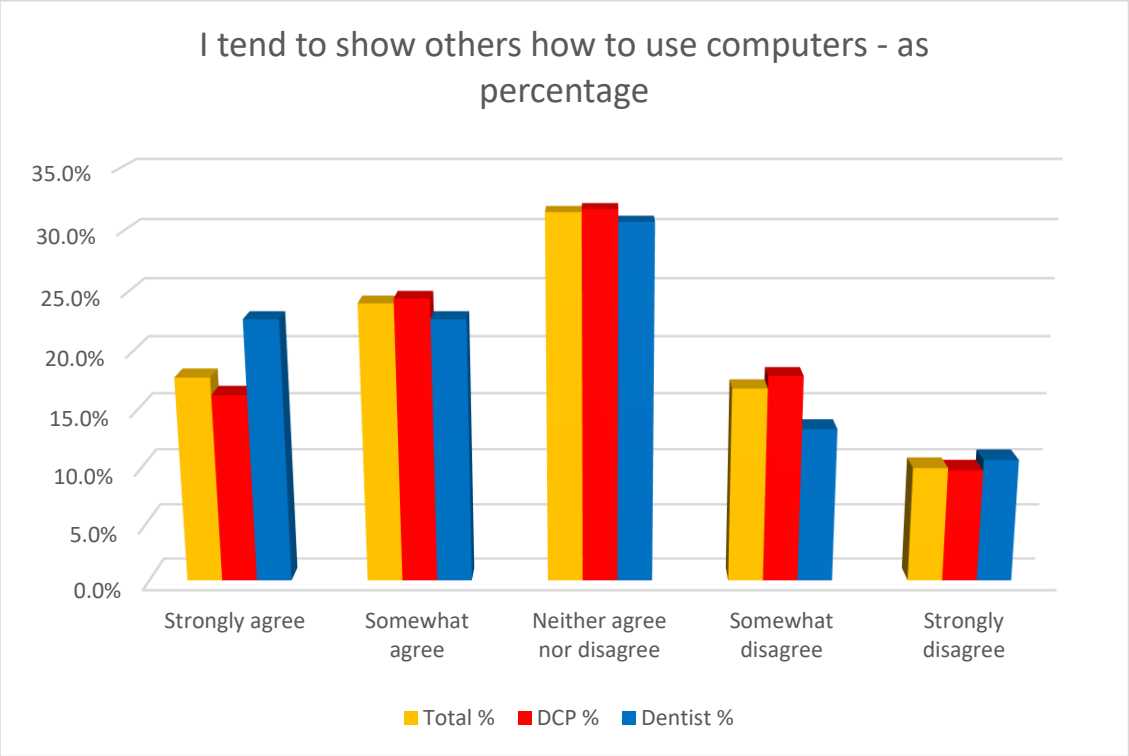


Figure 28 - I tend to show others how to use computers - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	17	22.7%	40	16.3%	57	17.8%
Somewhat agree	17	22.7%	60	24.4%	77	24.0%
Neither agree nor disagree	23	30.7%	78	31.7%	101	31.5%

Somewhat disagree	10	13.3%	44	17.9%	54	16.8%
Strongly disagree	8	10.7%	24	9.8%	32	10.0%
Total	75		246		321	

Table 14 - I tend to show others how to use computers - as a percentage by group.

4.2.3. Attitude Towards Using (ATU)

This encompasses users' overall emotional and cognitive evaluations of the technology. A positive attitude towards using a technology indicates that users have favourable opinions and beliefs about its usefulness and ease of use. This attitude is a crucial predictor of their intention to use the technology. The attitude towards technology can be multifaceted and varies based on individual experiences, societal influences, and specific contexts. It can range from technophilia—an optimistic embrace of new technologies—to technophobia—a hesitance or outright refusal to adapt to technological changes (Castells, 2009).

Table 15 and Figure 29 show that although dental professionals thought that social media improved their performance in their job (Figure 25 & Table 11), they did not feel the same about their productivity as only 28.2% (n=91) felt that it did in comparison to 48.2% (n=155) who felt it improved their performance. There is a statistically significant relationship between the two groups (*P= 0.00858*) (Effect Size (Cramér's V) 0.206) as DCPs are more likely to somewhat agree that the use of social media does increase their productivity.

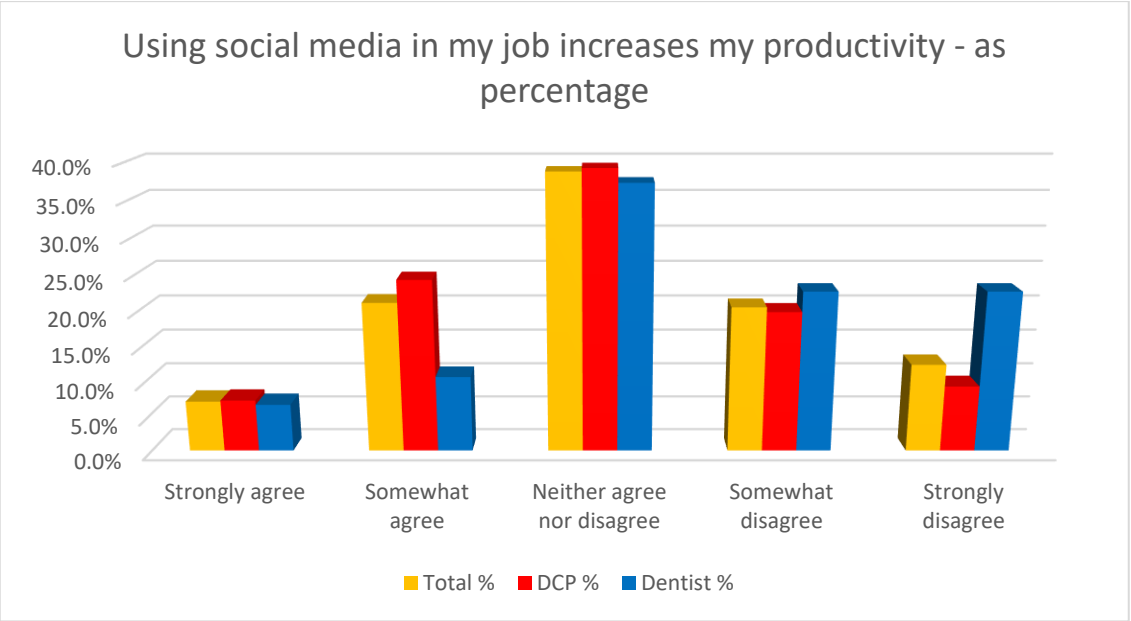


Figure 29 - Using social media in my job increases my productivity - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	5	6.7%	18	7.3%	23	7.1%
Somewhat agree	8	10.7%	60	24.3%	68	21.1%
Neither agree nor disagree	28	37.3%	97	39.3%	125	38.8%
Somewhat disagree	17	22.7%	49	19.8%	66	20.5%
Strongly disagree	17	22.7%	23	9.3%	40	12.4%
Total	75		247		322	

Table 15 - Using social media in my job increases my productivity - as a percentage by group.

Both groups find social media to be useful to their job, with Figure 30 and Table 16 showing 44% (n=33) of dentists and 67.6% (n=167) of DCPs agreeing or strongly agreeing with this, overall, 62.1% (n=200) agreed that social media was useful to their

job. There is a statistically significant relationship between the two groups (*P=0.00653*) (Effect Size (Cramér's V) 0.210).

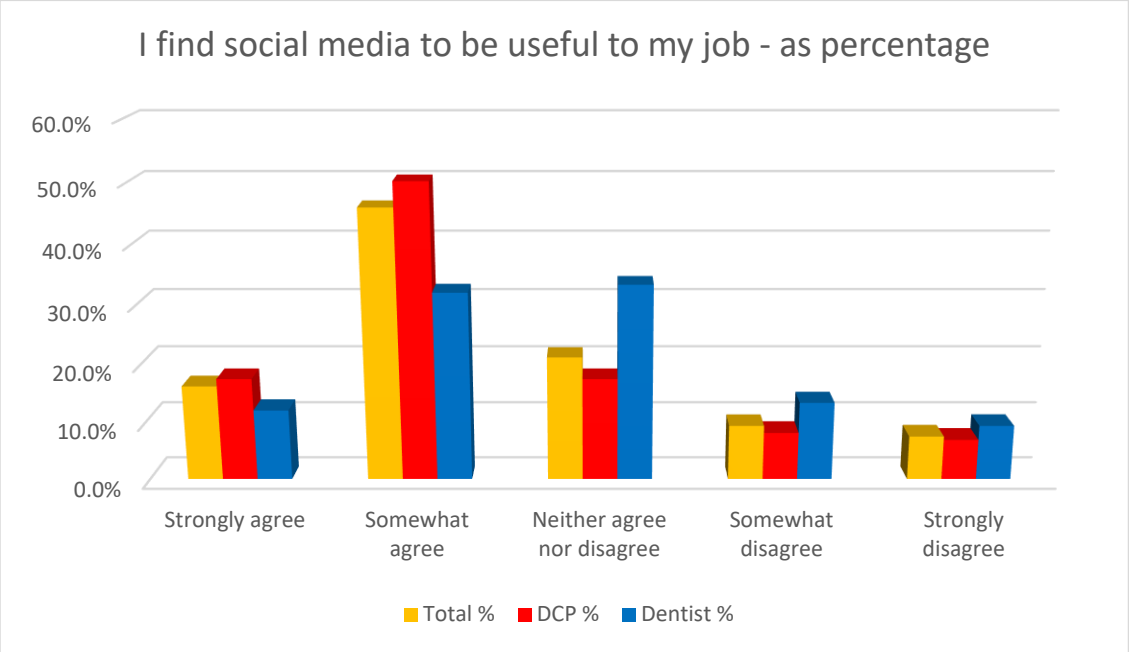


Figure 30 - I find social media to be useful to my job - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	9	12.0%	43	17.4%	52	16.1%
Somewhat agree	24	32.0%	124	50.2%	148	46.0%
Neither agree nor disagree	25	33.3%	43	17.4%	68	21.1%
Somewhat disagree	10	13.3%	20	8.1%	30	9.3%
Strongly disagree	7	9.3%	17	6.9%	24	7.5%
Total	75		247		322	

Table 16 - I find social media to be useful to my job - as a percentage by group.

Overall, 61.2% (n=197) found that they were clear about their interaction with social media as shown in Figure 31and Table 17, with 52% (n=39) of dentists and 64% (n=158) of DCPs agreeing. There is no statistically significant relationship between the two groups (*P=0.216*) (Effect Size (Cramér's V) 0.134).

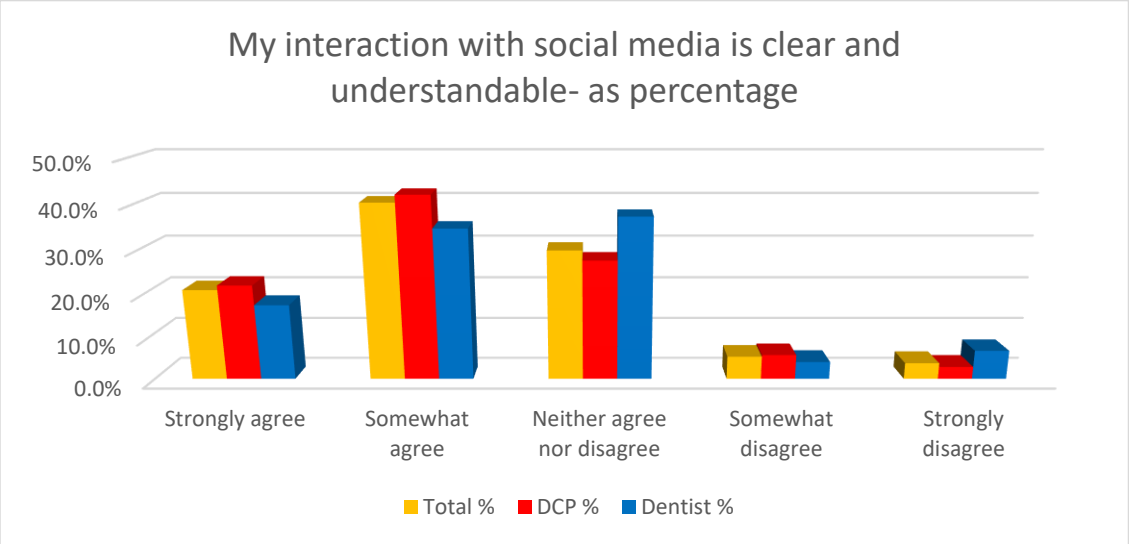


Figure 31 - My interaction with social media is clear and understandable- as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	13	17.3%	54	21.9%	67	20.8%
Somewhat agree	26	34.7%	104	42.1%	130	40.4%
Neither agree nor disagree	28	37.3%	68	27.5%	96	29.8%
Somewhat disagree	3	4.0%	14	5.7%	17	5.3%
Strongly disagree	5	6.7%	7	2.8%	12	3.7%
Total	75		247		322	

Table 17 - My interaction with social media is clear and understandable- as a percentage by group.

In interacting with social media 49.4% (n=37) of Dentists and 59.9% (n=148) of DCPs, as shown in Figure 32and Table 18, do not think that this interaction requires a lot of mental effort. There is no statistically significant relationship between the two groups (*P=0.161*) (Effect Size (Cramér's V) 0.143).

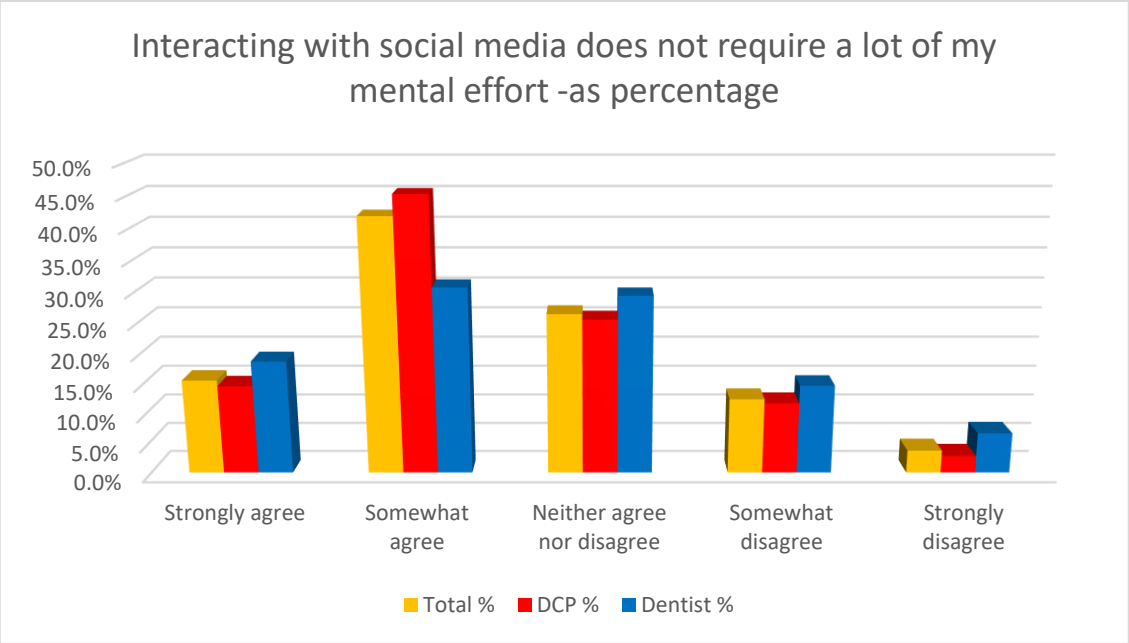


Figure 32 - Interacting with social media does not require a lot of my mental effort -as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	14	18.7%	36	14.6%	50	15.5%
Somewhat agree	23	30.7%	112	45.3%	135	41.9%
Neither agree nor disagree	22	29.3%	63	25.5%	85	26.4%
Somewhat disagree	11	14.7%	29	11.7%	40	12.4%
Strongly disagree	5	6.7%	7	2.8%	12	3.7%
Total	75		247		322	

Table 18 - Interacting with social media does not require a lot of my mental effort -as a percentage by group.

62.7% (n=47) of Dentists and 84.9% (n=209) of DCPs reported that they find social media easy to use as shown in Figure 33and Table 19. There is a statistically significant relationship between the two groups (*P=0.00124*) (Effect Size (Cramér's V) 0.237).

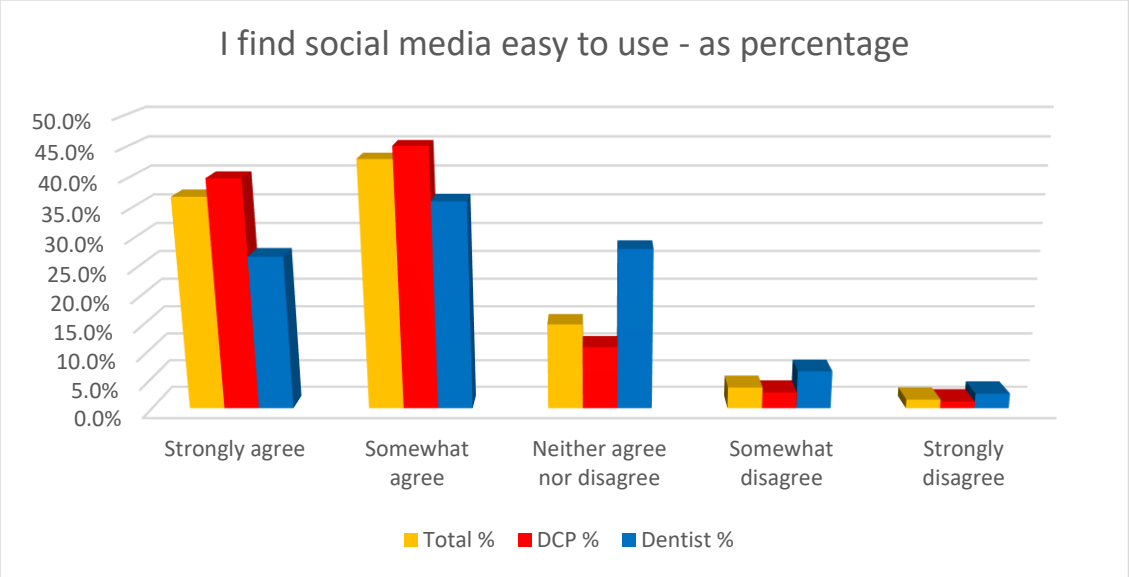


Figure 33 - I find social media easy to use - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	20	26.7%	98	39.8%	118	36.8%
Somewhat agree	27	36.0%	111	45.1%	138	43.0%
Neither agree nor disagree	21	28.0%	27	11.0%	48	15.0%
Somewhat disagree	5	6.7%	7	2.8%	12	3.7%
Strongly disagree	2	2.7%	3	1.2%	5	1.6%
Total	75		246		321	

Table 19 - I find social media easy to use - as a percentage by group.

Overall, 69.2% agreed that they find it easy to get apps to do what they want, this figure is higher in the DCP group (74.4%, n=183) compared to the Dentist group (52%, n=39) as shown in Figure 34 and Table 20. There is a statistically significant relationship between the two groups (*P=0.00411*) (Effect Size (Cramér's V) 0.218).

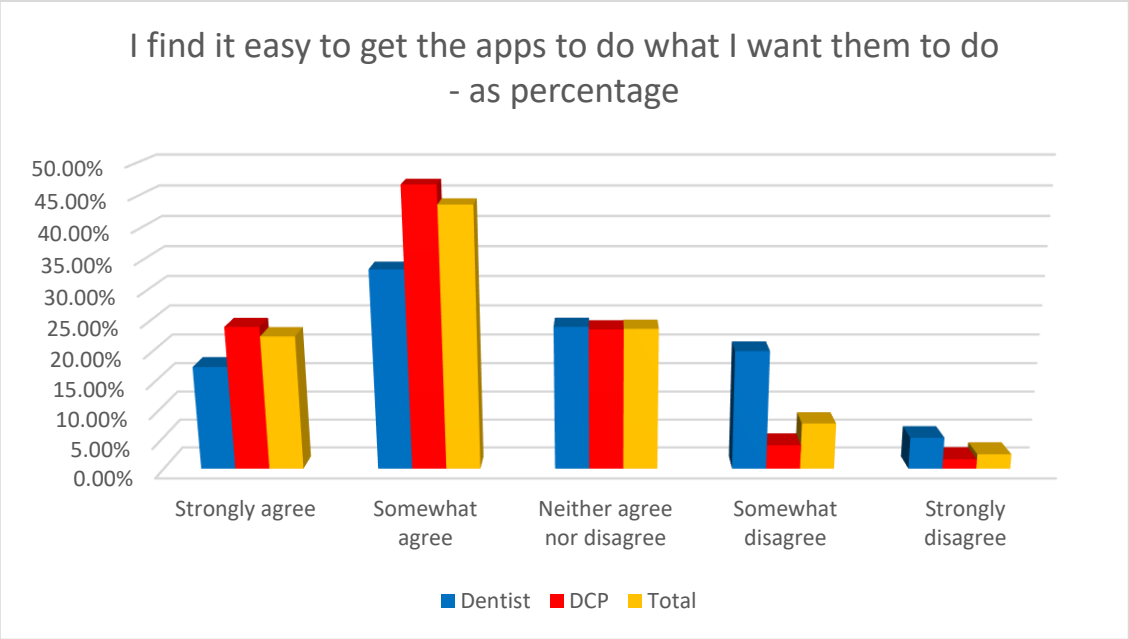


Figure 34 - I find it easy to get the apps to do what I want them to do. - as a percentage by group

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	14	18.7%	62	25.2%	76	23.7%
Somewhat agree	25	33.3%	121	49.2%	146	45.5%
Neither agree nor disagree	21	28.0%	44	17.9%	65	20.2%
Somewhat disagree	12	16.0%	15	6.1%	27	8.4%
Strongly disagree	3	4.0%	4	1.6%	7	2.2%
Total	75		246		321	

Table 20 - I find it easy to get the apps to do what I want them to do. - as a percentage by group

To test reliability this question was asked in a slightly different manner, yielding very similar results with 66% (n=212) overall, 70.7% (n=174) in the DCP group and 50.6% (n=38) in the Dentist group agreeing that they were able to control the apps as shown in Figure 35 and Table 21. Analysing the reliability produced a Cronbach's alpha score of .915, suggesting excellent internal consistency. This showed a statistically significant relationship between the two groups (*P=0.0000414*) (Effect Size (Cramér's V)0.281).

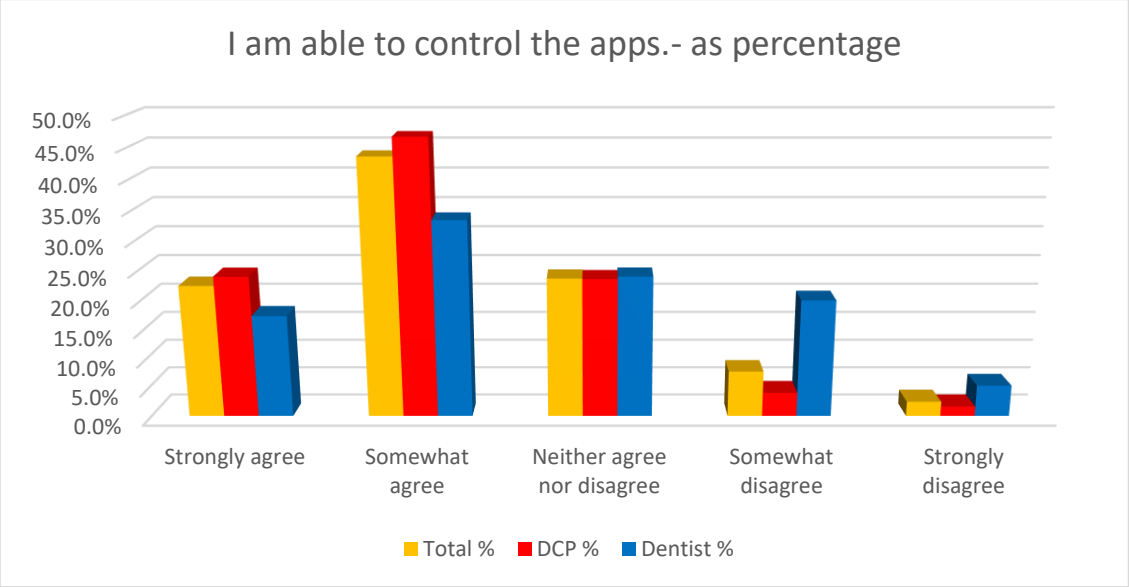


Figure 35 - I am able to control the apps. - as a percentage by group

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	13	17.3%	59	24.0%	72	22.4%
Somewhat agree	25	33.3%	115	46.7%	140	43.6%
Neither agree nor disagree	18	24.0%	58	23.6%	76	23.7%
Somewhat disagree	15	20.0%	10	4.1%	25	7.8%
Strongly disagree	4	5.3%	4	1.6%	8	2.5%
Total	75		246		321	

Table 21 - I am able to control the apps. - as percentage by group

Respondents were asked if they have the resources necessary in order to use the applications. Overall, 69.3% (n=223) agreed that they do have the necessary resources (Figure 36 & Table 22). There is no statistically significant relationship between the two groups (*P=0.0559*) (Effect Size (Cramér's V) 0.169).

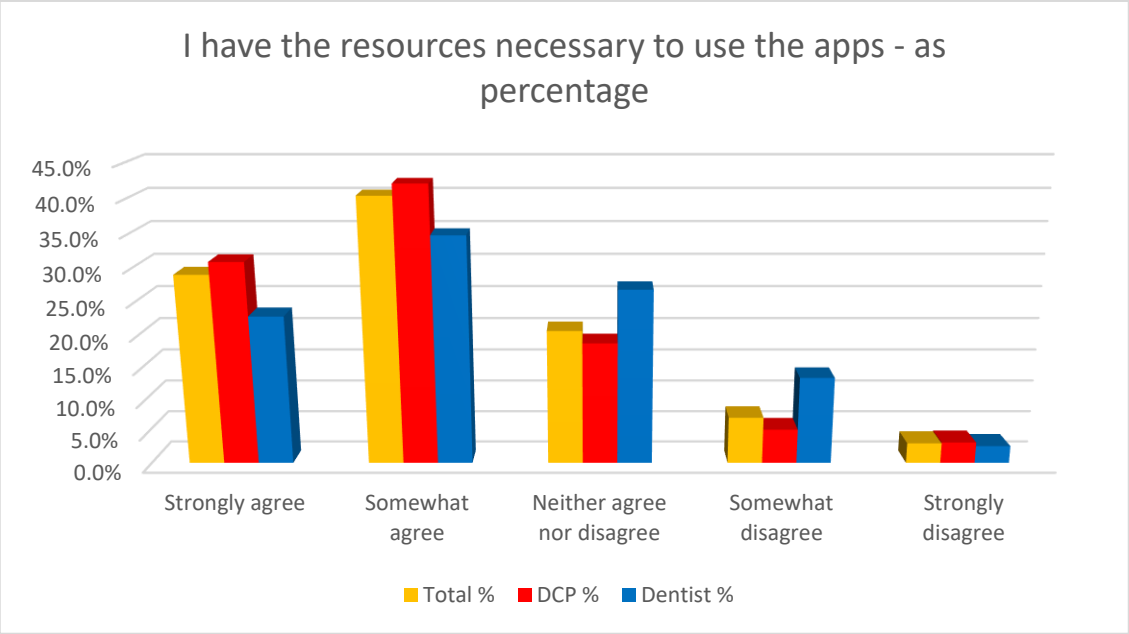


Figure 36 - I have the resources necessary to use the apps - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	17	22.7%	76	30.8%	93	28.9%
Somewhat agree	26	34.7%	104	42.1%	130	40.4%
Neither agree nor disagree	20	26.7%	46	18.6%	66	20.5%
Somewhat disagree	10	13.3%	13	5.3%	23	7.1%
Strongly disagree	2	2.7%	8	3.2%	10	3.1%
Total	75		247		322	

Table 22 - I have the resources necessary to use the apps – as a percentage by group.

Respondents were asked if it would be easy to make the most of the applications if given the resources, opportunities, and the knowledge. 73.8% (n=204) overall either agreed or strongly agreed that it would (Figure 37 & Table 23). There is no statistically significant relationship between the two groups (*P=0.0559*) (Effect Size (Cramér's V) 0.169).

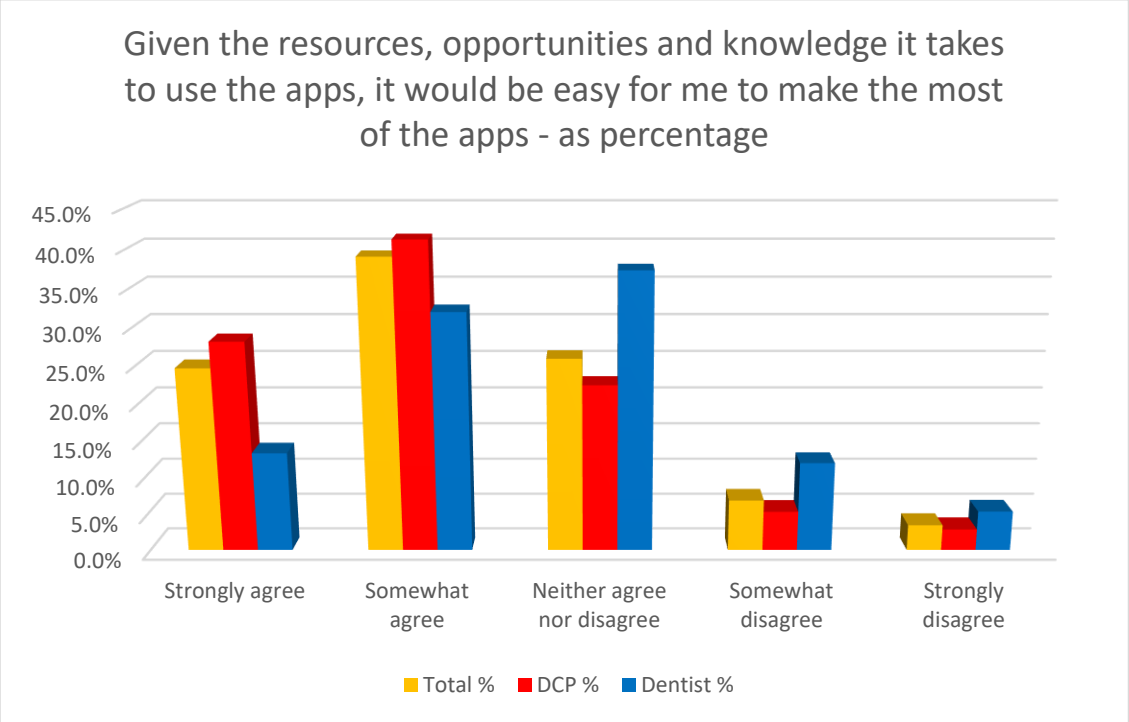


Figure 37 - Given the resources, opportunities, and knowledge it takes to use the apps, it would be easy for me to make the most of the apps - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	10	13.3%	69	28.2%	79	24.7%
Somewhat agree	24	32.0%	101	41.2%	125	39.1%
Neither agree nor disagree	28	37.3%	55	22.4%	83	25.9%

Somewhat disagree	9	12.0%	13	5.3%	22	6.9%
Strongly disagree	4	5.3%	7	2.9%	11	3.4%
Total	75		245		320	

Table 23 - Given the resources, opportunities, and knowledge it takes to use the apps, it would be easy for me to make the most of the apps – as a percentage by group.

Respondents were asked if they agreed with the statement "I love technology and what it can do", overall, 59.5% (n=191) either strongly or somewhat agreed (Figure 38 & Table 24). There is no statistically significant relationship between the two groups (*P=0.104*) (Effect Size (Cramér's V) 0.155).

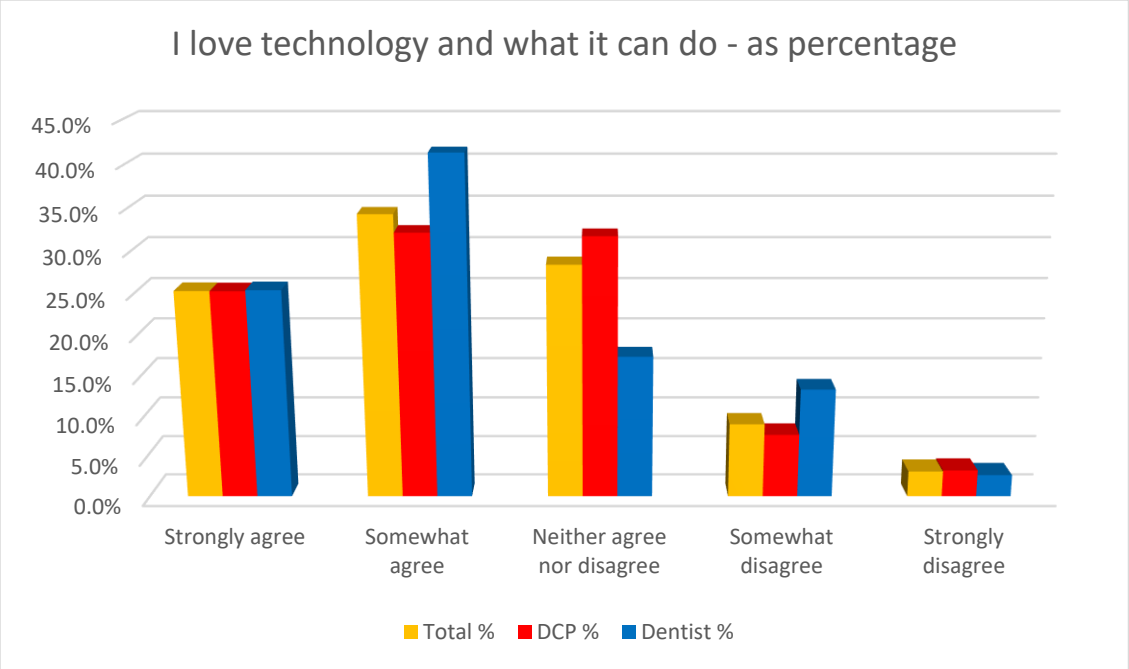


Figure 38 - I love technology and what it can do - as a percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	19	25.3%	62	25.2%	81	25.2%
Somewhat agree	31	41.3%	79	32.1%	110	34.3%
Neither agree nor disagree	13	17.3%	78	31.7%	91	28.3%
Somewhat disagree	10	13.3%	19	7.7%	29	9.0%
Strongly disagree	2	2.7%	8	3.3%	10	3.1%
Total	75		246		321	

Table 24 - I love technology and what it can do - as a percentage by group.

Respondents were asked if they thought technology will become more important in healthcare, 88.8% (n=285) of respondents agreed that it would become more important (Figure 39 & Table 25). There is no statistically significant relationship between the two groups (*P=0.151*) (Effect Size (Cramér's V) 0.145).

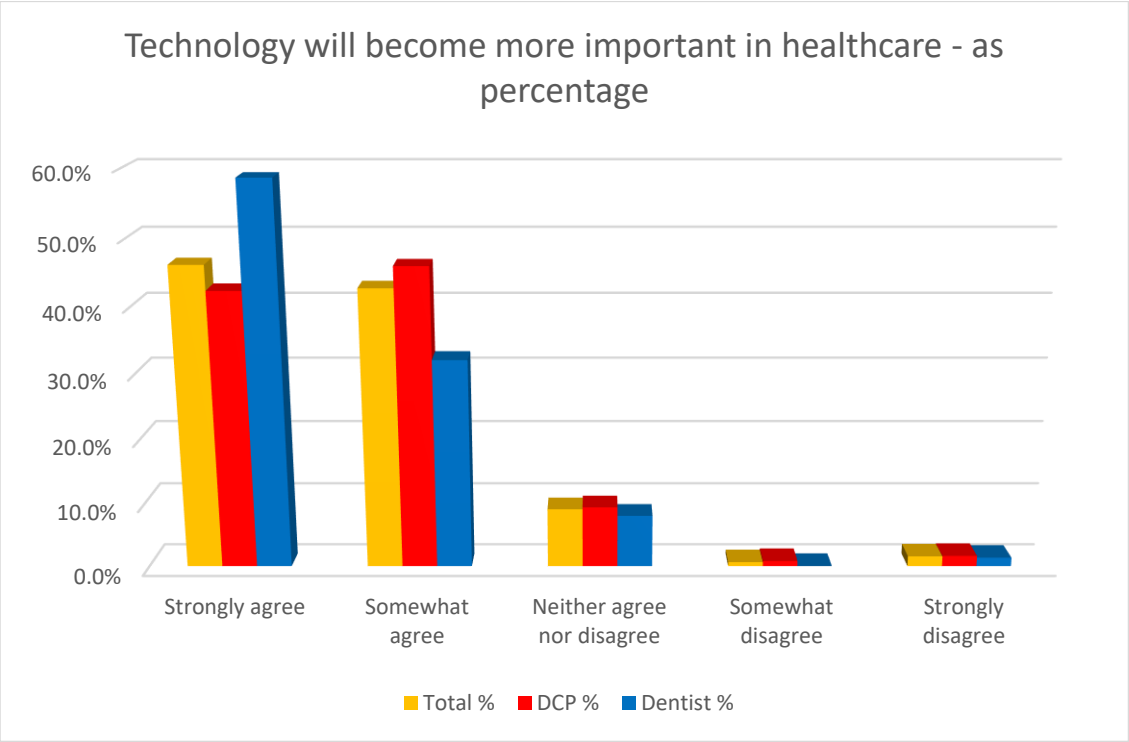


Figure 39 - Technology will become more important in healthcare - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	44	58.7%	104	42.3%	148	46.1%
Somewhat agree	24	32.0%	113	45.9%	137	42.7%
Neither agree nor disagree	6	8.0%	23	9.3%	29	9.0%
Somewhat disagree	0	0.0%	2	0.8%	2	0.6%
Strongly disagree	1	1.3%	4	1.6%	5	1.6%
Total	75		246		321	

Table 25 - Technology will become more important in healthcare - as percentage by group.

Both groups of respondents were equal in their opinions that it was important for them to be able to use technology competently with 92.2% (n=296) agreeing (Figure 40 & Table 26). There is no statistically significant relationship between the two groups (*P=0.953*) (Effect Size (Cramér's V) 0.0462).

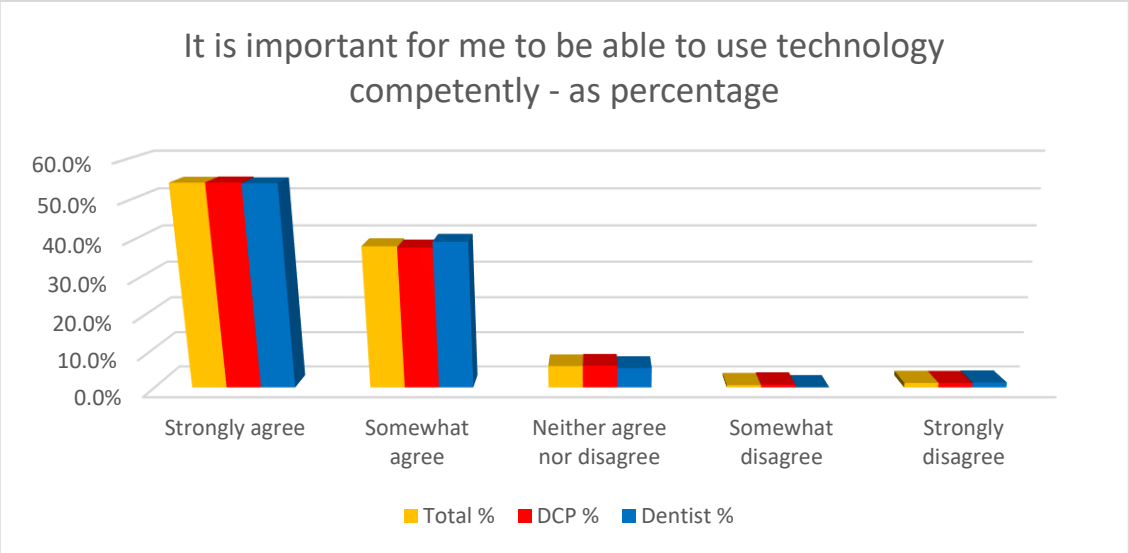


Figure 40 - It is important for me to be able to use technology competently - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	40	54.1%	134	54.3%	174	54.2%
Somewhat agree	29	39.2%	93	37.7%	122	38.0%
Neither agree nor disagree	4	5.4%	15	6.1%	19	5.9%
Somewhat disagree	0	0.0%	2	0.8%	2	0.6%
Strongly disagree	1	1.4%	3	1.2%	4	1.2%
Total	74		247		321	

Table 26 - It is important for me to be able to use technology competently - as percentage by group.

Respondents were asked if they wanted to improve their use of technology in their job, 73% (n=235) agreed that they did want to improve their use of technology (Figure 41 & Table 27). There is no statistically significant relationship between the two groups (*P=0.180*) (Effect Size (Cramér's V) 0.139).

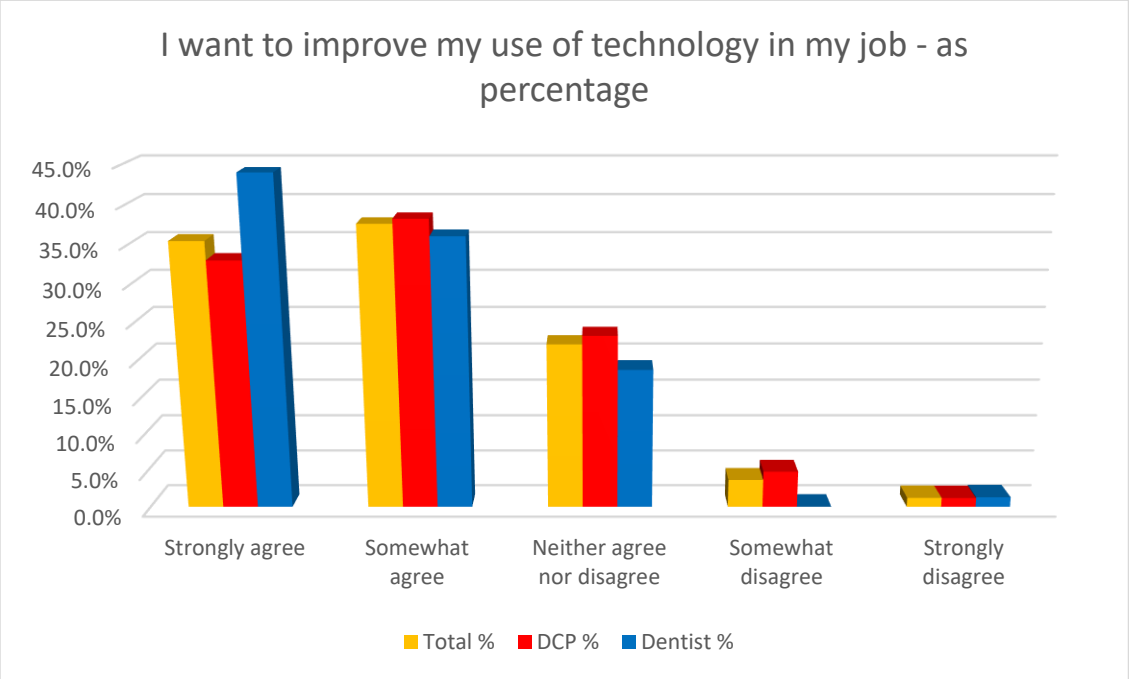


Figure 41 - I want to improve my use of technology in my job - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	33	44.0%	81	32.9%	114	35.4%
Somewhat agree	27	36.0%	94	38.2%	121	37.6%
Neither agree nor disagree	14	18.7%	57	23.2%	71	22.0%
Somewhat disagree	0	0.0%	12	4.9%	12	3.7%

Strongly disagree	1	1.3%	3	1.2%	4	1.2%
Total	75		246		322	

Table 27 - I want to improve my use of technology in my job - as percentage by group

4.3. Learning Needs

In examining the learning requisites of the individual, with a particular emphasis on practitioners assuming accountability for their own professional growth, a substantial impetus is placed on fostering a meaningful engagement with their CPD (Bullock et al., 2020). The findings were assessed by both the respondents' professional cohort and their age bracket, seeking to discern any potential statistical disparities.

Figure 42 and Table 28 shows that 86.3% (n=282) overall strongly agree or somewhat agree that they prefer to determine their own learning needs. The Dentist group is highest with 98.7% (n=74) agreeing that they prefer to determine their own learning needs, this shows a statistically significant relationship, (*P= 0.00155)* (Effect Size (Cramér's V) 0.199).

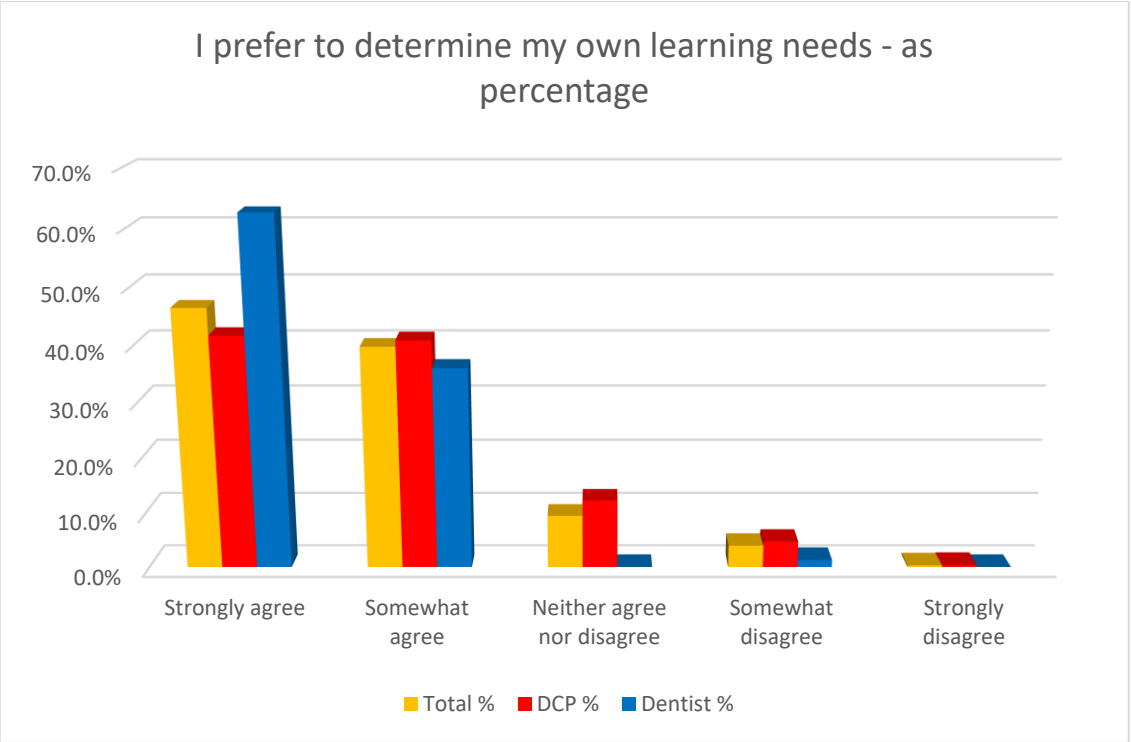


Figure 42 - I prefer to determine my own learning needs - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	47	62.7%	105	41.7%	152	46.5%
Somewhat agree	27	36.0%	103	40.9%	130	39.8%
Neither agree nor disagree	0	0.0%	31	12.3%	31	9.5%
Somewhat disagree	1	1.3%	12	4.8%	13	4.0%
Strongly disagree	0	0.0%	1	0.4%	1	0.3%
Total	75		252		327	

Table 28 - I prefer to determine my own learning needs - as percentage by group.

Next the breakdown by age was explored to determine if this was due to the age of the respondents. This did show (Figure 43 & Table 29) that those respondents under 30 were less likely to prefer to determine their own learning needs than those in the older age groups (over 30 years old), however, even in this younger age group 64% still preferred to determine their own learning needs. This may be attributed to the lack of experience of the younger group, whereas those in the over 60 years old group 94% preferred to determine their own learning needs. There was found to be no statistically significant relationship between age groups and preferring to determine my own learning needs, (*P= 0.169*) (Effect Size (Cramér's V) 0.118).

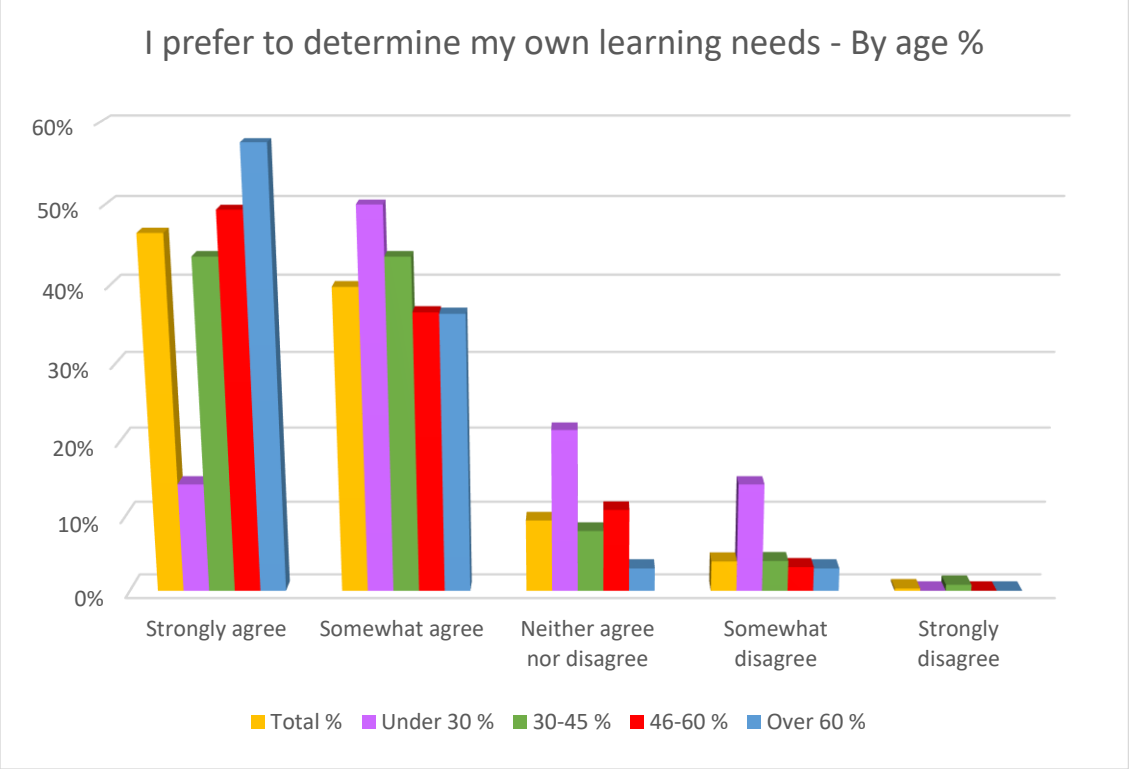


Figure 43 - I prefer to determine my own learning needs - By age %

	Total	Total %	Under 30	Under 30 %	30 – 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	152	46%	2	14%	54	44%	77	49%	19	58%
Somewhat agree	130	40%	7	50%	54	44%	57	37%	12	36%
Neither agree nor disagree	31	9%	3	21%	10	8%	17	11%	1	3%
Somewhat disagree	13	4%	2	14%	5	4%	5	3%	1	3%
Strongly disagree	1	0%	0	0%	1	1%	0	0%	0	0%
Total	327		14		124		156		33	

Table 29 - I prefer to determine my own learning needs - By age %

Respondents were asked to agree or disagree with the statement "I prefer a formal course of learning", the responses ranging from 'Strongly agree' to 'Strongly disagree'. Overall (n = 233) 71.5 percent of respondents either somewhat agreed or strongly agreed they preferred a formal course of learning (Figure 44 & Table 30). When bucketed together into Agree (Strongly/Somewhat), Neither, and Disagree (Strongly/Somewhat), there was found to be no statistically significant relationship between the groups, (*P= 0.372*) (Effect Size (Cramér's V) 0.0779). There was however a statistical significance in the Dentists who strongly agreed which was clearly a lower value than most (*P=0.00887*) (Effect Size (Cramér's V) 0.165).

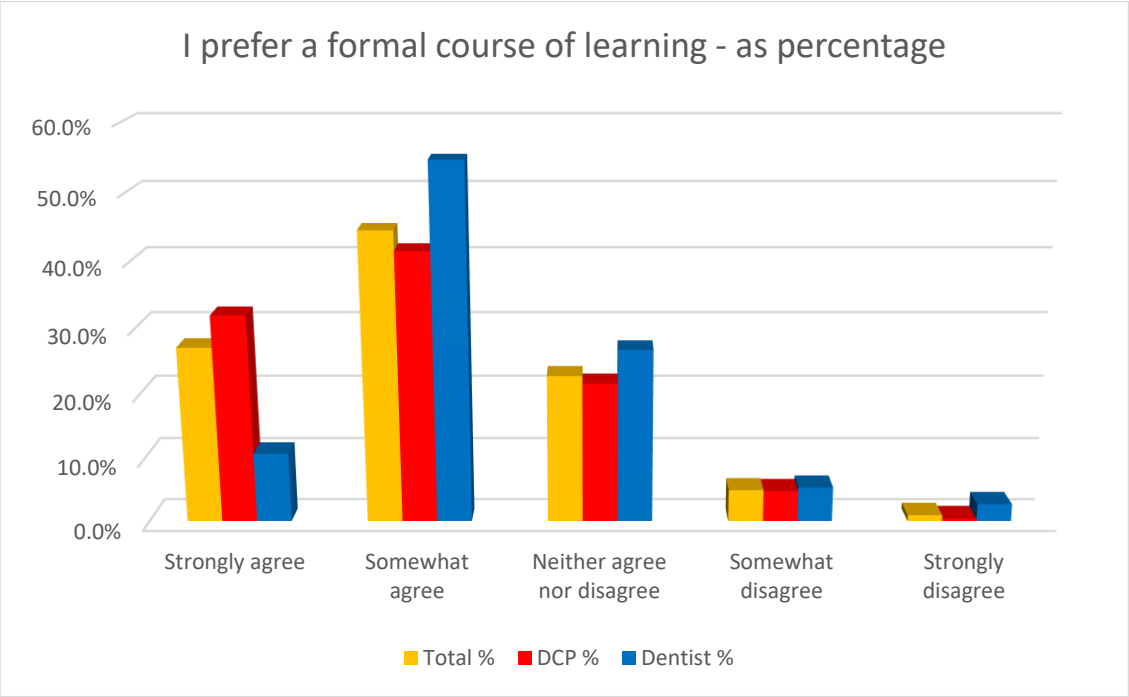


Figure 44 - I prefer a formal course of learning - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	8	10.7%	80	31.9%	88	27.0%
Somewhat agree	41	54.7%	104	41.4%	145	44.5%
Neither agree nor disagree	20	26.7%	54	21.5%	74	22.7%
Somewhat disagree	4	5.3%	12	4.8%	16	4.9%
Strongly disagree	2	2.7%	1	0.4%	3	0.9%
Total	75		251		326	

Table 30 - I prefer a formal course of learning - as percentage by group.

When this data was analysed by age group, it was found there was no statistically significant relationship by age grouping (Figure 45 & Table 31) (*P=0.0635*), with (n = 0) 0 percent in the under 30 years old group disagreeing and only (n = 19) 6 percent in total disagreeing, *P= 0.256*. Therefore, this corelates to the findings of Bullock et al. (2003, p. 50), where courses featured strongly.

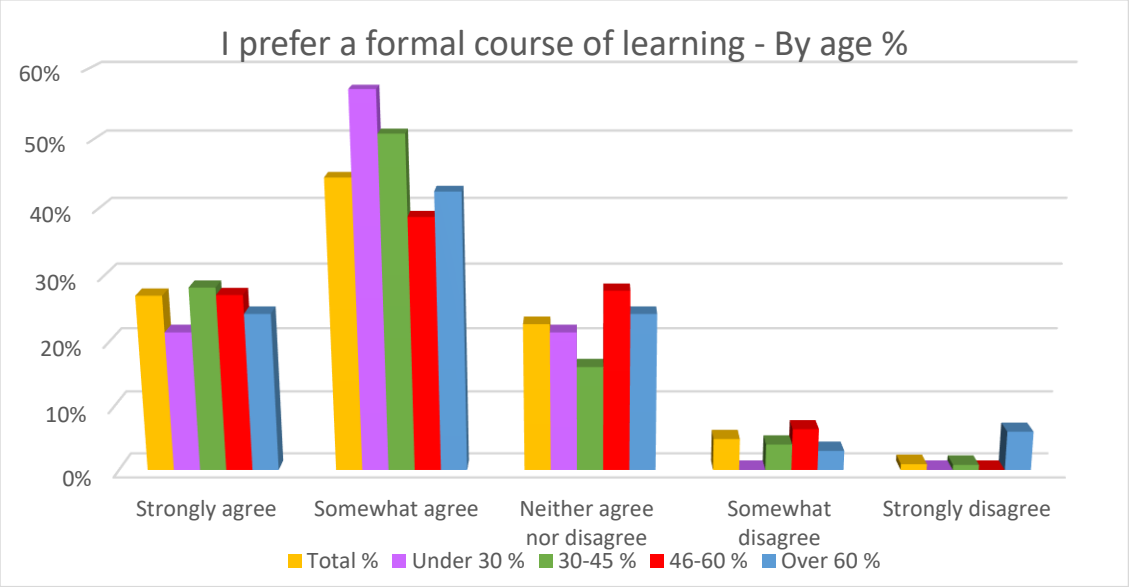


Figure 45 - I prefer a formal course of learning - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	88	27%	3	21%	35	28%	42	27%	8	24%
Somewhat agree	145	44%	8	57%	63	51%	60	39%	14	42%
Neither agree nor disagree	74	23%	3	21%	20	16%	43	28%	8	24%
Somewhat disagree	16	5%	0	0%	5	4%	10	6%	1	3%
Strongly disagree	3	1%	0	0%	1	1%	0	0%	2	6%
Total	326		14		124		155		33	

Table 31 - I prefer a formal course of learning - By age %

When asked if they like to pick what they learn 90.7% (n=68) of Dentists and 87.6% (n=220) of DCPs agreed that they do like to pick what they learn (Figure 46 and Table 32). There was found to be no statistically significant relationship between the two groups (*P= 0.702) (Effect Size (Cramér's V)0.0466)*.

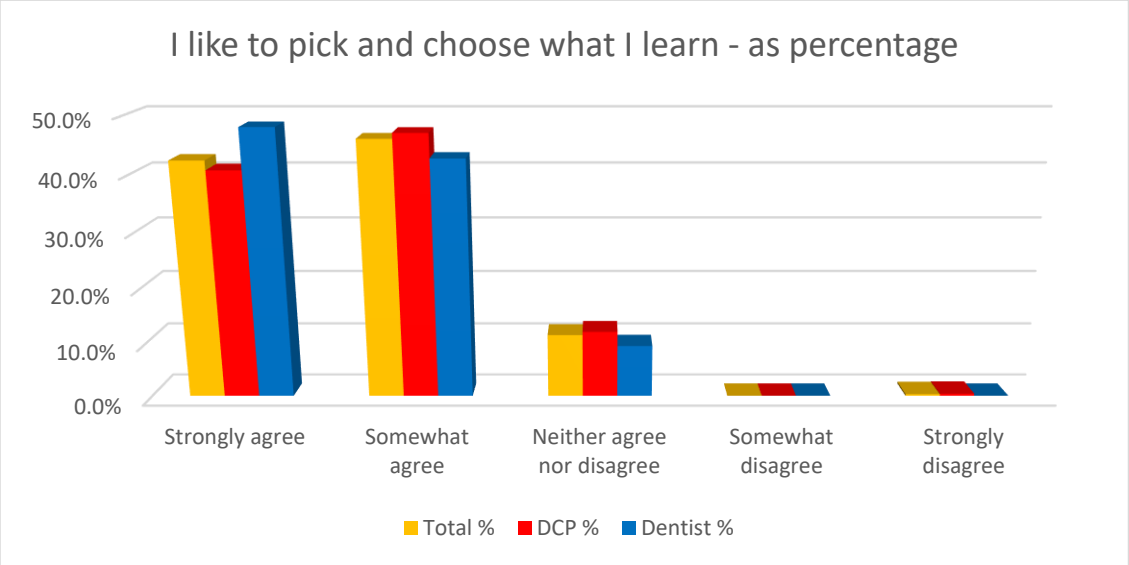


Figure 46 - - I like to pick and choose what I learn - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	36	48.0%	102	40.6%	138	42.3%
Somewhat agree	32	42.7%	118	47.0%	150	46.0%
Neither agree nor disagree	7	9.3%	30	12.0%	37	11.3%
Somewhat disagree	0	0.0%	0	0.0%	0	0.0%
Strongly disagree	0	0.0%	1	0.4%	1	0.3%
Total	75		251		326	

Table 32 - I like to pick and choose what I learn - as percentage by group.

The data was further analysed by age to investigate whether there were differences in how the age groups made decisions about what to learn. The results indicated that there was no statistically significant relationship between the age groups (P=0.0788) (Effect Size (Cramér's V) 0.126).

Specifically, the analysis revealed that 71% (n=10) of respondents under 30, 86% (n=107) of those in the 30-45 age group, 91% (n=141) of participants aged 46-60, and 91% (n=30) of individuals over 60 expressed a preference for choosing what they learn (Figure 47 and Table 33).

In summary, both the professional groups and the age groups predominantly displayed a preference for selecting their own learning topics. The analysis did not find any significant differences between the age groups in this regard. This indicates that regardless of age, individuals in the study showed a strong inclination towards personalised learning, where they have the autonomy to decide what knowledge and skills they wish to acquire.

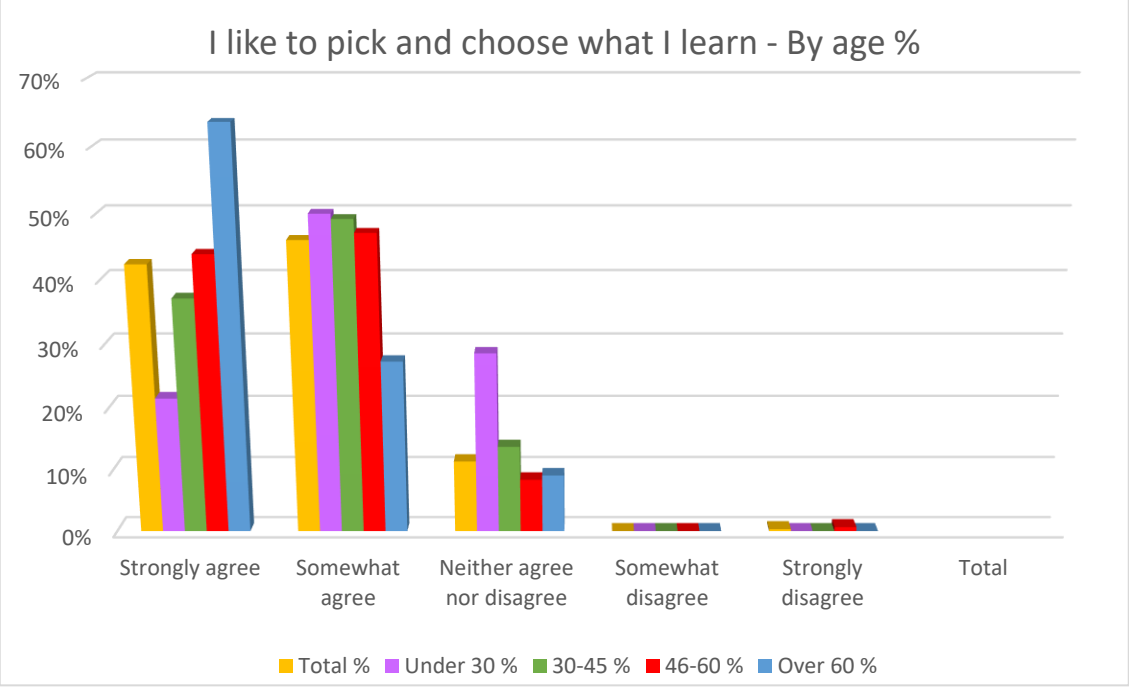


Figure 47 - I like to pick and choose what I learn - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	138	42%	3	21%	46	37%	68	44%	21	64%
Somewhat agree	150	46%	7	50%	61	49%	73	47%	9	27%
Neither agree nor disagree	37	11%	4	29%	17	14%	13	8%	3	9%
Somewhat disagree	0	0%	0	0%	0	0%	0	0%	0	0%
Strongly disagree	1	0%	0	0%	0	0%	1	1%	0	0%
Total	326		14		124		155		33	

Table 33 - I like to pick and choose what I learn - By age %

When questioned about whether their learning is influenced by what they need to know at any given time, in other words, if their learning needs fluctuate in response to their experiences in practice, with a continuous process of reflecting and adapting their learning, a significant 89% (n=291) of respondents agreed with this statement (Figure 48 & Table 34). This data showed no statistically significant relationship between the two groups, *P= 0.928 (Effect Size (Cramér's V) 0.0375)*.

In summary, the study indicates that a vast majority of respondents acknowledge that their learning is shaped by their current needs, demonstrating a dynamic approach where learning evolves in response to practical experiences. Nonetheless, the absence of a statistically significant relationship between the two groups suggests that this tendency is consistent across both groups. The data underscores the significance of adaptive learning practices and reflective processes in professional development.

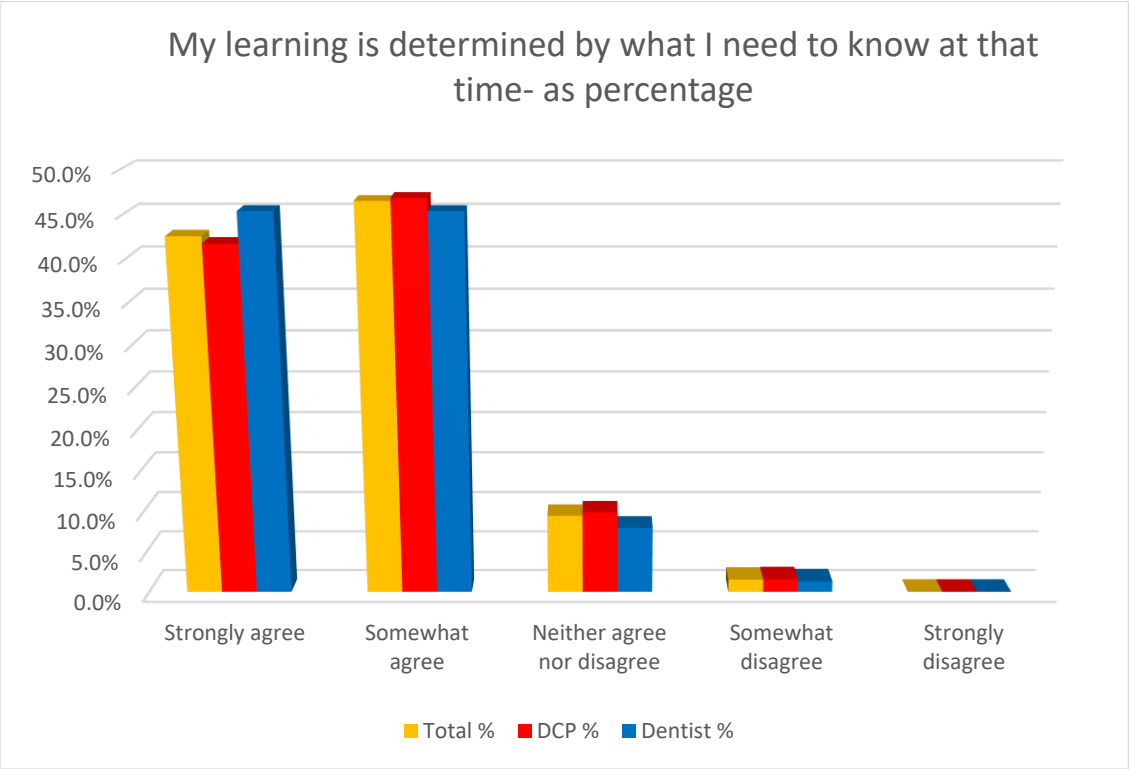


Figure 48 - My learning is determined by what I need to know at that time- as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	34	45.3%	105	41.7%	139	42.5%
Somewhat agree	34	45.3%	118	46.8%	152	46.5%
Neither agree nor disagree	6	8.0%	25	9.9%	31	9.5%
Somewhat disagree	1	1.3%	4	1.6%	5	1.5%
Strongly disagree	0	0.0%	0	0.0%	0	0.0%
Total	75		252		327	

Table 34 - My learning is determined by what I need to know at that time- as percentage by group.

When the same statement was analysed by age (Figure 49 & Table 35) the data showed similar results across the age ranges with 82% – 92% agreeing with the statement. When bucketed together into Agree (Strongly/Somewhat), Neither, and Disagree (Strongly/Somewhat) the data showed no statistically significant relationship between the age groups, *P= 0.141 (Effect Size (Cramér's V) 0.121)*.

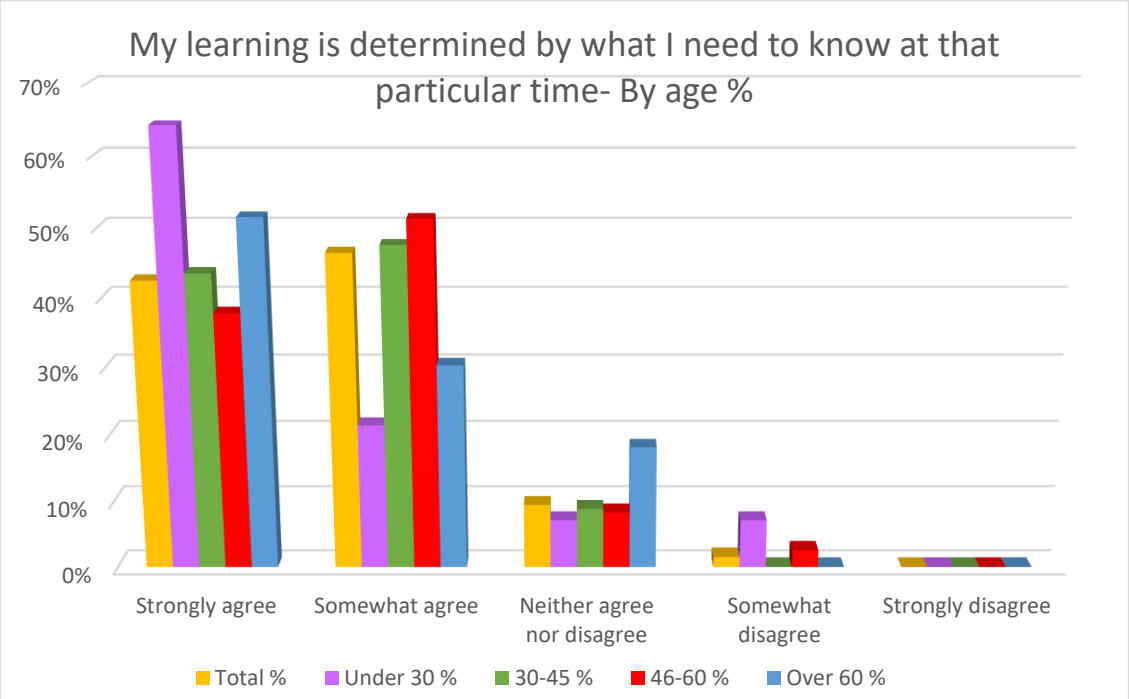


Figure 49 - My learning is determined by what I need to know at that particular time- By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	139	43%	9	64%	54	44%	59	38%	17	52%
Somewhat agree	152	46%	3	21%	59	48%	80	51%	10	30%
Neither agree nor disagree	31	9%	1	7%	11	9%	13	8%	6	18%
Somewhat disagree	5	2%	1	7%	0	0%	4	3%	0	0%

Strongly disagree	0	0%	0	0%	0	0%	0	0%	0	0%
Total	327		14		124		156		33	

Table 35 - My learning is determined by what I need to know at that particular time- By age %

When asked if they like to plan their learning 74.3% (n=243) of respondents agreed that they did like to plan their learning (Figure 50 & Table 36). There is no statistically significant relationship between the two groups, *P= 0.501 (Effect Size (Cramér's V) 0.101)*.

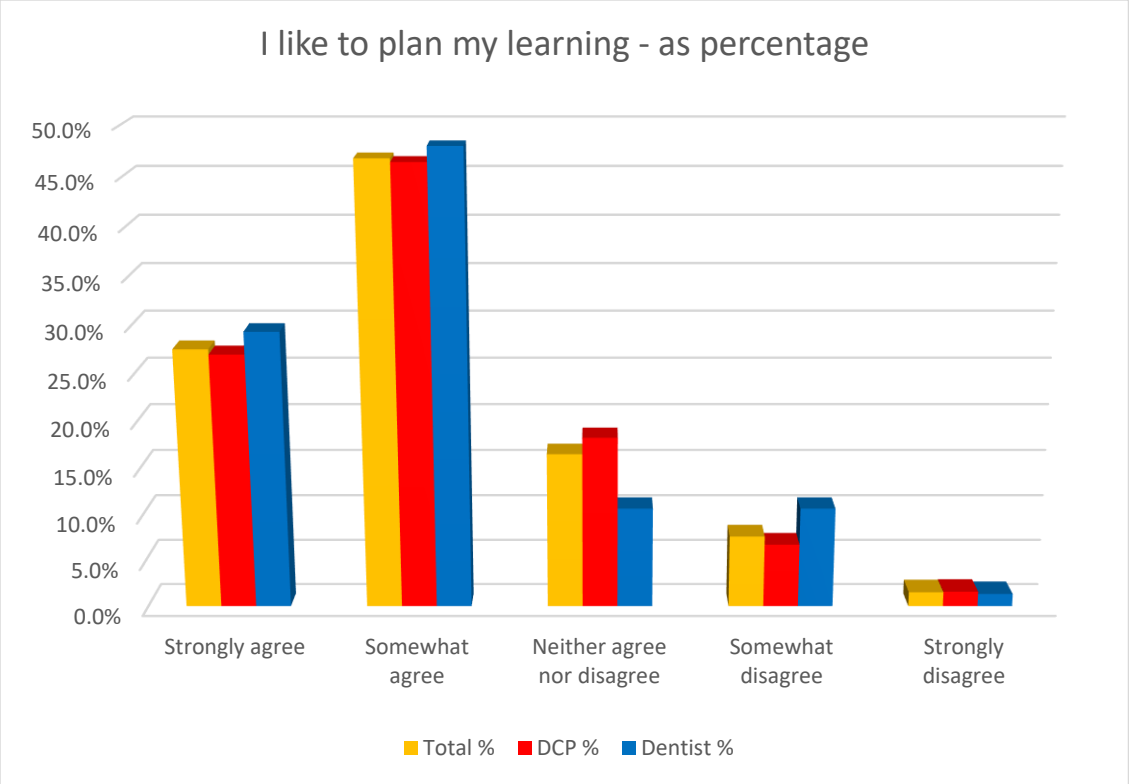


Figure 50 - I like to plan my learning - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	22	29.3%	68	27.0%	90	27.5%
Somewhat agree	36	48.0%	117	46.4%	153	46.8%
Neither agree nor disagree	8	10.7%	46	18.3%	54	16.5%
Somewhat disagree	8	10.7%	17	6.7%	25	7.6%
Strongly disagree	1	1.3%	4	1.6%	5	1.5%
Total	75		252		327	

Table 36 - I like to plan my learning - as percentage by group.

When analysed by age the overall result was as above, there was however one outlier. In the under 30 age group, it was found that 29% (n=4) somewhat disagreed. However as can be seen in Figure 51 & Table 37 , the under 30 age group only accounts for 5.5% of respondents. Overall, there is no statistically significant relationship between the age groups, *P= 0.154 (Effect Size (Cramér's V) 0.131)*.

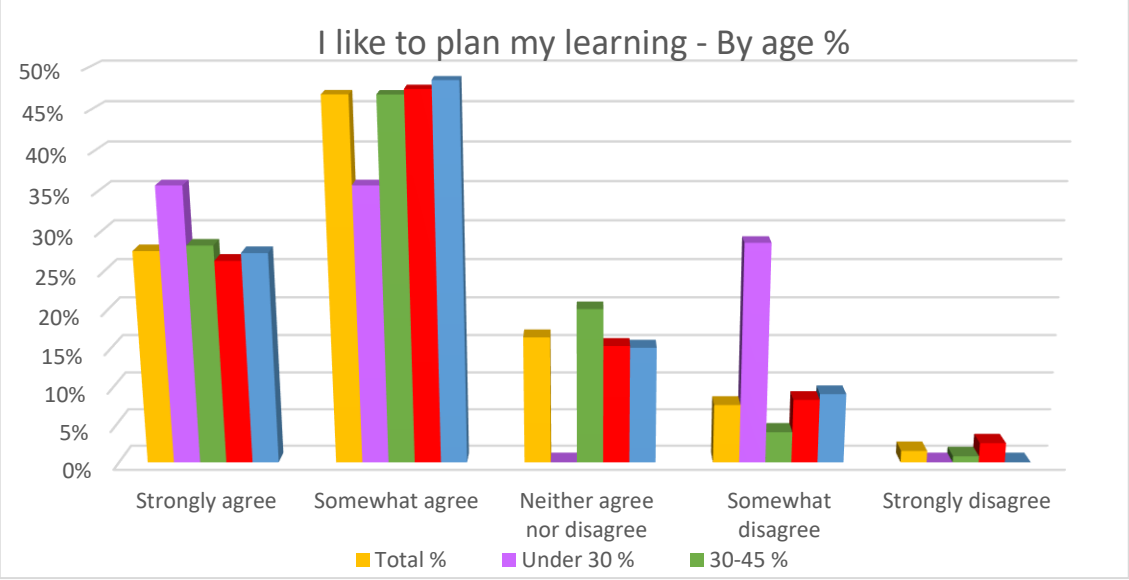


Figure 51 - I like to plan my learning - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	90	28%	5	36%	35	28%	41	26%	9	27%
Somewhat agree	153	47%	5	36%	58	47%	74	47%	16	48%
Neither agree nor disagree	54	17%	0	0%	25	20%	24	15%	5	15%
Somewhat disagree	25	8%	4	29%	5	4%	13	8%	3	9%
Strongly disagree	5	2%	0	0%	1	1%	4	3%	0	0%
Total	327		14		124		156		33	

Table 37 - I like to plan my learning - By age %

When questioned about their perception of learning, specifically whether they believed they learned better when the subject was something they wanted to learn, an overwhelming 97.4% (n=317) of respondents agreed with this statement (Figure 52 & Table 38). There is no statistically significant relationship between the two groups, *P= 0.123 (Effect Size (Cramér's V) 0.133)*.

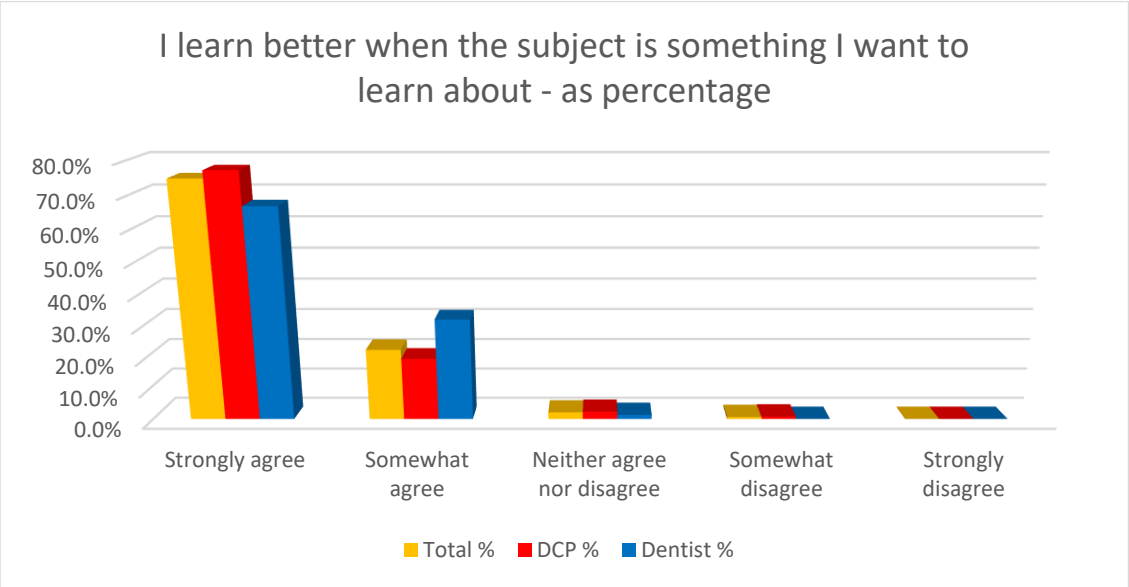


Figure 52 - I learn better when the subject is something I want to learn about - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	50	66.7%	194	77.3%	244	74.8%
Somewhat agree	24	32.0%	49	19.5%	73	22.4%
Neither agree nor disagree	1	1.3%	6	2.4%	7	2.1%
Somewhat disagree	0	0.0%	2	0.8%	2	0.6%
Strongly disagree	0	0.0%	0	0.0%	0	0.0%
Total	75		251		326	

Table 38 - I learn better when the subject is something I want to learn about - as percentage by group.

When examining the data by age (Figure 53 & Table 39), a similar pattern emerged as observed in the grouping by professional group. There was no statistically significant relationship between age groups, with a P-value of 0.377 (Effect Size (Cramér's V) 0.0995).

Figure 53 illustrates the percentages of respondents in each age group who expressed their agreement with the statement "I learn better when the subject is something I want to learn about." Among the total respondents, 75% agreed with this sentiment. The breakdown by age groups shows that 71% of those under 30, 79% of individuals aged 30 to 45, 74% of participants aged 46 to 60, and 67% of those over 60 expressed agreement with the statement.

In summary, the analysis by age groups indicates a consistent response pattern with the overall findings. A significant majority of participants in each age group agreed that learning improves when they have a personal interest in the subject. However, the lack of a statistically significant relationship between age groups suggests that this perception is shared uniformly across different age cohorts. The results emphasise the importance of incorporating learners' interests and passions into educational approaches, irrespective of their age, to enhance the learning experience and outcomes.

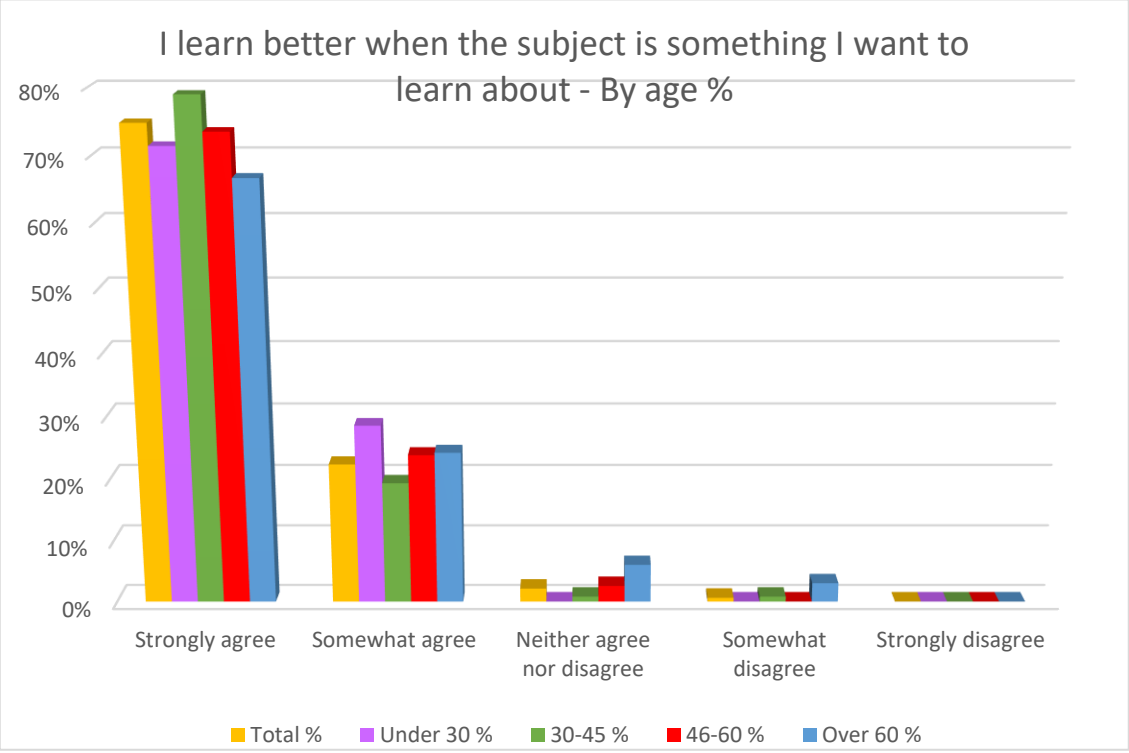


Figure 53 - I learn better when the subject is something I want to learn about - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	244	75%	10	71%	98	79%	114	74%	22	67%
Somewhat agree	73	22%	4	29%	24	19%	37	24%	8	24%
Neither agree nor disagree	7	2%	0	0%	1	1%	4	3%	2	6%
Somewhat disagree	2	1%	0	0%	1	1%	0	0%	1	3%
Strongly disagree	0	0%	0	0%	0	0%	0	0%	0	0%
Total	326		14		124		155		33	

Table 39 - I learn better when the subject is something I want to learn about - By age %

The participants were asked whether they considered themselves to be the best person to evaluate what they needed to learn. A significant 77.1% (n=252) agreed that they were indeed the best person to evaluate their learning needs (Figure 54 & Table 40). When the results were grouped into (strongly and somewhat) agree and (strongly and somewhat) disagree categories, there was no statistically significant relationship between the two groups, with a P-value of 0.0865 (Effect Size (Cramér's V) 0.122). However, it is important to note that there is a statistically significant relationship (P=0.0190) (Effect Size (Cramér's V) 0.190) at the level of somewhat agree when not grouped.

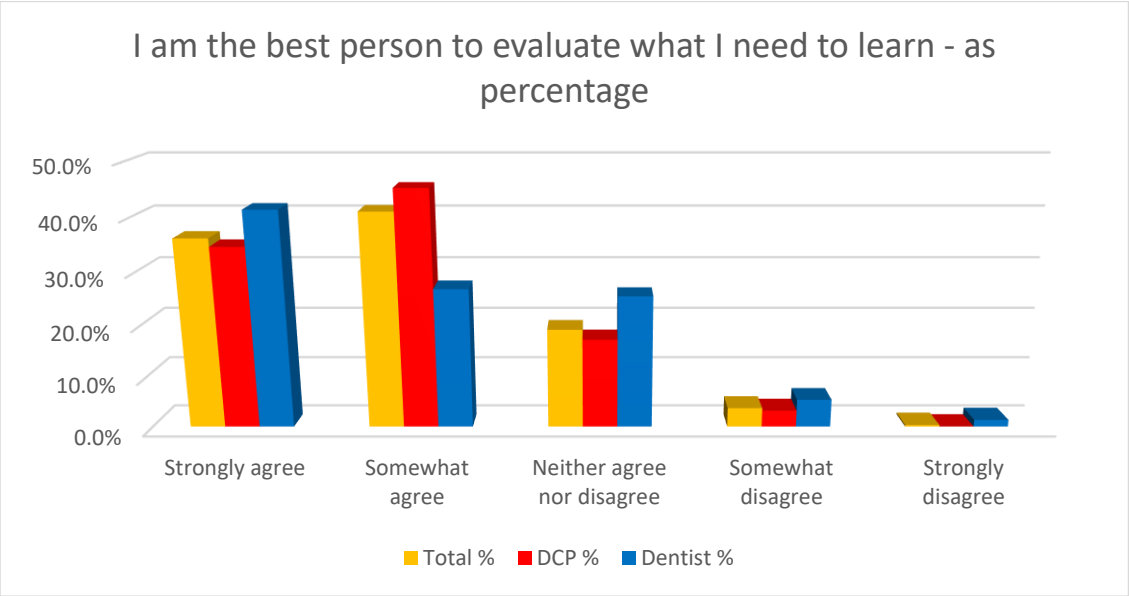


Figure 54 - I am the best person to evaluate what I need to learn - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	31	41.3%	87	34.5%	118	36.1%
Somewhat agree	20	26.7%	114	45.2%	134	41.0%
Neither agree nor disagree	19	25.3%	43	17.1%	62	19.0%
Somewhat disagree	4	5.3%	8	3.2%	12	3.7%
Strongly disagree	1	1.3%	0	0.0%	1	0.3%
Total	75		252		327	

Table 40 - I am the best person to evaluate what I need to learn - as percentage by group.

When the data was analysed by age group there was found to be no statistically significant relationship by age group, *P= 0.0997 (Effect Size (Cramér's V) 0.138)*. However, the over 60 age group did have a statistically higher value than typical in strongly agree (Figure 55 and Table 41).

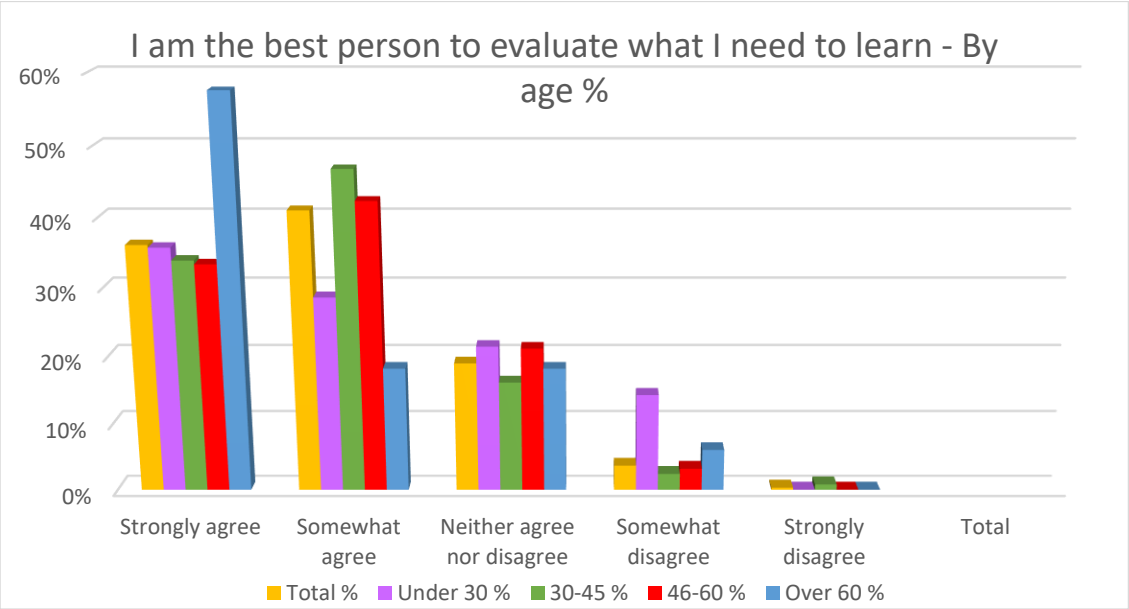


Figure 55 - I am the best person to evaluate what I need to learn - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	118	36%	5	36%	42	34%	52	33%	19	58%
Somewhat agree	134	41%	4	29%	58	47%	66	42%	6	18%
Neither agree nor disagree	62	19%	3	21%	20	16%	33	21%	6	18%
Somewhat disagree	12	4%	2	14%	3	2%	5	3%	2	6%
Strongly disagree	1	0%	0	0%	1	1%	0	0%	0	0%
Total	327		14		124		156		33	

Table 41 - I am the best person to evaluate what I need to learn - By age %

4.4. Reflection

The pivotal role of reflection in adult learning has been widely acknowledged and valued, particularly within the domain of healthcare professions (Eraut, 2004b; Sandars, 2009; Schön, 1983b). Within the context of healthcare, where the impact of decisions can be profound and even life-altering, cultivating a culture of reflection is paramount. It enables practitioners to learn from their daily encounters with patients, complex cases, and diverse medical scenarios. This ongoing introspection empowers healthcare professionals to enhance their expertise, sharpen their judgment, and ultimately elevate the quality of care they provide.

Moreover, reflection is not merely a solitary endeavour; it can be effectively nurtured through various channels. Collaborative discussions, mentorship relationships, and peer evaluations serve as valuable means to facilitate reflective learning among healthcare practitioners. These interactive processes encourage the exchange of perspectives, fostering a deeper understanding of one's actions and their potential implications.

The findings were assessed by both the respondents' professional cohort and their age bracket, seeking to discern any potential statistical disparities.

Respondents were asked about their reflection, 93.5% (n=305) agreed that they were able to reflect on their learning and put it into practice or decide that they needed to learn more (Figure 56 & Table 42). There was shown to be no statistically significant relationship between the two groups, *P= 0.499 (Effect Size (Cramér's V) 0.0853)*.

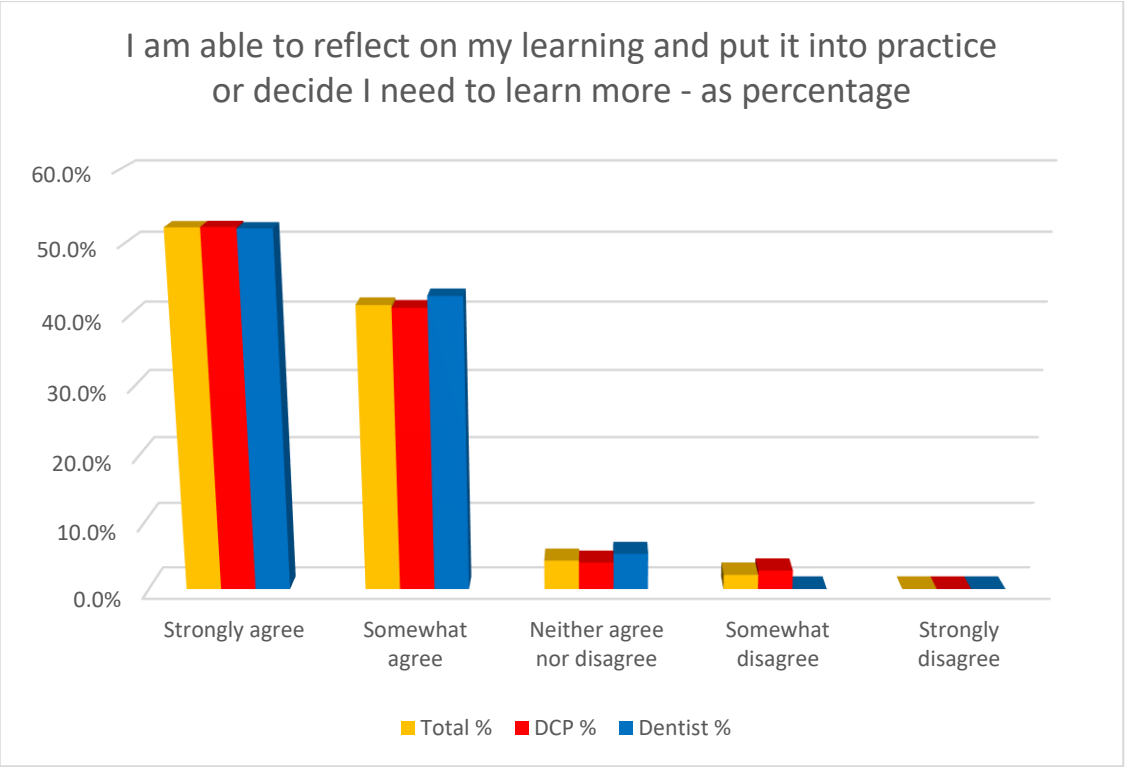


Figure 56 - I am able to reflect on my learning and put it into practice or decide I need to learn more - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	39	52.0%	131	52.2%	170	52.1%
Somewhat agree	32	42.7%	103	41.0%	135	41.4%
Neither agree nor disagree	4	5.3%	10	4.0%	14	4.3%
Somewhat disagree	0	0.0%	7	2.8%	7	2.1%
Strongly disagree	0	0.0%	0	0.0%	0	0.0%
Total	75		251		326	

Table 42 - I am able to reflect on my learning and put it into practice or decide I need to learn more - as percentage by group.

The data was analysed by age group (Figure 57 and Table 43), it was found to have no statistically significant relationship between the age groups, *P= 0.474* (Effect Size (Cramér's V) 0.0938).

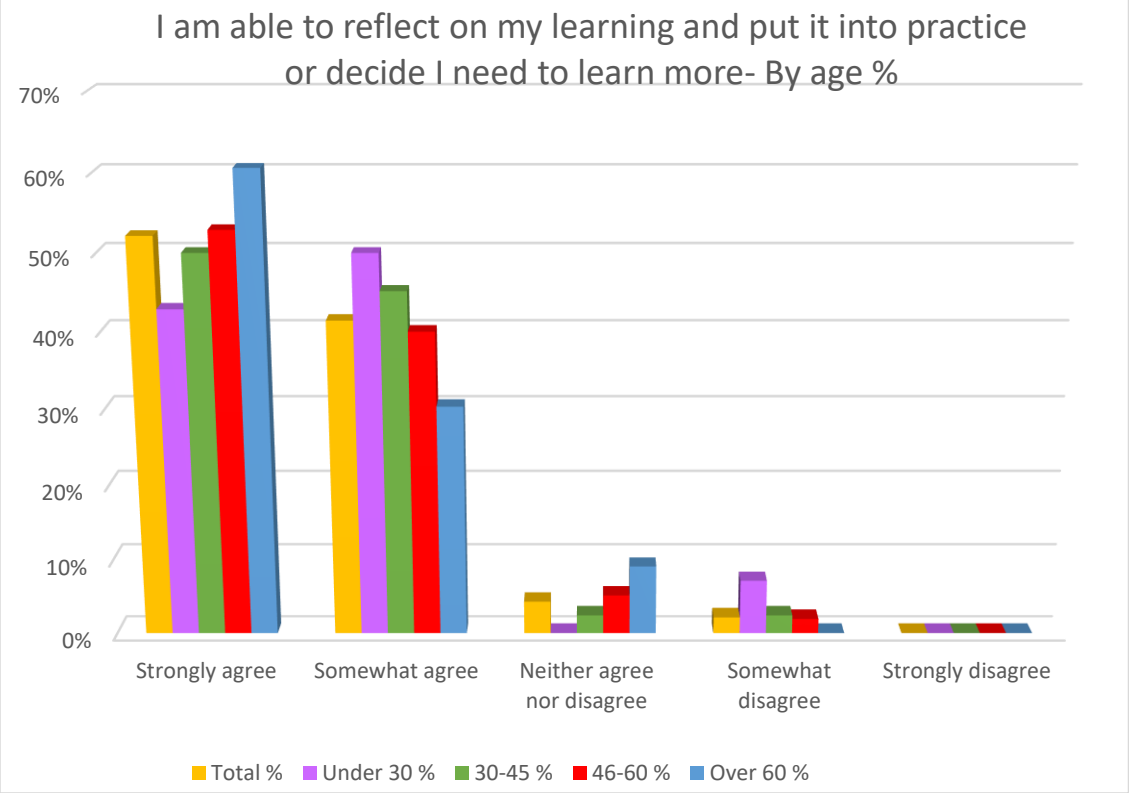


Figure 57 - I am able to reflect on my learning and put it into practice or decide I need to learn more- By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	170	52%	6	43%	62	50%	82	53%	20	61%
Somewhat agree	135	41%	7	50%	56	45%	62	40%	10	30%
Neither agree nor disagree	14	4%	0	0%	3	2%	8	5%	3	9%

Somewhat disagree	7	2%	1	7%	3	2%	3	2%	0	0%
Strongly disagree	0	0%	0	0%	0	0%	0	0%	0	0%
Total	326		14		124		155		33	

Table 43 - I am able to reflect on my learning and put it into practice or decide I need to learn more- By age %

4.5. Collaboration

Collaboration with others in learning is required for knowledge making and is seen as more important than just information gathering (MacNeill, Telner, Sparaggis-Agaliotis, & Hanna, 2014). Collaborative construction of knowledge is seen as a key characteristic of learning and effective professional development (Teräs & Kartoglu, 2017), ensuring exposure to debate and discussion.

The findings were assessed by both the respondents' professional cohort and their age bracket, seeking to discern any potential statistical disparities.

Respondents were asked about their collaboration, firstly if they like to collaborate with others in their learning. Overall, 72.6% (n=236) either strongly or somewhat agreed that they like to collaborate with others in their learning (Figure 58 and Table 44). There was no statistically significant relationship between the two groups, *P= 0.144 (Effect Size (Cramér's V) 0.145)*.

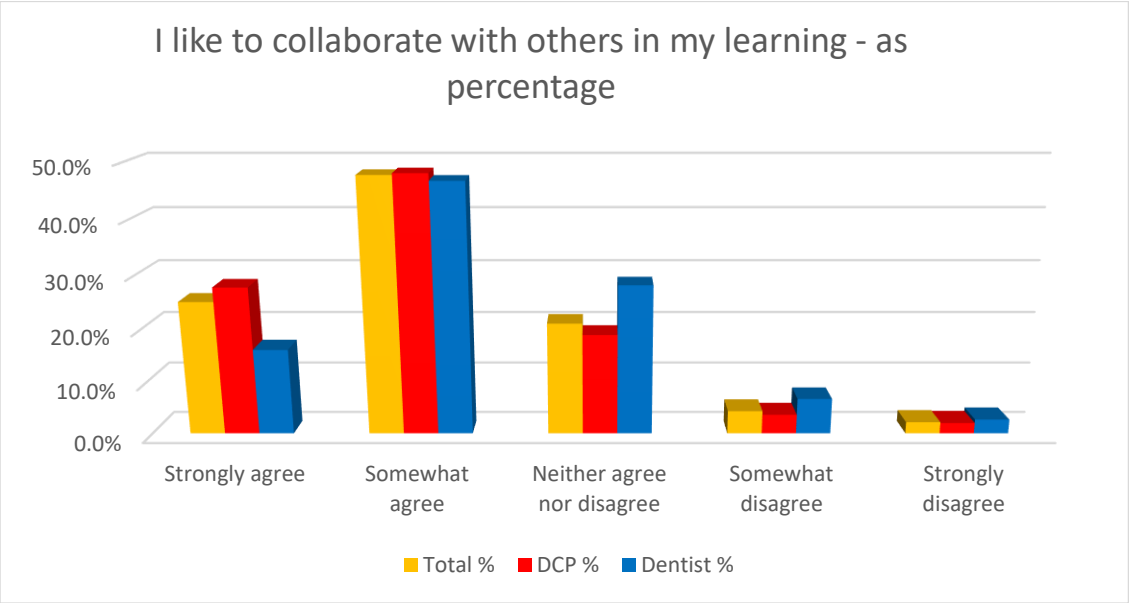


Figure 58 - I like to collaborate with others in my learning - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	12	16.0%	69	27.6%	81	24.9%
Somewhat agree	35	46.7%	120	48.0%	155	47.7%
Neither agree nor disagree	21	28.0%	47	18.8%	68	20.9%
Somewhat disagree	5	6.7%	9	3.6%	14	4.3%
Strongly disagree	2	2.7%	5	2.0%	7	2.2%
Total	75		250		325	

Table 44 - I like to collaborate with others in my learning - as percentage by group.

The responses were then analysed by age group (Figure 59and Table 45), again there was found to be no statistically significant relationship between the age groups, *P= 0.390 (Effect Size (Cramér's V) 0.114)*.

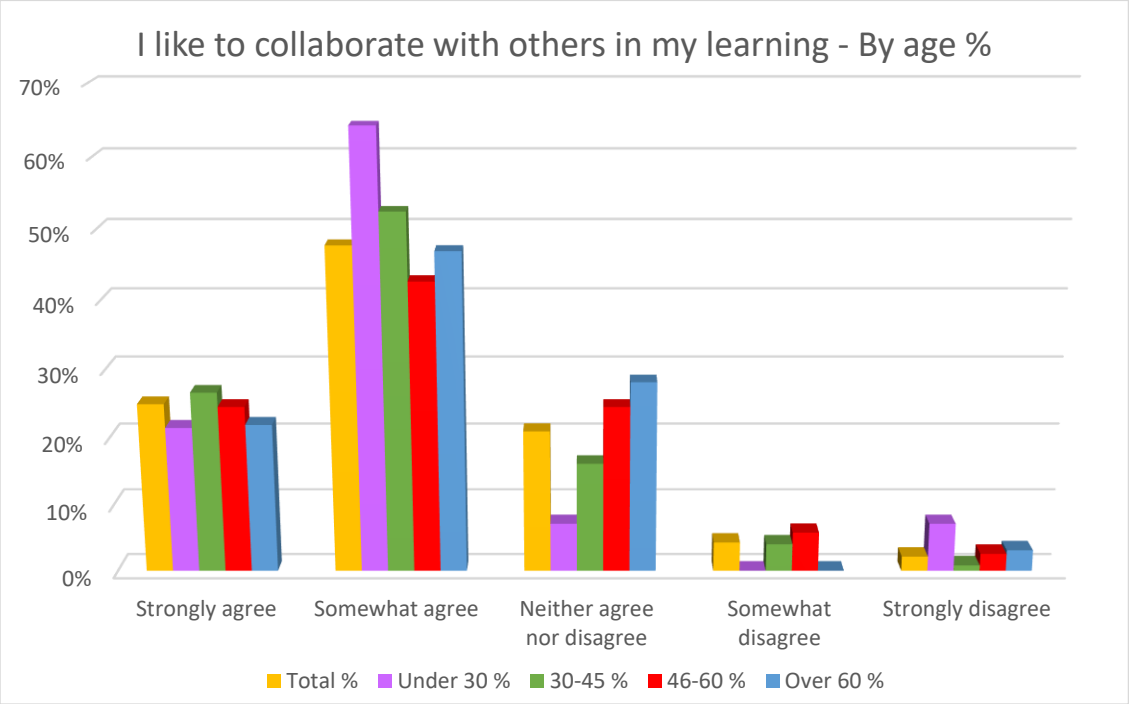


Figure 59 - I like to collaborate with others in my learning - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	81	25%	3	21%	33	27%	38	25%	7	22%
Somewhat agree	155	48%	9	64%	65	52%	66	43%	15	47%
Neither agree nor disagree	68	21%	1	7%	20	16%	38	25%	9	28%
Somewhat disagree	14	4%	0	0%	5	4%	9	6%	0	0%
Strongly disagree	7	2%	1	7%	1	1%	4	3%	1	3%
Total	325		14		124		155		32	

Table 45 - I like to collaborate with others in my learning - By age %

Respondents were asked whether they believed that social media enabled them to collaborate effectively with their peers. The analysis of responses revealed a statistically significant relationship between the two professional groups, with Dental Care Professionals (DCPs) being more inclined to agree that social media facilitates collaboration with peers compared to the Dentist group (Figure 60 and Table 46). The statistical analysis yielded a P-value of 0.0000473 (Effect Size (Cramér's V) 0.278), indicating a notable difference in perspectives between the two groups.

A breakdown of the responses shows that 37.4% (n=28) of Dentists agreed that social media allows them to collaborate with peers, while a substantial 68.5% (n=172) of DCPs shared this sentiment.

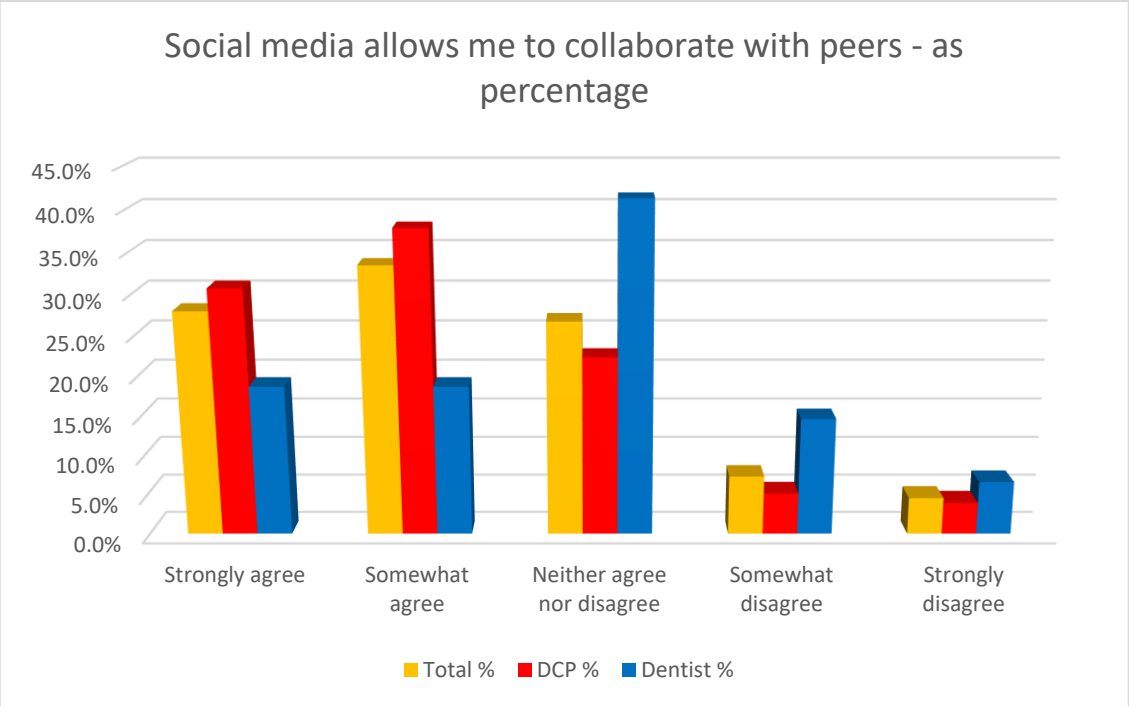


Figure 60 - Social media allows me to collaborate with peers - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	14	18.7%	77	30.7%	91	27.9%
Somewhat agree	14	18.7%	95	37.8%	109	33.4%

Neither agree nor disagree	31	41.3%	56	22.3%	87	26.7%
Somewhat disagree	11	14.7%	13	5.2%	24	7.4%
Strongly disagree	5	6.7%	10	4.0%	15	4.6%
Total	75		251		326	

Table 46 - Social media allows me to collaborate with peers - as percentage by group.

Upon analysing this data by age groups, a statistically significant relationship was also observed, particularly in the 30-45 age group, which exhibited a significantly higher percentage in the "strongly agree" category (Figure 61 and Table 47) (*P= 0.0122*) (Effect Size (Cramér's V) 0.162). This suggests that individuals in this particular age range may be more inclined to embrace social media as a means of collaborative engagement with peers.

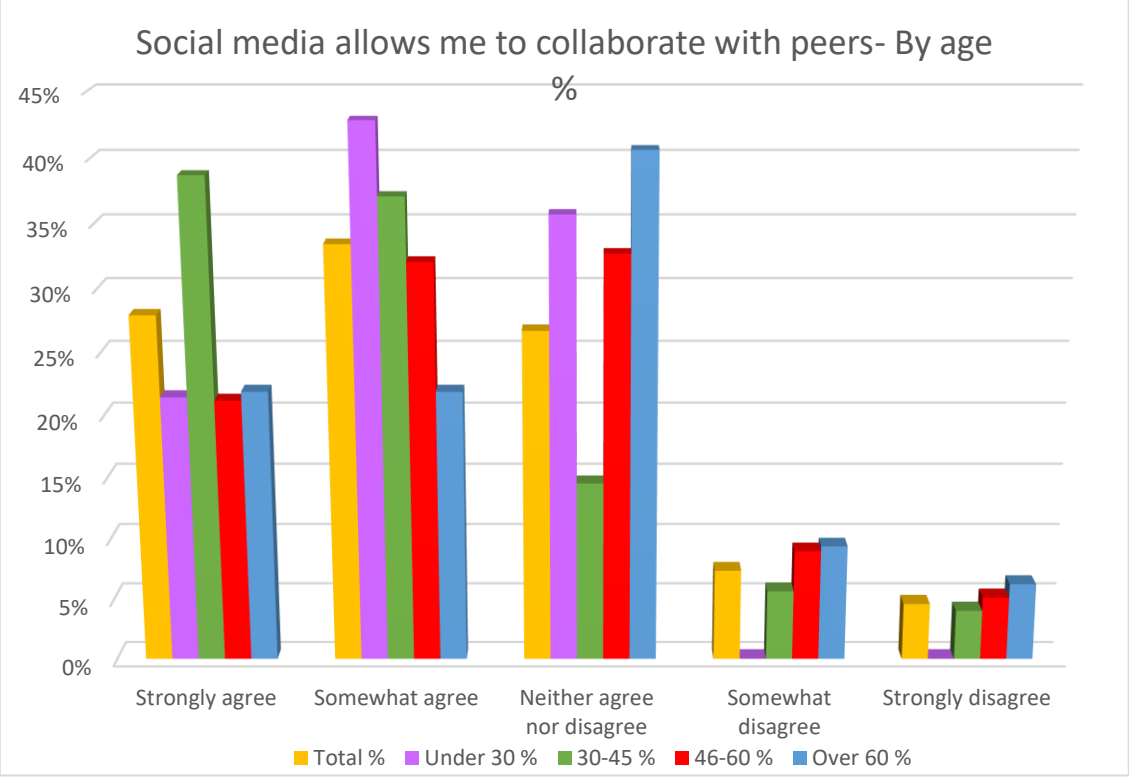


Figure 61 - Social media allows me to collaborate with peers- By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	91	28%	3	21%	48	39%	33	21%	7	22%
Somewhat agree	109	33%	6	43%	46	37%	50	32%	7	22%
Neither agree nor disagree	87	27%	5	36%	18	15%	51	33%	13	41%
Somewhat disagree	24	7%	0	0%	7	6%	14	9%	3	9%
Strongly disagree	15	5%	0	0%	5	4%	8	5%	2	6%
Total	326		14		124		156		32	

Table 47 - Social media allows me to collaborate with peers- By age %

The respondents were asked about their perception of social media as a platform for collaborating with experts, which would offer them opportunities to observe how experts solve problems and learn from their experiences. The analysis of responses revealed a statistically significant relationship between the two professional groups (Figure 62 and Table 48). A notable 65.1% (n=164) of Dental Care Professionals (DCPs) either strongly or somewhat agreed that social media enables them to collaborate with experts, in contrast to only 38.7% (n=29) of Dentists who shared this perspective. The statistical analysis yielded a P-value of 0.0000382 (Effect Size (Cramér's V) 0.249), indicating a significant difference in views between the two groups.

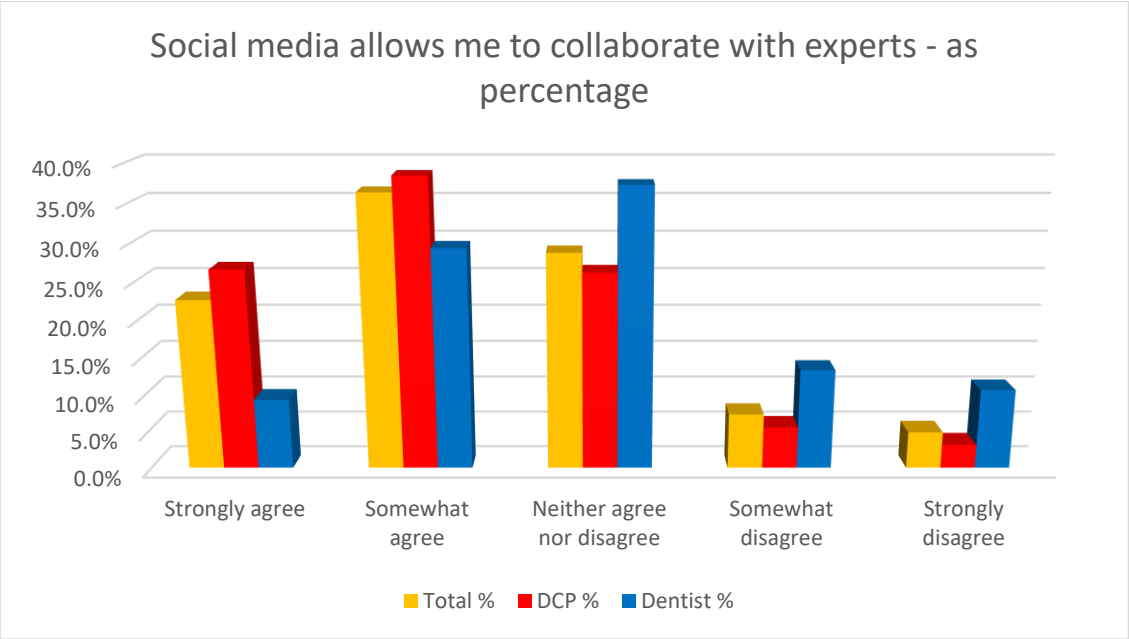


Figure 62 - Social media allows me to collaborate with experts - as percentage by group.

	Dentist count	Dentist %	DCP count	DCP %	Total count	Total %
Strongly agree	7	9.3%	67	26.6%	74	22.6%
Somewhat agree	22	29.3%	97	38.5%	119	36.4%
Neither agree nor disagree	28	37.3%	66	26.2%	94	28.7%
Somewhat disagree	10	13.3%	14	5.6%	24	7.3%
Strongly disagree	8	10.7%	8	3.2%	16	4.9%
Total	75		252		327	

Table 48 - Social media allows me to collaborate with experts - as percentage by group.

However, when analysing the data by age groups (Figure 63 and Table 49), , there was no statistically significant relationship (P= 0.190) (Effect Size (Cramér's V) 0.128) between age groups in their perception of social media's role in collaborating with

experts. Despite this, the 30-45 age group displayed a notably higher percentage in the strongly/somewhat agree category, indicating a relatively more positive attitude towards using social media for expert collaboration within this age bracket.

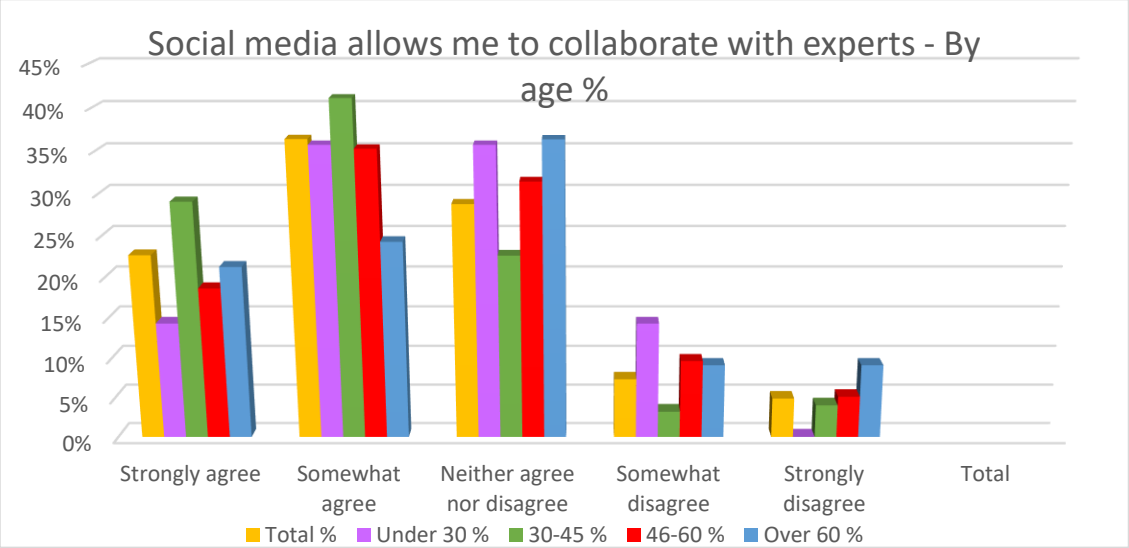


Figure 63 - Social media allows me to collaborate with experts - By age %

	Total	Total %	Under 30	Under 30 %	30 - 45	30-45 %	46 - 60	46-60 %	Over 60	Over 60 %
Strongly agree	74	23%	2	14%	36	29%	29	19%	7	21%
Somewhat agree	119	36%	5	36%	51	41%	55	35%	8	24%
Neither agree nor disagree	94	29%	5	36%	28	23%	49	31%	12	36%
Somewhat disagree	24	7%	2	14%	4	3%	15	10%	3	9%
Strongly disagree	16	5%	0	0%	5	4%	8	5%	3	9%
Total	327		14		124		156		33	

Table 49 - Social media allows me to collaborate with experts - By age %

4.6. Other Networking

Apart from social media, many respondents utilise various forms of networking to interact with colleagues and experts. They were asked to indicate the extent to which they use each of these networking methods, and the results are presented in Table 50 and Figure 64 showcasing the percentage of respondents for each level, ranging from "A great deal" to "None at all." It is noteworthy that there were no respondents in the "None at all" category for any of the other networking forms, indicating that most participants engage in one or more additional networking methods besides social media.

The data reveals that different networking methods are utilised to varying degrees. "Conferences" and "A lot" of "Courses (lectures)" are among the less frequently used networking forms, with only around 10-11% of respondents engaging in these activities to a significant extent. On the other hand, "Courses (hands-on)" and "Study Groups" are employed more actively, with approximately 42-35% of respondents indicating a moderate amount of involvement.

Moreover, "A little" level of participation is observed in "Conferences," "Study Groups," and "Courses (lectures)," indicating some involvement, albeit to a lesser extent.

It is important to note that a substantial number of participants partake in "Other" forms of networking, with percentages ranging from 3.6% to 40.6%. This variability suggests that dental professionals explore diverse avenues for networking and knowledge exchange beyond conventional social media platforms.

	Conferences	Study Groups	Training Days	Courses (lectures)	Courses (hands-on)	Other
A great deal	10.3%	2.4%	8.0%	14.2%	5.7%	3.6%
A lot	10.9%	6.5%	18.3%	20.4%	10.1%	5.4%
A moderate amount	32.8%	15.7%	42.8%	42.6%	28.7%	18.7%
A little	37.0%	34.6%	27.1%	21.6%	40.6%	31.7%
None at all	9.1%	40.8%	3.8%	1.2%	14.9%	40.6%

Table 50 - other forms of networking other than social media

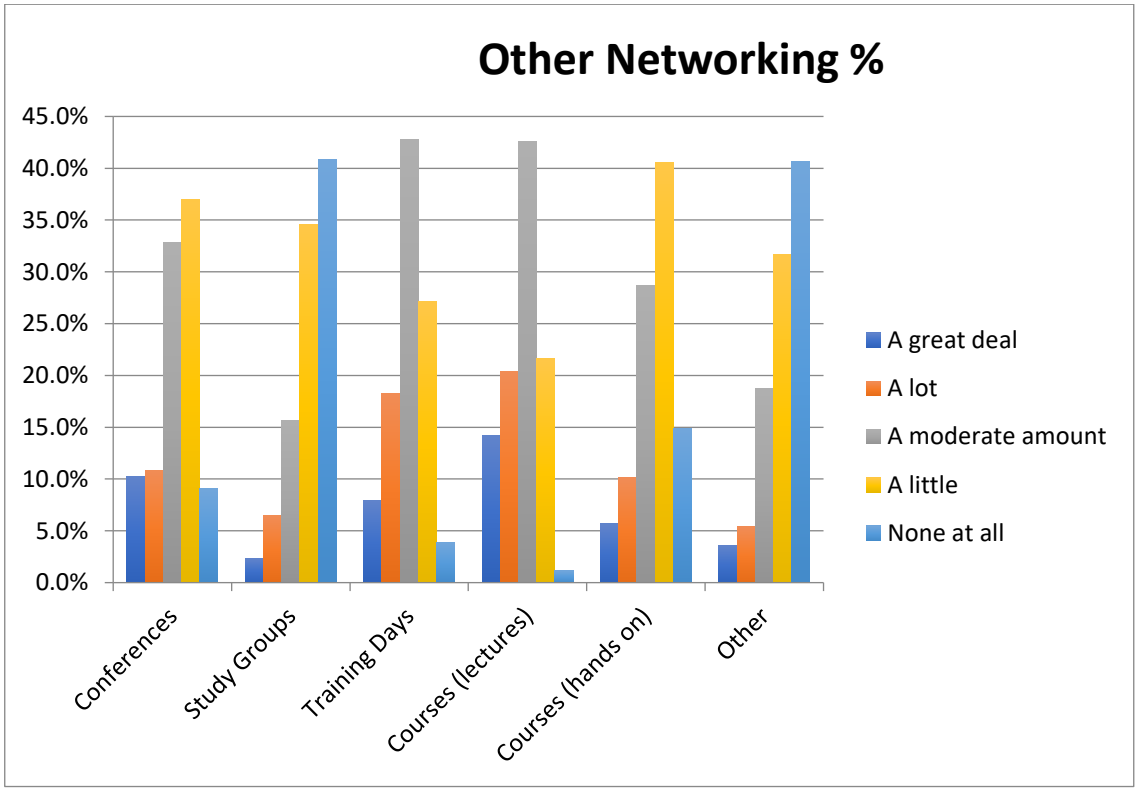
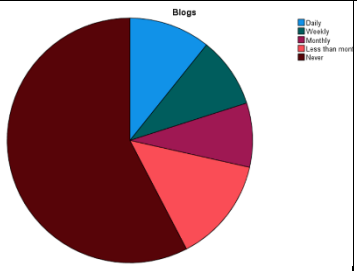
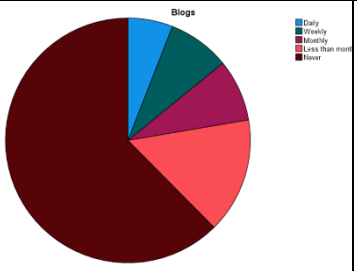
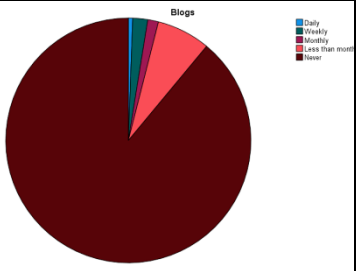


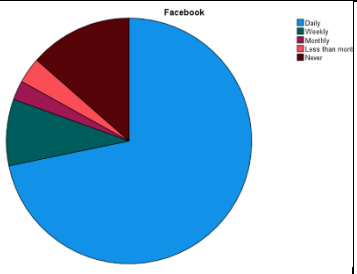
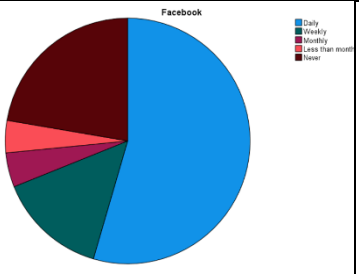
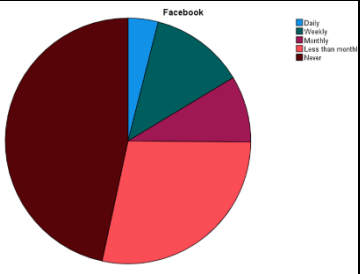
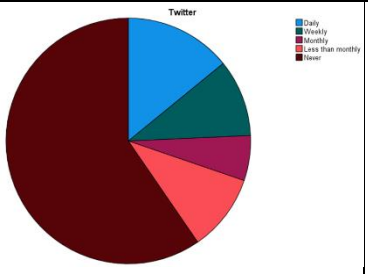
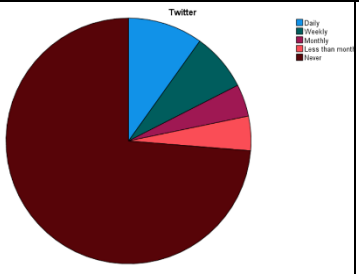
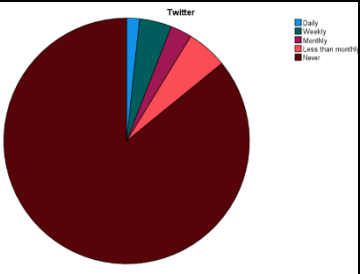
Figure 64 - Other Networking %

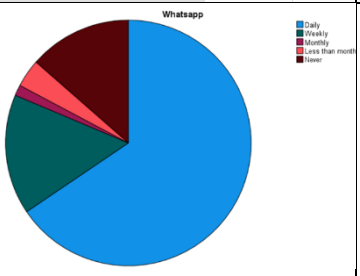
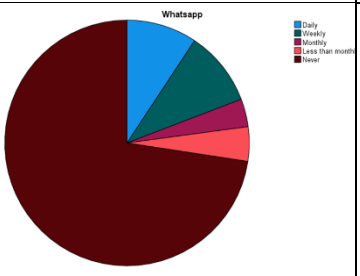
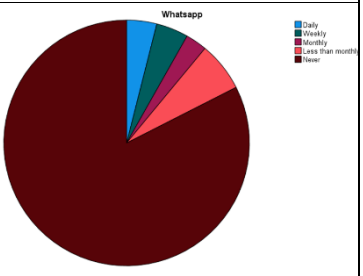
4.7. Social Media Usage

4.7.1. Platforms

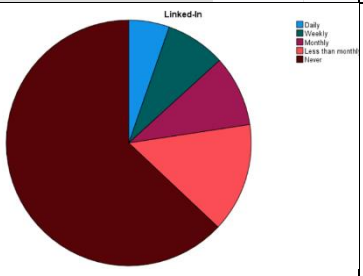
Respondents were asked about their use of social media both in their personal, and in their professional use to access professional content and to post professional content. It can be seen from Table 51 & Table 52 that some social media is used more than others. Analysing the relationship between personal use and professional use shows a statistically significant relationship as does the relationship between professional use and posting content. These relationships shall be discussed further in the next section (4.7.2), along with the other relationships.

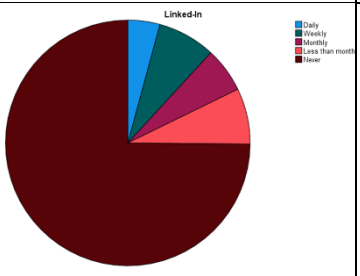
Personal Use			Professional Use			Professional Post		
								
Blogs			Blogs			Blogs		
	N	%		N	%		N	%
Daily	38	8.9%	Daily	21	4.9%	Daily	2	0.5%
Weekly	33	7.7%	Weekly	29	6.8%	Weekly	7	1.6%
Monthly	30	7.0%	Monthly	29	6.8%	Monthly	5	1.2%
Less than monthly	49	11.5%	Less than monthly	54	12.7%	Less than monthly	25	5.9%
Never	204	47.9%	Never	221	51.9%	Never	315	73.9%

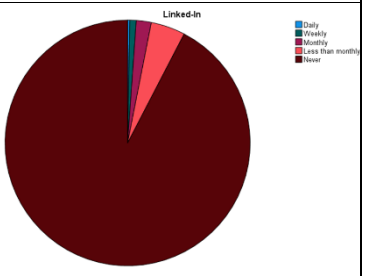
Missing	72	16.9 %	Missing	72	16.9 %	Missing	72	16.9 %
								
Facebook			Facebook			Facebook		
	N	%		N	%		N	%
Daily	254	59.6 %	Daily	193	45.3 %	Daily	14	3.3%
Weekly	31	7.3%	Weekly	51	12.0 %	Weekly	44	10.3 %
Monthly	9	2.1%	Monthly	16	3.8%	Monthly	31	7.3%
Less than monthly	12	2.8%	Less than monthly	15	3.5%	Less than monthly	100	23.5 %
Never	48	11.3 %	Never	79	18.5 %	Never	165	38.7 %
Missing	72	16.9 %	Missing	72	16.9 %	Missing	72	16.9 %
								
Twitter			Twitter			Twitter		
	N	%		N	%		N	%

Daily	50	11.7 %	Daily	35	8.2%	Daily	6	1.4%
Weekly	36	8.5%	Weekly	27	6.3%	Weekly	15	3.5%
Monthly	21	4.9%	Monthly	15	3.5%	Monthly	10	2.3%
Less than monthly	36	8.5%	Less than monthly	16	3.8%	Less than monthly	19	4.5%
Never	211	49.5 %	Never	261	61.3 %	Never	304	71.4 %
Missing	72	16.9 %	Missing	72	16.9 %	Missing	72	16.9 %
								
Whatsapp			Whatsapp			Whatsapp		
	N	%		N	%		N	%
Daily	232	54.5 %	Daily	33	7.7%	Daily	14	3.3%
Weekly	56	13.1 %	Weekly	35	8.2%	Weekly	15	3.5%
Monthly	5	1.2%	Monthly	13	3.1%	Monthly	10	2.3%
Less than monthly	13	3.1%	Less than monthly	16	3.8%	Less than monthly	23	5.4%
Never	48	11.3 %	Never	257	60.3 %	Never	292	68.5 %
			Missing	72	16.9 %	Missing	72	16.9 %

Missing	72	16.9 %



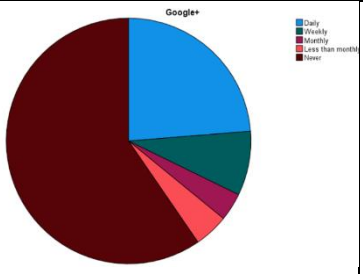


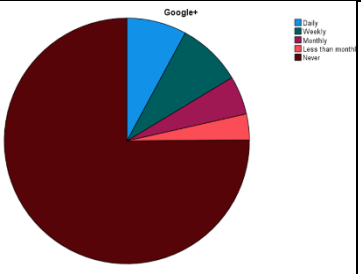


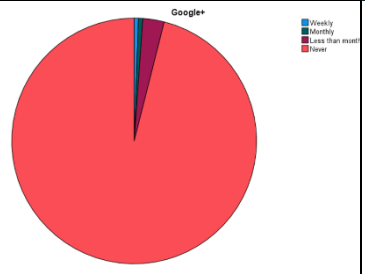
LinkedIn		
	N	%
Daily	19	4.5%
Weekly	28	6.6%
Monthly	33	7.7%
Less than monthly	51	12.0 %
Never	223	52.3 %
Missing	72	16.9 %

Linked-In		
	N	%
Daily	15	3.5%
Weekly	27	6.3%
Monthly	21	4.9%
Less than monthly	26	6.1%
Never	265	62.2 %
Missing	72	16.9 %

Linked-In		
	N	%
Daily	1	0.2%
Weekly	3	0.7%
Monthly	7	1.6%
Less than monthly	16	3.8%
Never	327	76.8 %
Missing	72	16.9 %







Google+		
	N	%
Daily	84	19.7 %

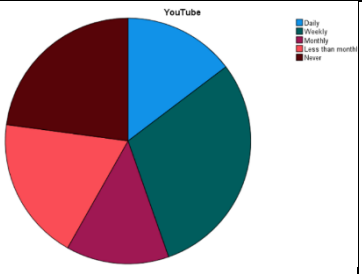
Google+		
	N	%
Daily	28	6.6%
Weekly	30	7.0%

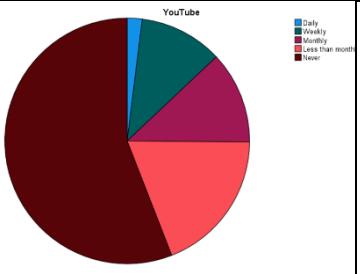
Google+		
	N	%
Weekly	2	0.5%
Monthly	2	0.5%

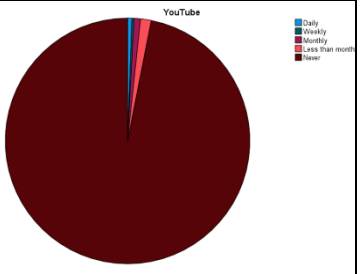
Weekly	30	7.0%
Monthly	13	3.1%
Less than monthly	16	3.8%
Never	211	49.5 %
Missing	72	16.9 %

Monthly	18	4.2%
Less than monthly	12	2.8%
Never	266	62.4 %
Missing	72	16.9 %

Less than monthly	10	2.3%
Never	340	79.8 %
Missing	72	16.9 %



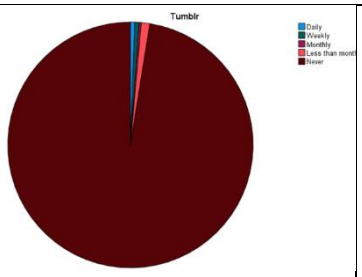




YouTube	N	%
Daily	52	12.2 %
Weekly	106	24.9 %
Monthly	48	11.3 %
Less than monthly	67	15.7 %
Never	81	19.0 %
Missing	72	16.9 %

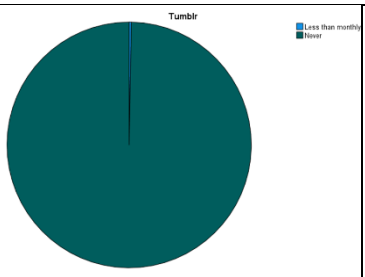
YouTube	N	%
Daily	7	1.6%
Weekly	39	9.2%
Monthly	43	10.1 %
Less than monthly	67	15.7 %
Never	198	46.5 %
Missing	72	16.9 %

YouTube	N	%
Daily	2	0.5%
Weekly	1	0.2%
Monthly	3	0.7%
Less than monthly	5	1.2%
Never	343	80.5 %
Missing	72	16.9 %



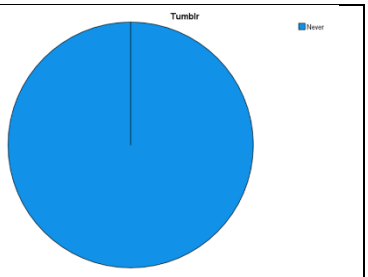
Tumblr

	N	%
Daily	2	0.5%
Weekly	2	0.5%
Monthly	1	0.2%
Less than monthly	4	0.9%
Never	345	81.0 %
Missing	72	16.9 %



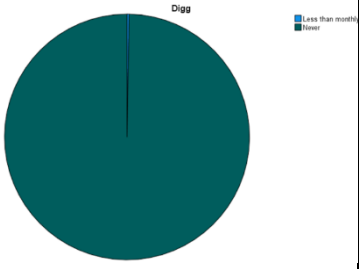
Tumblr

	N	%
Less than monthly	1	0.2%
Never	353	82.9 %
Missing	72	16.9 %



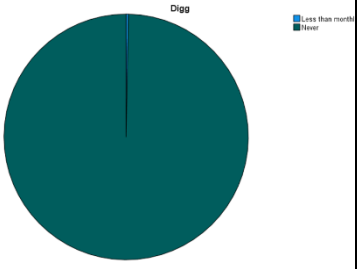
Tumblr

	N	%
Never	354	83.1%
Missing	72	16.9%



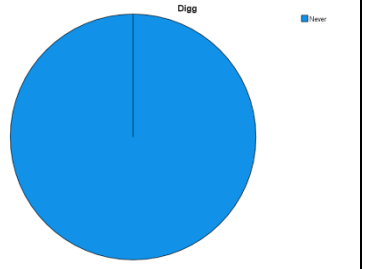
Digg

	N	%
Less than monthly	1	0.2%
Never	353	82.9 %



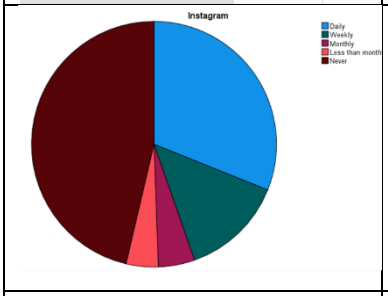
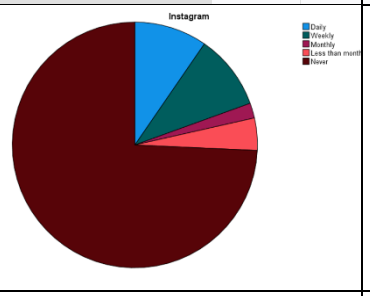
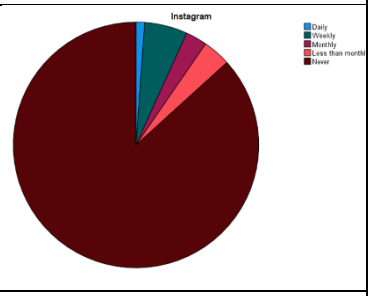
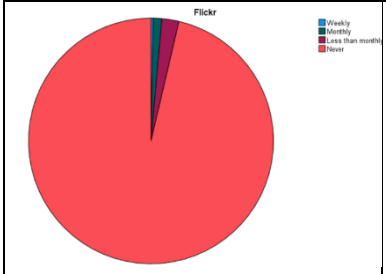
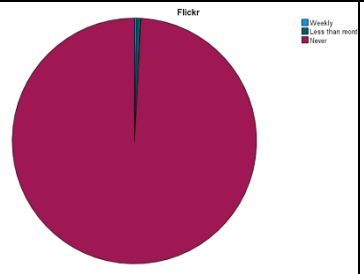
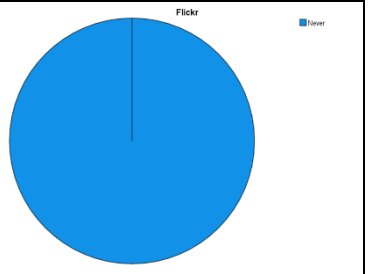
Digg

	N	%
Less than monthly	1	0.2%
Never	353	82.9 %



Digg

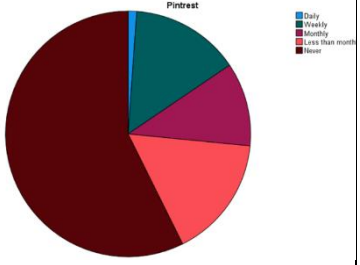
	N	%
Never	354	83.1%
Missing	72	16.9%

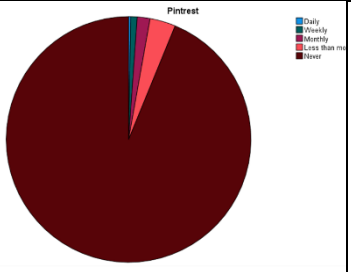
Missing	72	16.9 %	Missing	72	16.9 %			
								
Instagram			Instagram			Instagram		
	N	%		N	%		N	%
Daily	110	25.8 %	Daily	34	8.0%	Daily	4	0.9%
Weekly	48	11.3 %	Weekly	35	8.2%	Weekly	20	4.7%
Monthly	17	4.0%	Monthly	7	1.6%	Monthly	10	2.3%
Less than monthly	15	3.5%	Less than monthly	15	3.5%	Less than monthly	13	3.1%
Never	164	38.5 %	Never	263	61.7 %	Never	307	72.1 %
Missing	72	16.9 %	Missing	72	16.9 %	Missing	72	16.9 %
								
Flickr			Flickr			Flickr		
	N	%		N	%		N	%

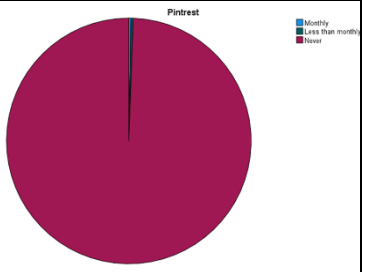
Weekly	1	0.2%
Monthly	4	0.9%
Less than monthly	8	1.9%
Never	341	80.0%
Missing	72	16.9%

Weekly	1	0.2%
Less than monthly	2	0.5%
Never	351	82.4%
Missing	72	16.9%

Never	354	83.1%
Missing	72	16.9%





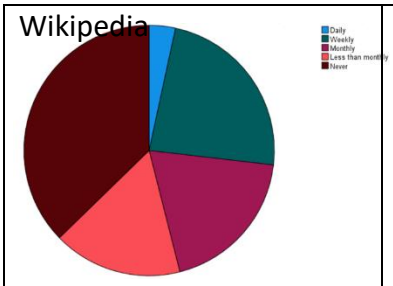


Pintrest	N	%
Daily	4	0.9%
Weekly	51	12.0%
Monthly	39	9.2%
Less than monthly	57	13.4%
Never	203	47.7%
Missing	72	16.9%

Pintrest	N	%
Daily	1	0.2%
Weekly	3	0.7%
Monthly	6	1.4%
Less than monthly	12	2.8%
Never	332	77.9%
Missing	72	16.9%

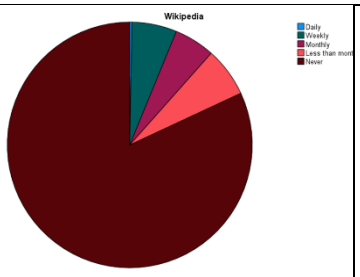
Pintrest	N	%
Monthly	1	0.2%
Less than monthly	1	0.2%
Never	352	82.6%
Missing	72	16.9%

Wikipedia



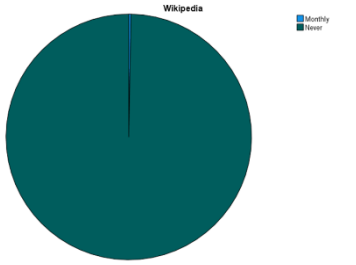
Wikipedia

	N	%
Daily	12	2.8%
Weekly	83	19.5 %
Monthly	68	16.0 %
Less than monthly	59	13.8 %
Never	132	31.0 %
Missing	72	16.9 %



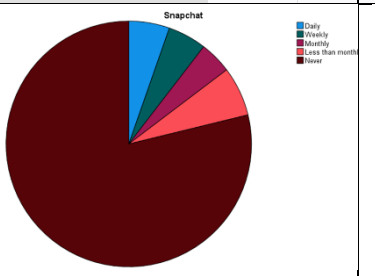
Wikipedia

	N	%
Daily	1	0.2%
Weekly	21	4.9%
Monthly	19	4.5%
Less than monthly	23	5.4%
Never	290	68.1 %
Missing	72	16.9 %



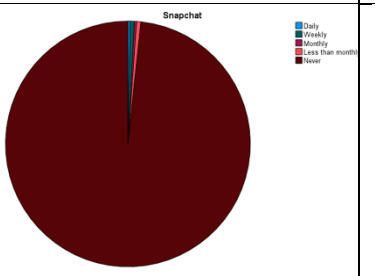
Wikipedia

	N	%
Monthly	1	0.2%
Never	353	82.9%
Missing	72	16.9%



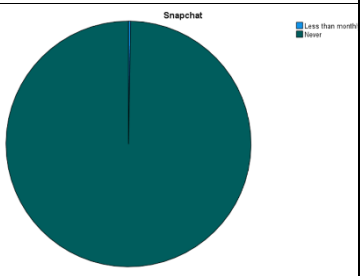
Snapchat

	N	%
Daily	19	4.5%
Weekly	18	4.2%



Snapchat

	N	%
Daily	1	0.2%
Weekly	2	0.5%



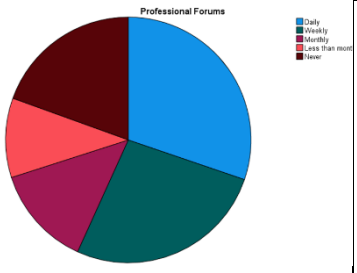
Snapchat

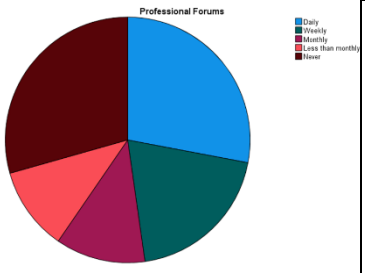
	N	%
Less than monthly	1	0.2%

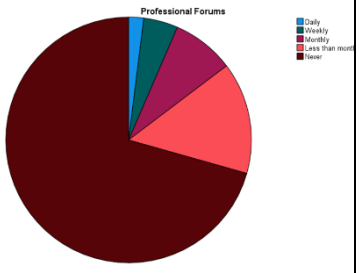
Monthly	15	3.5%
Less than monthly	23	5.4%
Never	279	65.5 %
Missing	72	16.9 %

Monthly	1	0.2%
Less than monthly	2	0.5%
Never	348	81.7 %
Missing	72	16.9 %

Never	353	82.9 %
Missing	72	16.9 %



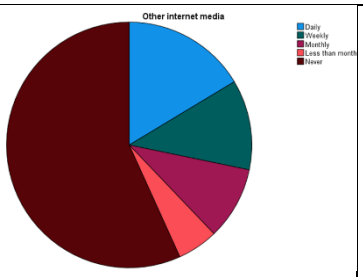




Professional Forums	N	%
Daily	107	25.1 %
Weekly	94	22.1 %
Monthly	47	11.0 %
Less than monthly	37	8.7%
Never	69	16.2 %
Missing	72	16.9 %

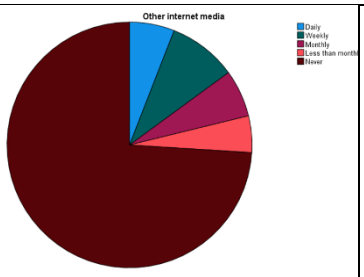
Professional Forums	N	%
Daily	99	23.2 %
Weekly	70	16.4 %
Monthly	42	9.9%
Less than monthly	39	9.2%
Never	104	24.4 %
Missing	72	16.9 %

Professional Forums	N	%
Daily	7	1.6%
Weekly	16	3.8%
Monthly	29	6.8%
Less than monthly	52	12.2 %
Never	250	58.7 %
Missing	72	16.9 %



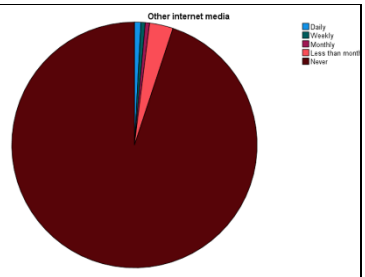
Other internet media

	N	%
Daily	58	13.6 %
Weekly	42	9.9%
Monthly	34	8.0%
Less than monthly	19	4.5%
Never	201	47.2 %
Missing	72	16.9 %



Other internet media

	N	%
Daily	21	4.9%
Weekly	32	7.5%
Monthly	22	5.2%
Less than monthly	17	4.0%
Never	262	61.5 %
Missing	72	16.9 %



Other internet media

	N	%
Daily	3	0.7%
Weekly	2	0.5%
Monthly	2	0.5%
Less than monthly	11	2.6%
Never	336	78.9 %
Missing	72	16.9 %

Table 51 - Social Media Platforms-Personal-Professional & Posts

The data depicted in Table 51 above, demonstrates the respondents use of the various social media platforms for personal use, professional use and how they post professionally related content to those sites. Some of the social media platforms are rarely used, such as Digg and Tumblr, and others are rarely used for professional use, for example, Snapchat and Flickr. The lack of personal use reflects how the respondents make use for their professional content, both in viewing and posting content, this is evidenced below in 4.7.2.

Table 52 - Social Media Access

Statistics - How often do you access the following social media sites

Personal Use		Blogs	Facebook	Twitter	Whatsapp	LinkedIn	Google+	YouTube	Tumblr	Digg	Instagram	Flickr	Pintrest	Wikipedia	Snapchat	Professional Forums	Other internet media
N	Valid	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354
	Missing	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Mean		3.98	1.78	3.91	1.84	4.22	3.68	3.05	4.94	5	3.21	4.95	4.14	3.61	4.48	2.62	3.74
Std. Deviation		1.416	1.434	1.527	1.42	1.216	1.736	1.412	0.401	0.053	1.8	0.301	1.16	1.289	1.135	1.491	1.598
Professional Use																	
N	Valid	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354
	Missing	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Mean		4.2	2.25	4.25	4.21	4.41	4.29	4.16	5	5	4.24	4.99	4.9	4.64	4.96	2.94	4.32
Std. Deviation		1.238	1.647	1.385	1.399	1.153	1.331	1.13	0.053	0.053	1.404	0.176	0.461	0.854	0.334	1.614	1.265
Professional Posts																	
N	Valid	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354	354
	Missing	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
Mean		4.82	4.01	4.69	4.59	4.88	4.94	4.94	5	5	4.69	5	4.99	4.99	5	4.47	4.91
Std. Deviation		0.603	1.188	0.853	1.015	0.481	0.314	0.401	0	0	0.864	0	0.119	0.106	0.053	0.961	0.482

4.7.2. Relationships

There is a statistically significant relationship between those accessing professional-related content and posting on professional forums.

P-Value	< 0.00001
Effect Size (Cramér's V)	0.255
Sample Size	354
95% confidence level	

Access	Post				
	Daily	Weekly	Monthly	Less than monthly	Never
Daily	100.0%	56.3%	41.4%	50.0%	18.0%
Weekly	0.0%	37.5%	41.4%	23.1%	16.0%
Monthly	0.0%	6.3%	10.3%	13.5%	12.4%
Less than monthly	0.0%	0.0%	0.0%	9.6%	13.6%
Never	0.0%	0.0%	6.9%	3.8%	40.0%

Table 53 - Accessing and Posting Content -Professional Forums

There is a strong statistically significant relationship between accessing and posting professional content on Facebook.

P-Value	< 0.00001
Effect Size (Cramér's V)	0.313
Sample Size	354
95% confidence level	

Access	Post				
	Daily	Weekly	Monthly	Less than monthly	Never
Daily	100.0%	86.4%	77.4%	71.0%	27.9%
Weekly	0.0%	11.4%	6.5%	23.0%	12.7%
Monthly	0.0%	0.0%	9.7%	1.0%	7.3%

Less than monthly	0.0%	0.0%	0.0%	2.0%	7.9%
Never	0.0%	2.3%	6.5%	3.0%	44.2%

Table 54 - Accessing and Posting Professional Content on Facebook

The data above in Table 53 and Table 54 would suggest that there is a statistical relationship between accessing professional content on a platform and posting professional content on that same platform. It would not be unreasonable to believe this is due to the respondent being comfortable on this same platform. This is confirmed in Table 55, where there is a strong statistically significant relationship between those who access Facebook for personal use and those who access professionally related content.

P-Value	< 0.00001
Effect Size (Cramér's V)	0.474
Sample Size	354
95% confidence level	

Access Professionally related content on Facebook	Access Facebook Personal Use				
	Daily	Weekly	Monthly	Less than monthly	Never
Daily	74.4%	9.7%	0.0%	0.0%	2.1%
Weekly	12.6%	54.8%	11.1%	0.0%	2.1%
Monthly	3.1%	12.9%	33.3%	8.3%	0.0%
Less than monthly	2,8%	3.2%	11.1%	41.7%	2.1%
Never	7.1%	19.4%	44.4%	50.0%	93.8%

Table 55- Accessing Facebook personal use and Facebook Professional Content

There is a statistically significant relationship between the respondent's belief that technology will become more important in healthcare and their accessing professional-related content on Facebook (Table 56).

P-Value	0.00824
Effect Size (Cramér's V)	0.159
Sample Size	321
95% confidence level	

Technology become more important in Healthcare	Access Professional Related Content - Facebook				
	Daily	Weekly	Never	Monthly	Less than monthly
Strongly agree	53.3%	43.5%	42.3%	16.7%	0.0%
Somewhat agree	38.9%	50.0%	40.8%	58.3%	66.7%
Neither agree nor disagree	5.6%	6.5%	14.1%	16.7%	33.3%
Somewhat disagree	0.6%	0.0%	1.4%	0.0%	0.0%
Strongly disagree	1.7%	0.0%	1.4%	8.3%	0.0%

Table 56- Relationship between belief in Technology becoming more important in Healthcare and Accessing Content on Facebook

There is a statistically significant relationship between accessing professional-related content on Facebook and opinions on loving technology and what it can do (Table 57).

P-Value	0.000625
Effect Size (Cramér's V)	0.178
Sample Size	321
95% confidence level	

Access Professional Related Content - Facebook	I love technology and what it can do				
	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Daily	74.1%	53.6%	47.3%	55.2%	30.0%
Weekly	8.6%	16.4%	18.7%	6.9%	10.0%
Monthly	2.5%	4.5%	5.5%	0.0%	0.0%
Less than monthly	0.0%	3.6%	3.3%	6.9%	30.0%
Never	14.8%	21.8%	25.3%	31.0%	30.0%

Table 57 Relationship between loving what technology can do and accessing professionally related content on Facebook.

When examined it was found that there was no statistically significant relationship between age groups and posting professionally related content on Facebook (Table 58).

P-Value	0.230
Effect Size (Cramér's V)	0.120
Sample Size	353
95% confidence level	

Age Group	Post content on Facebook				
	Never	Less than monthly	Monthly	Weekly	Daily
Under 30	6.1%	4.0%	3.2%	2.3%	0.0%
Over 60	8.5%	7.0%	9.7%	13.6%	35.7%
46 - 60	48.2%	46.0%	45.2%	47.7%	28.6%
30 - 45	37.2%	43.0%	41.9%	36.4%	35.7%

Table 58 - Relationship between Age Group and Posting Professional content on Facebook.

There is a statistically significant relationship between the respondent's confidence in their computer use and the belief that they can usually find what they are looking for on the internet (Table 59).

P-Value	0.00937
Effect Size (Cramér's V)	0.164
Sample Size	326
95% confidence level	

I am a confident computer user	I can usually find the information I am looking for on the internet			
	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree
Strongly agree	59.1%	40.6%	35.0%	50.0%
Somewhat agree	29.9%	42.3%	45.0%	25.0%
Neither agree nor disagree	9.4%	14.9%	10.0%	0.0%
Somewhat disagree	1.6%	1.7%	10.0%	25.0%
Strongly disagree	0.0%	0.6%	0.0%	0.0%

Table 59 - Relationship between confidence in computer use and being able to find information on the internet.

There is a statistically significant relationship between accessing professional-related content on Facebook and the belief that Social Media allows the respondent to collaborate with peers (Table 60).

P-Value	< 0.00001
Effect Size (Cramér's V)	0.279
Sample Size	326
95% confidence level	

Social Media allows me to collaborate with peers	How often do you access professional-related content on Facebook				
	Daily	Weekly	Monthly	Less than monthly	Never
Strongly agree	41.8%	23.9%	7.7%	0.0%	4.2%
Somewhat agree	35.7%	41.3%	30.8%	23.1%	25.0%
Neither agree nor disagree	19.2%	23.9%	46.2%	53.8%	38.9%
Somewhat disagree	2.7%	10.9%	7.7%	23.1%	13.9%
Strongly disagree	0.5%	0.0%	7.7%	0.0%	18.1%

Table 60- Relationship between accessing professional-related content on Facebook and the belief that social media allows collaboration with peers.

There is a statistically significant relationship between accessing professional-related content on professional forums and the belief that Social Media allowed collaboration with experts (Table 61).

P-Value	0.00677
Effect Size (Cramér's V)	0.160
Sample Size	327
95% confidence level	

Social Media allows me to collaborate with experts	How often do you access professional-related content on Professional Forums				
	Daily	Weekly	Monthly	Less than monthly	Never
Strongly agree	32.3%	24.6%	20.0%	5.6%	19.4%
Somewhat agree	29.0%	49.2%	25.0%	55.6%	32.3%

Neither agree nor disagree	29.0%	23.1%	32.5%	25.0%	32.3%
Somewhat disagree	5.4%	1.5%	17.5%	5.6%	9.7%
Strongly disagree	4.3%	1.5%	5.0%	8.3%	6.5%

Table 61- Relationship between accessing professional-related content on professional forums and the belief that social media allows collaboration with experts.

There is a statistically significant relationship between respondents who like to collaborate with others in their learning and their belief that social media allows them to collaborate with experts (Table 62).

P-Value	0.000233
Effect Size (Cramér's V)	0.183
Sample Size	325
95% confidence level	

Social Media allows me to collaborate with experts	I like to collaborate with others in my learning				
	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
Strongly agree	35.8%	21.9%	11.8%	14.3%	0.0%
Somewhat agree	39.5%	36.8%	30.9%	42.9%	42.9%
Neither agree nor disagree	14.8%	31.6%	42.6%	14.3%	14.3%
Somewhat disagree	7.4%	6.5%	8.8%	7.1%	14.3%
Strongly disagree	2.5%	3.2%	5.9%	21.4%	28.6%

Table 62 - Relationship between liking to collaborate with others in their learning and the belief that social media allows them to collaborate with experts.

5. Qualitative Responses

In the previous chapter, we comprehensively unveiled the quantitative findings of the survey. In the current chapter, we delve into the qualitative dimension of the research, meticulously examining the selection of thematic analysis as the chosen approach, along with a thorough exploration of the methodology employed and its implementation. Subsequently, the results of the survey's inquiries, with their corresponding themes skilfully developed, are presented individually. A comprehensive discussion of these findings follows, delving into their implications and insights.

To add richer detail to the quantitative data gathered in Chapter 4 the use of open questions in the questionnaire gives more context than allowed for in the closed questions. However, due to the nature of an open question, there can be a huge range of answers. Guest, MacQueen, & Namey (2011) suggest that qualitative data may be collected and analysed in many ways and that the data can range from a single word to a complete narrative and to a photo or video.

Reflexive Thematic analysis was chosen as the method of analysing the qualitative data from the survey (Braun & Clarke, 2019; Braun, Clarke, Boulton, Davey, & McEvoy, 2021; Campbell et al., 2021), most qualitative studies have a much smaller sample size, although mixed-method studies may be larger(Braun & Clarke, 2014) as have some surveys using thematic analysis (Jahner, Penz, Stewart, & MacLeod, 2020). Others have used thematic analysis to conduct research into self-directed learning using the paradigm of connectivism (Conradie, 2014) and a mixed methods case study of Networked Professional Learning (Bui, 2019).

Whilst many instances of thematic analysis are developed to analyse only one question, this is not always the case, (Jahner, Penz, Stewart, & MacLeod, 2020) in their paper "Exploring the Distressing Events and Perceptions of Support Experienced by Rural and Remote Nurses" carried out a thematic analysis on two questions as part of a large survey.

The themes emanating from this data will be merged with the quantitative data in the final analysis (Chapter 6) so that the complexity of the subject may emerge.

5.1. Methodology

Two open questions were asked of the respondents in the online questionnaire, which they were not required to answer, nor were they restricted in how much they could respond. The open-ended data from the two survey questions (ranging from a few words/phrases to longer paragraphs) were analysed separately. Reflexive thematic analysis was utilised in this study, as it provided a flexible method to analyse the large datasets of open-ended text data (Jahner, Penz, Stewart, & MacLeod, 2020).

Question 1. - Could you please give an example of something you have learnt or shared with other Dental Professionals via social media or forums?

Question 2. - Please describe your thoughts about how you use the internet and social media in keeping abreast of developments and new knowledge in your profession.

The respondent's answers to the questions were exported into ATLAS.ti 9 to code the responses, each set of questions was dealt with separately. Using the six phases as

developed in a step-by-step guide by Braun & Clarke (2006) developed as guidelines for the thematic analysis of qualitative data. One must be aware that the analysis is not linear, but is a recursive process, moving back and forth throughout the process of analysis.

The first step in the process is familiarisation with the data, this involves reading through the text to become familiar with it and taking any necessary notes. Immersion in the data involves the repeated reading of the data searching for meanings and patterns within it.

Second step is to code the data, developing shortcodes to describe the content and adding new codes, if necessary, as the data is read. Once coded, the data is collated into the groups identified by the codes to get an overview of the main points and commonalities recurring throughout the data.

Third step, when the codes are looked at and patterns identified, it may combine some of the codes into the themes that emerge.

Fourth step is reviewing the themes and checking that they work with the data. Nothing at this point is taken for granted.

Fifth step is refining each theme's specifics and defining the names of each theme.

Sixth step is reporting on the analysis and selecting compelling extracts and examples. This part tells the story of the data, producing evidence of the themes, and giving credibility to the findings.

5.2. Method

Following the six stages described above in section 5.1:

The steps to each question will be described below, each of the questions will develop different codes and themes but the steps are the same.

Question 1:

Step 1:

The responses to Question 1: Could you please give an example of something you have learnt or shared with other Dental Professionals via social media or forums?

were read through several times to get a feel for the data and become familiar with the depth and breadth of the responses. There were 261 responses to read and re-read from the 426 who responded to the survey. This data was imported into ATLAS.ti 9 to facilitate the coding and development of codes.

Step 2:

Initial codes developed from the data, organising the data into meaningful groups, each response may belong to one or many groups. This initial coding has meanings which emanate from the reading of each response and discovering the diversification between each. The codes developed were (Figure 65):

- **making connections** – generally the respondent was making connections with others.
- **connecting with experts** – respondents mention the connection to experts.
- **getting updates on Guidelines** – respondents referring to updating guidelines.
- **Information** – respondents refer to gathering and searching for information.
- **Learning** -respondents acknowledge learning.

- **connecting with Peers** – respondents refer to the connections made with their peers.
- **Sharing information** – respondents express their sharing of information with others.
- **Supportive** – respondents refer to giving or receiving support.

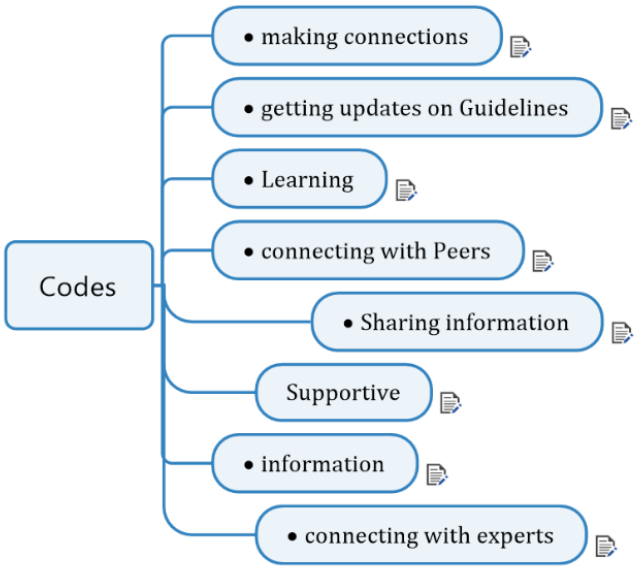


Figure 65 - Thematic map of codes to Question 1

Step 3

The codes are then classified into themes, grouping the codes into common meanings, thus becoming unified. A collection of themes is developed from the codes (Figure 66) and the data is merged into the themes by using the software (Atlas.ti). Then rechecking the themes against the data to ensure they still hold as they are, or if they need to be further refined.

- Connecting
- Guidelines
- Information
- Learning
- Supportive

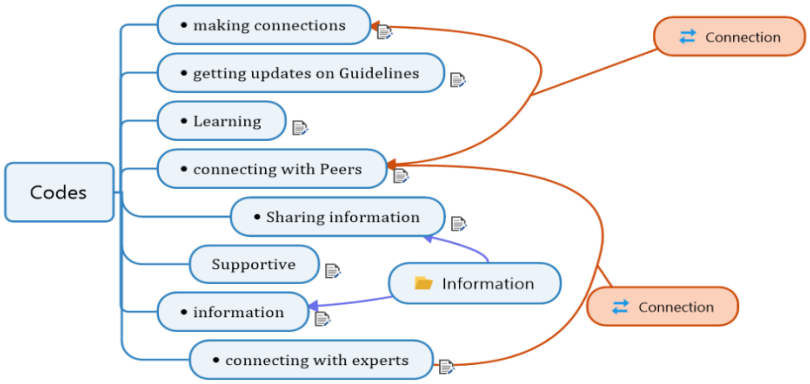


Figure 66 - Developing Themes – Thematic map to Question 1

Step 4

Refining the themes ensuring that the extracts form a coherent pattern and providing an accurate representation of the meanings in the responses. Stopping when the refinements are adding nothing to the meaning.

Step 5

Renaming the themes – in other words identifying what each theme is about:

- Connecting – Making connections to peers and experts.
- Guidelines – keeping up to date with the professional guidelines.

- Information – new information and opinions.
- Learning – learning from and sharing learning with others.
- Supportive – support for and from others.

Step 6

This is the write-up of what has been learned from the responses, the narrative of which will be shared in the results in section 5.3.

Question 2

Step 1

The responses to question 2: “Please describe your thoughts about how you use the internet and social media in keeping abreast of developments and new knowledge in your profession.” were read through several times to get a feel for the data and become familiar with the depth and breadth of the responses. There were 235 responses to read and re-read from the 426 who responded to the survey. This data was imported into ATLAS.ti 9 to facilitate the coding and development of codes.

Step 2

Initial codes developed from the data, organising the data into meaningful groups, each response may belong to one or many groups. The codes developed were (Table 63 & Figure 67), in this instance a greater number of codes were developed than in the previous question.

webinar	convenient	courses
Discussion	Essential	experts
follow	learning	Loud voices
network	New Knowledge	new or interesting information

opinions	Peer learning	Professional
quality	research	sharing
unbalanced opinion	update knowledge	validity checking

Table 63 - Codes developed for Question 2

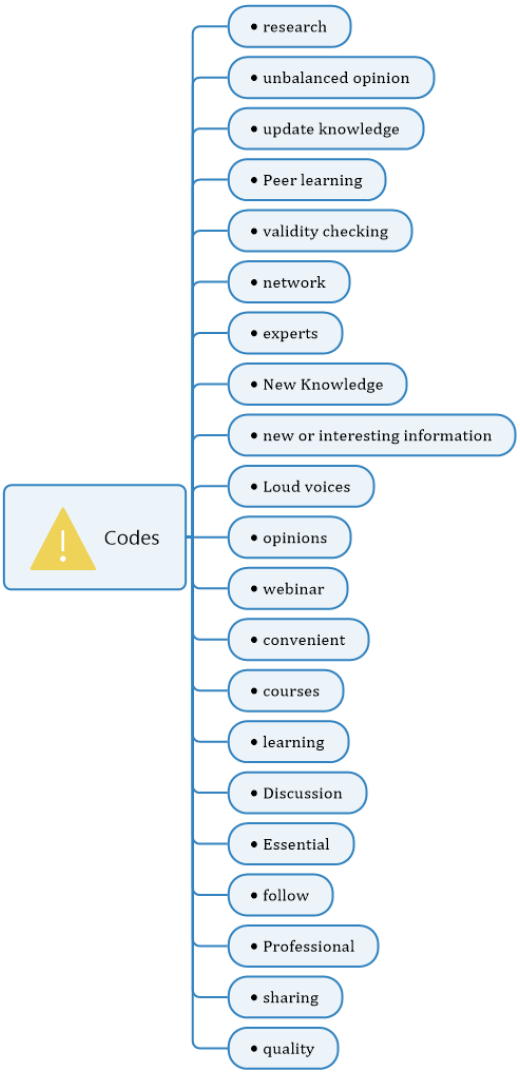


Figure 67 - Thematic map of codes to question 2.

Step 3

In this step in the data analysis the codes are organised, reflected on, and compared to the similarities, giving labels to each of the clusters. These are developed into themes, and the codes are merged into the themes (Figure 68).

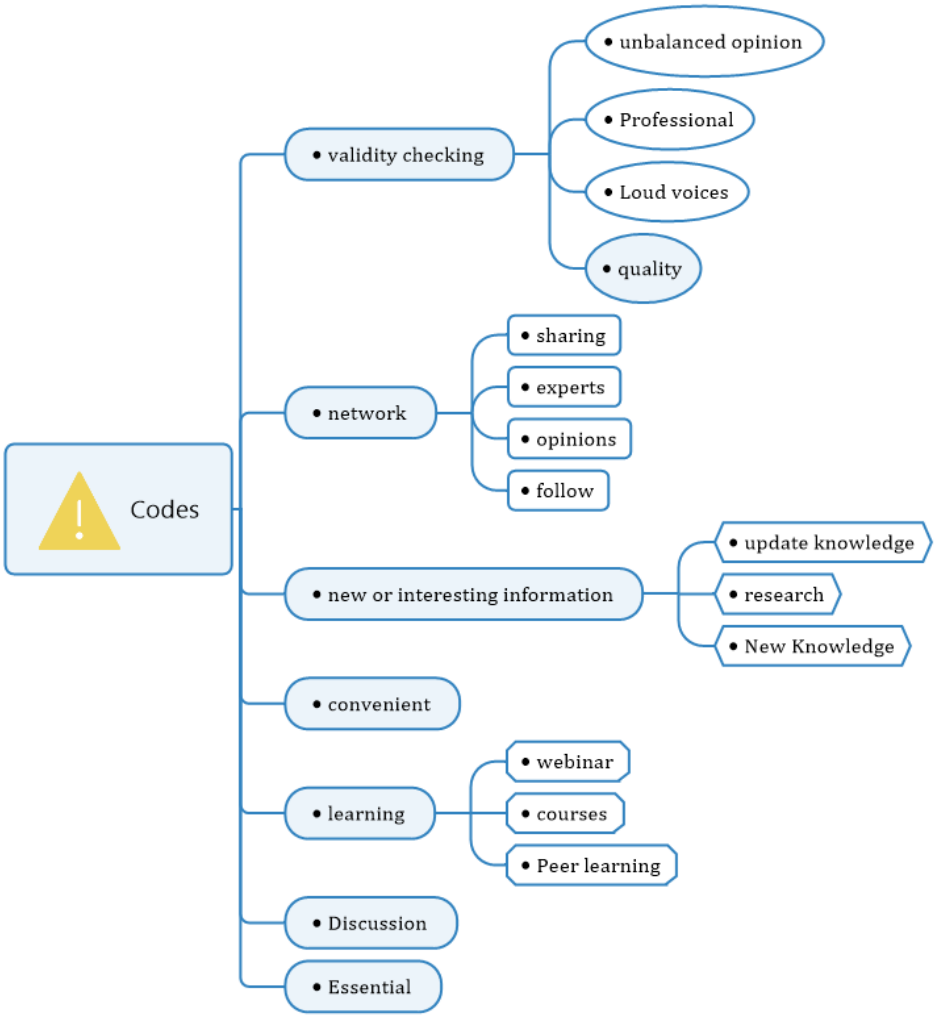


Figure 68 - Codes merged into themes - question 2.

Step 4

Once the themes are merged, they are rechecked against the responses to ensure they are still a good fit. Refining until nothing more can be added, and ensuring it captures something important.

Step 5

Renaming the themes –identifying what each theme is about, capturing what is important as presented by the respondent.

- Validity checking – Reliability of information found or expressed.
- Network – Making connections.
- New or interesting information – Researching and updating knowledge.
- Convenient – At a time and place to suit.
- Learning – Learning from courses and webinars.
- Discussion – Being able to discuss work-life.
- Essential – A part of work.

Step 6

The narrative of the findings will be shared in the results in section 5.4.

For each of the steps outlined above for both questions, there is constant revisiting to ensure the codes and themes reflect what is being conveyed by the respondents. Sundler, Lindberg, Nilsson, & Palmér, (2019, p.737) has said "Reflexivity must be maintained during the entire process, and the researcher needs to sustain a reflective attitude. Particularly, reflexivity must involve questioning the understanding of data and themes derived."

5.3. Results Question 1

Question 1: Could you please give an example of something you have learnt or shared with other Dental Professionals via social media or forums?

This question was asked to identify first if the respondents had identified that they had learnt from others and if they shared their learning, this was best identified by the respondent giving examples. This collaborative approach to learning with peers and experts is in essence what HSLNs are about, the knowledge bridging across networks (Cook & Gregory, 2018) in a heutagogical approach to their lifelong learning (Blaschke, 2012). Secondly, it was used to identify what the respondents were learning and sharing as this may show trends in educational needs.

Theme: Making Connections:

Many respondents found that making connections with their peers and experts helped them become confident in asking questions in areas where they were unsure of procedures. By making connections they can share their experiences. Within dentistry, most work in small units and are therefore isolated from their peers, whereas, in other industries and even other healthcare professions, there may be larger communities in which to ask advice. These connections may be seen in the context of a CoP (Lave & Wenger, 1991) and the sharing of knowledge via networks (Jones, 2004).

> "Asked friends about types/brands of SLS free toothpastes"

> "I am part of a small (private) group of dental hygienists on Instagram who share our posts and what we are doing outside of social media with each other. This has opened up other learning opportunities, courses available and directions to take my career that I might not have otherwise considered."

Numerous connections formed among individuals serve a practical purpose, as they seek assistance in addressing unfamiliar challenges or exploring potential treatment options. Through these dialogues, knowledge gaps are bridged, either through direct inquiries or communal discussions. Active participation in these exchanges contributes to the construction of contextual knowledge, enriching the understanding and expertise of the involved parties.

> "makes me think about how i work from listening to other people eg instrument separation treat or refer at moment on gdp-uk"

Certain respondents express a preference for engaging in case discussions exclusively within closed forums. In these intimate settings, they can exchange insights with like-minded colleagues and established experts, fostering a sense of reassurance in the responses received. Such facilitated sharing of discussions and reflections on cases serves as a conduit, transporting knowledge into the social realm, where it takes shape and contributes significantly to further development (Bullock, 2014). This may be seen as a constructivist approach which has been developed and refined by many theorists, not least Lev Vygotsky (1980) who emphasised the importance of social interactions in learning, building on their prior knowledge and experiences as they interact with others and the environment to construct new knowledge.

> "i belong to a local dentist WhatsApp group and i have learnt about how people approach different clinical problems"

> "Restorative techniques being shared on professional forums closed to members. Also interesting cases being discussed on closed professional forums."

Amidst those who actively seek information and assistance, there are also individuals who willingly share valuable insights with their connections, deeming the information worthy of dissemination. This act of sharing stands as a pivotal element of Network

Learning, fostering a vibrant exchange of knowledge within the network (Gobbi, 2010; McMurtry, Rohse, & Kilgour, 2016).

> "I recently shared a piece on no longer using the term DNA for children missing appointments and saying 'was not brought' instead. I thought this was an important thing to share."

Theme: Getting updates on guidelines:

A significant portion of the respondents actively seek updates on guidelines, primarily due to the dynamic nature of their profession, where organizations can implement changes without disseminating them widely throughout the entire professional community. In an ever-evolving field, practitioners face the formidable challenge of staying current with the latest developments, as new guidelines and protocols emerge frequently. By acquiring timely updates from specific sources, practitioners can streamline their information intake, making their busy lives more efficient.

> "Current guidelines for use of cavitron on patients with pacemaker via Facebook"

Even for those rarely using social media, it can be a rich source of information.

> "Very rarely use social media forums but recently found/chatted about new Perio classification and BGT"

> "I wanted to check my knowledge on numerous occasions regarding topics that have changed recently (Nice guidelines etc) or in areas I have not had much recent experience in (deciduous crown preps etc)"

For dental professionals, the requirement to keep up to date can be crucial for the care of patients, this may be seen as part of a CoP (Wenger, 2015) sharing resources and interacting.

> "The need for a INR check to be at least 72 hours prior to treatment and what can happen if this isn't followed"

Theme: New information and opinions:

The sharing of information and experiences is situated in Communities of Practice (Wenger, 2015) and also in HSLN where it promotes connections between a learning community and its resources (Cook et al., 2016). It is more usual in a thematic analysis to share only one or two illustrations for a theme; however, this theme demonstrated several salient illustrations as to the affordance provided by social media and forums. It is however not unknown when it is merited (Jahner, Penz, Stewart, & MacLeod, 2020).

> "Apparently some people were not aware of drug interactions eg warfarin with antifungal. I advised a person of this as she was ready to misadvise."

> "Usually updates on things like, using ultra sonics with pacemaker patients etc, generally taking interest in discussions of any changes or revised techniques. Facebook pages seem to be the most useful. New BPE grading and stages for example."

> "I shared reason for not working without a nurse and how to negotiate getting one"

> "My most recent share was a study that showed that early loss of sense of smell could be linked with early cognitive decline which I thought might be useful for my peers to read"

> "Recognising various presentations in the mouth of conditions I don't see very often"

Much of the information is gathered through discussions with peers and experts.

> "I have learnt a lot of things such as what courses are available, tips and techniques when treating patients such as best ultra sonic tips to use ,"

Information flow within this vast field is far from one-directional; instead, it takes on a multi-directional nature, where knowledge circulates and enriches through dynamic discussions. Participants actively contribute their research findings, effectively sharing valuable insights with others. Simultaneously, they gather additional information from the discourse, enhancing their understanding and enriching their ongoing research endeavours within the field. This reciprocal exchange fosters a collaborative and knowledge-driven community, propelling collective growth and advancement in their area of expertise (Treasure-Jones, Sarigianni, Maier, Santos, & Dewey, 2019).

> "Dental antimicrobial stewardship is my area of interest and research. I regularly share my research papers, presentations and answer questions posed by others about appropriate antimicrobial prescribing and resistance. Mainly on Facebook d4d forum. I have also used my open facebook page to ask friends and family questions about how the public see antibiotic and currently have an undergrad student using a social media search to show how the public talk about and view antibiotics for dental problems."

Theme: Learning from and sharing learning with others:

Within these social networks, forums, and face-to-face meetings, dental professionals not only acquire knowledge but also actively disseminate their learning within their respective groups. The technology-driven tools available empower users to not only create valuable content but also facilitate effortless distribution and seamless collaboration. This enhanced connectivity fosters a more participative and engaged community (Herlo, 2017), propelling dental professionals towards a shared journey of continuous learning and growth.

> "Currently learning about mineral Hypoplasia, was sent an informative patient advice leaflet that I will plagiarise (with permission) to suit our own needs"

> "How to understand the new classification system. There were also CPD events shared which allowed me to increase my understanding"

> "I have learnt about more complex medical histories and their complexities within dental treatments."

Theme: Support for and from others:

A prevalent concern among those in primary dental care in the UK is the sense of isolation that can arise due to the relatively small number of colleagues working in a practice. This isolation may lead to feelings of loneliness, potentially triggering negative psychological effects (Farsi, 2021). However, social media has proven to be a valuable remedy, as it has been shown to diminish feelings of isolation and loneliness. Additionally, social media platforms play a pivotal role in fostering connections among dental professionals(Schmitt, Sims-Giddens, & Booth, 2012).

> "Support for members of the forum going through difficult professional experiences"

> "New products, asking for opinions, sharing good and bad days !"

> "How to deal with contracts at work"

5.4. Results Question 2

Question 2: “Please describe your thoughts about how you use the internet and social media in keeping abreast of developments and new knowledge in your profession.”

In this question, it was the identification of how the respondents used technology to learn and develop their self-directed learning (Blaschke & Hase, 2016).

Theme: Reliability of information found or expressed:

A significant dynamic observed in online networks is that approximately 10% of the most active participants are responsible for around 70% of the messages shared, leading to their dominance within the online communities (Baek & Kim, 2015) This particular aspect emerged as a prominent point emphasised by numerous respondents in response to the question, prompting contemplation on the influence exerted by "Loud Voices" (which will be discussed further in Section 5.5).

> “I think social media is a useful tool for professional discussion but people need to be aware that the content is often opinion and not always quality assured. Sometimes people who shout the loudest are the least qualified to give an opinion.”
>
> “It is ideal however I find the professional forums dominated by self anointed experts who are no better than any other hygienist who is well read. This is frustrating when their word is considered gospel.”
>
> “I am not a fan of social media, as unfortunately it can give ill informed people a platform and turn into a point scoring exercise by

> other hygienist over their peers. I think it is also too easy for common sense to be replaced by mass hysteria on certain subjects."
>
> "However, there are some self-proclaimed experts who clearly aren't and recognising the 'barrack room lawyers' is important. I'm experienced enough to make that distinction but I'm sure there are others who believe everything they read."

In response to the dynamics observed on certain social media platforms (Baek & Kim, 2015), a considerable number of respondents took proactive measures to counteract potential misinformation. They accomplished this by verifying and validating the information they encountered through reputable sources, including peer-reviewed sites produced by esteemed professional organisations. This cautious approach allowed them to ensure the accuracy and reliability of the information they accessed (Jalonen, 2015), thus safeguarding the integrity of their professional knowledge and decision-making process.

> "Use refereed sites such as BDA, GDC, NICE, SDCEP
>
> GDPUK forums, but aware that opinions given by users are not always accurate. Stimulate further research instead of taking at face value."
>
> "Search reputable knowledge bases to check facts. Use of social media to determine trends and ideas with frequent and broad cross referencing for validity. Avoidance of low confidence single site information"

Certain respondents opted to refrain from relying on social media sites for obtaining reliable information. Instead, they strategically utilised social media as a means of identifying trends and signposting potential areas that require further research. By

employing this discerning approach, they recognised social media's value in directing their attention towards relevant topics, subsequently motivating them to delve deeper into those subjects through more dependable and authoritative sources.

> "I use the internet but not social media so much. I would rather go to an established and trusted source. I would choose a website/company that I believe has integrity and will provide accurate and relevant information."

> "There is a lot of fake news and self proclaimed experts so Facts need to be checked and evidence based. SM is a great platform form for knowledge sharing and discussion"

Theme: Making connections:

Connectivity runs through the whole concept of HSLN, as it does through many other concepts such as Networked Learning (de Laat, 2006) and Connectivism (Strong & Hutchins, 2009). Within HSLN, individuals actively seek out various connections: some with their peers, others with experts, and some aspire to become part of a community. The respondents observed that establishing connections with their peers through social media played a pivotal role in enhancing their understanding, providing insights that would have been challenging to attain through traditional means alone.

> "Like to read blogs and opinions of others - peer learning is an important tool which I think is underused especially by the more newly qualified. I personally think it's ok to admit if I don't know an answer but most people struggle with that."

> "I follow experts and peers on social media, I enjoy reading articles they share and their thoughts and comments. I find new knowledge easier on social media than in traditional media for example, I don`t

receive professional journals at work and most articles online are behind a paid access wall."

"Networking and this last year social media posts have highlighted courses events that I would never have known about from other educational institutions or lecturers"

Using connections made in one network can lead to connections in other networks, thus extending the range of interactions.

"Twitter gives me the opportunity to engage with opinion formers and research leaders in the field in a way that I could not achieve otherwise. The international contacts I have made and the results we have achieved together have been stunning."

"I find being a member of Dental forums the best way of gaining knowledge about my profession as I can access information and opinions from peers and experts around the world."

The forming of communities through connections can reduce the feeling of isolation. The emergence of communities from the various forums the respondent accesses, creates a dynamic relationship which would be problematic if it wasn't for these virtual communities in which the respondent interacts.

"I find it excellent and has really helped in the isolation that you can feel as a dental hygienist"

"I'm very grateful for access to the internet at work to help with my learning needs. It enables me to connect with others in the profession, that I would not be able to do so as regularly."

> "I love my hygienist Facebook group - it's so informative, lots of expert advice as well as peer support, which in a lonely profession is invaluable."

Theme: Researching and updating knowledge:

Respondents emphasised their commitment to staying up to date with knowledge and advancements in their professional practice. The ability to access information almost instantly is deemed an invaluable resource, especially in cases where practitioners are unaware of the medications their patients are taking, or in the face of the vast number of conditions and medications in use, including their oral side effects. Traditionally, information and new research were confined to journals and libraries (Tait, Martzoukou, & Reid, 2016), with access limited to subscribers and library-goers. Academics played the role of gatekeepers, producing and disseminating knowledge. However, the advent of the Internet has revolutionised this landscape, with social media acting as a catalyst in disseminating knowledge widely. Knowledge is now pushed out to learners, rather than requiring them to seek it out actively.

This transformative shift empowers learners to take control of their own learning journey (Conradie, 2014). They can now develop their knowledge in a self-determined manner, accessing information precisely when and where it suits their needs, which it is suggested resides within the heutagogical paradigm (Blaschke & Hase, 2016). This newfound autonomy fuels a sense of ownership over their learning process, fostering a more engaged and proactive approach to professional development. With social media serving as a dynamic tool for knowledge-sharing, learners are no longer restricted by geographical boundaries or limited access to resources. Instead, they can tap into a vast network of information, drawing from a diverse array of perspectives and expertise.

> "I find new knowledge easier on social media than in traditional media"

> “Social media tends to be very informative and ahead of the game, comments from lots of people give plenty of thoughts and opinions on the subject matter.”

> “Helps you find information quickly and easily you may need for a specific patient if they have a problem you’ve not come across before.”

> “I use the internet daily for researching topics and for watching educational lectures and demonstrations on YouTube.”

> “I think that having social media forums for help, guidance and learning about new developments in dentistry is now becoming an essential everyday tool for improving knowledge. It is also helpful in providing information on new courses and training.”

Given the amount of digital information available, these professionals direct their learning in a heutagogical manner, developing their capability and sharing it with others(Hase & Kenyon, 2001, 2007).

> “We all have knowledge from our training and it's more keeping updated and being aware of changes”

> “I like the flexibility it gives me and the choices it gives me to Taylor my learning needs. Also the links to other websites and companies makes it easy to find what I’m looking for or tempt me to look at things I may not have thought of yet”

Theme: At a time and place to suit:

A considerable number of respondents acknowledged the convenience of online information, finding it immensely helpful in managing their work patterns and striking a balance between their home life and professional responsibilities. The accessibility of online resources offers them the flexibility to access information whenever and wherever it suits them, enabling them to optimise their time effectively and navigate the demands of their personal and work commitments with greater ease.

> "Without the use of social media, I wouldn't of known about the new classification. It's a great source of information. When you're working full time, run a house and have children social media is very helpful"

> "As a working mother its not always possible for me to take courses or attend study groups, i find social media and the internet invaluable as a source of i information and for learning"

> "I think information is in general easy to access. In a busy practice it helps to source this learning material away from valuable clinical time. I'd prefer to home study in my spare time than to lose a day's clinical time to take time out for a course during my working week."

Theme: Learning from courses and webinars:

According to the respondents, they utilised online courses and webinars as part of their learning journey, with varying reasons driving this choice. Some highlighted cost issues, as online options often prove more budget friendly. Others appreciated the convenience of not having to travel or take time away from their clinical practice, enabling them to seamlessly integrate learning into their busy schedules. The flexibility

to dip in and out of online courses as needed also appealed to participants, as it allowed them to tailor their learning experience to suit their individual requirements.

Participants further reported that access to face-to-face courses was limited due to geographical constraints or their demanding clinical settings. Additionally, being self-employed, they faced financial constraints, making the availability of online courses an attractive proposition. Embracing online learning became a practical and viable solution for these professionals, affording them the opportunity to enhance their knowledge and skills conveniently and efficiently.

> "I find these very helpful, the courses in my area are few and far between "

> "I live in a rural setting and so webinars are particularly useful. Preferably live but recordings are also helpful"

> "Sometimes it's the only access I have to subjects I wish to learn about due to cost and location restrictions of lectures/courses etc"

For some respondents, this learning approach aligns seamlessly with their preferred learning style, and they find it to be a perfect fit. The accessibility of online learning empowers them to incorporate it into their schedules, effortlessly blending it with the demands of their work and home life. The flexibility of learning at their own pace and in their chosen setting resonates with their individual preferences, making it a highly beneficial and convenient mode of learning.

> "Blended learning is the way forward especially bite sized chunks for on the go people."

> "I am a recent convert to webinairs and think them worthwhile particularly if the reference material can be accessed later"

Theme: Being able to discuss work-life:

The capacity to engage in discussions about various aspects of their work, including cases, materials, working practices, and even non-work-related matters, significantly contributes to why Dental Professionals find social media to be a valuable resource. These interactive exchanges enable them to gather and convert information, ultimately applying it to their professional practice, enriching their knowledge base, and enhancing the quality of care they provide.

> "Facebook forum for debate on the working with a nurse was a useful debate , although I didn't learn anything I was up to date in the professions point of view."

> "When new developments occur there is often discussions regarding this on different platforms of the internet which is extremely helpful."

> "We all need to keep updated with skills and learning. Hearing others discuss what they have been reading or studying does help prompt an interest and can spark a new train of thought if relevant. Other times not"

Theme: A part of work:

The Internet and Social Media have seamlessly integrated into our lives to the extent that their usage is often taken for granted. This phenomenon is equally evident in the healthcare industry, where they have become indispensable tools for staying up to date and facilitating routine practices. Their routine use has become an integral part of

healthcare, affirming their significance in ensuring practitioners remain informed and connected in their professional pursuits.

> "I think that having social media forums for help, guidance and learning about new developments in dentistry is now becoming an essential everyday tool for improving knowledge. "

5.5. Discussion

Dental professionals have effectively integrated social networks into their daily practice, as evident in numerous instances. They actively engage in researching information and proactively share their own expertise with others across various networks and communities they belong to. Through these interactions, they construct meaning and gain valuable insights from discussions with both peers and experts, ultimately applying this newfound knowledge to enhance their practice.

Moreover, forming connections extends beyond a mere quest for information; it also fulfils the vital need for a supportive network. Dental professionals often experience isolation within their professional spheres, making these connections invaluable in fostering a sense of belonging and camaraderie.

However, they remain mindful of the importance of validating the information or opinions they encounter, particularly due to the phenomenon of "Loud Voices" or influencers. Such influential figures can inadvertently disrupt the validity of information due to potential biases or lack of an evidence base. Xudong & Shahira (2011) explored the 'Spiral of Silence Theory', finding that "expressing online opinions is perceived to be another dimension of speaking out, and as accessibility of online opinions becomes far more extensive and immediate than opinions and

information presented by traditional media". The central assumption of this theory is that individuals who perceive their opinion to deviate from the norm may choose to stay quiet rather than challenge the dominant voice. The lack of challenge may however give more validity to the opinion, it may even be seen as lending support due to the lack of explicit challenge.

The respondents have reported that they actively research their learning, utilising information available and discussing their findings with peers and experts and thus learning at a deeper cognitive level via co-construction of knowledge. This self-determined learning practised by these dental professionals demonstrates a heutagogical learning approach (Blaschke, Kenyon, & Hase, 2014) reflecting on and questioning their learning. The learning they carry out, share, and discuss, bridges many networks both online and face-to-face, each personal network is different (Caldwell, Bilandzic, & Foth, 2012) there may, however, be intersections between the networks.

When we examine the emergent themes through the lens of complexity theory, the interactions and relationships between actors and resources are multi-faceted and contain paradoxes. It can be seen that there is an appreciation for the information and learning that takes place and yet there seems to be a trust issue in some of the opinions shared, this trust issue stems from the emergent phenomenon of "Loud Voices".

Respondents use the resources such as courses and webinars, however, for some, this is a compromise due to availability, time, convenience, or cost. As each platform is dynamic there is no one dominant system that satisfies all the needs. Each network has connections to other networks via actors or resources and each network expands and contracts due to seemingly minor changes. The users of these platforms are not only consumers of information they are also producers and co-producers of information and debate, the lifeblood of fora. The platforms also demonstrate a feedback mechanism, this can promote trust when debate and discussion are not stifled by dominant opinion, thus stimulating discussion and growth of a platform. However, there is not always a positive development, such as when discussions

contradict existing knowledge or become personal attacks, this can destabilise the community and the trust within it, resulting in its collapse.

The majority of learning taking place in these communities is situated in informal learning and in self-directed learning, however, online courses also have their place, which is situated towards the formal end of the informal/formal continuum. Learner autonomy seems to be a central theme in how the respondent conducts their learning and research guided by their emergent learning requirements.

The forthcoming chapter will merge the quantitative and qualitative findings to provide comprehensive answers to the research questions. By combining both types of data, a more holistic and nuanced understanding of the phenomena under investigation can be achieved. By combining quantitative and qualitative findings, researchers can overcome the limitations associated with each method individually and capitalise on the strengths of both approaches.

6. Integration of Findings

This chapter examines the previous two chapters' findings and relates the research outcomes to the research questions. The overarching theme of the enquiry is to establish the use of Informal Learning using Hybrid Social Learning Networks (HSLN) for Professional Development amongst Dental Professionals in the UK. As set out in the introduction to this research, a lens of complexity theory has been employed to uncover any underlying patterns.

6.1. How do Dental Professionals in the UK use Hybrid Social Learning Networks for their Professional Development? (RQ)

In the United Kingdom, dental professionals leverage hybrid social learning networks as a valuable tool for their professional development. These platforms combine the benefits of social networking with educational resources, creating an interactive and collaborative environment for learning. Dental professionals, utilise these networks to enhance their knowledge and skills in the field of dentistry.

The primary goal of these hybrid social learning networks is to facilitate knowledge sharing, promote continuous learning, and foster professional growth among dental professionals. Through these platforms, dental professionals can engage in various activities that contribute to their ongoing education. They can access a wide range of resources, such as e-learning modules, webinars, research articles, and case studies, all of which are tailored to their specific areas of interest and professional needs. They may interact face to face at meetings, conferences and courses and bring contributions from there to the virtual domain, thus linking in a hybrid manner.

One of the key features of these networks is the ability to connect and interact with peers and experts in the dental field. Dental professionals can join online communities, participate in discussion forums, and engage in group activities. These interactions allow them to share experiences, seek advice, and exchange best practices with colleagues from across the country and worldwide. By collaborating with other professionals, they can gain new insights, broaden their perspectives, and stay up to date with the latest advancements in dental practice. Much of which takes place at a time of their choosing in both synchronous and asynchronous discussions.

Furthermore, these hybrid social learning networks often offer opportunities for dental professionals to attend virtual conferences, workshops, and seminars. These events are conducted through webinars or live streaming platforms, enabling practitioners to access high-quality educational content without the need for physical attendance. By participating in these virtual events, dental professionals can learn from renowned speakers, explore emerging trends, and acquire new skills that are relevant to their practice. I would argue that Dental Professionals learning is intrinsically linked with work itself and not an activity that takes place in isolation, interacting with peers and experts and situated in practice, an idea that was posited by Goh & Lim (2022)

6.2. What, if any, are the differences in how Dentists and Dental Care Professionals use social media for professional use?

We know that Facebook is the most used form of social media (2.4 Figure 7) therefore a comparison was made between Dentists and DCPs in their professional use of Facebook. First between how often each group accessed professional-related content, which showed a statistically significant relationship in the variables. DCPs were more likely to access content daily (58.1%, n=161) and dentists were more likely not to access content at all (37.7%, n=29) Table 64.

		Total	Dentist	DCP
How often do you access professional-related content in the following social	Daily	193.0	32.0	161.0
		54.5%	41.6%	58.1%
				A
	Weekly	51.0	10.0	41.0
		14.4%	13.0%	14.8%

media sites? | Facebook	Monthly	16.0	4.0	12.0
		4.5%	5.2%	4.3%
	Less than monthly	15.0	2.0	13.0
		4.2%	2.6%	4.7%
	Never	79.0	29.0	50.0
		22.3%	37.7% B	18.1%
	Overall Stat Test of Percentages	< 0.1		

Table 64 - Access Professional-related Content on Facebook

Then a comparison was made between the two groups on how often they posted professional-related content on Facebook. This showed that there was a statistically significant relationship between the variables. 61% (n=47) of dentists reported that they never posted professionally related content on Facebook in comparison to 42.6% (n=118) of DCPs. Also 32.1% (n=89) of DCPs in comparison to 14.3% (n=11) of dentists posted less than monthly. When the two tables are compared the standout item is that both groups report accessing professional-related content daily 54.5% (n=193) overall, yet 46.6% (n=165) report never posting professional-related content on Facebook (Table 65).

		Total	Dentist	DCP
How often do you POST professional-related content in the following social media sites? | Facebook	Daily	14.0	3.0	11.0
		4.0%	3.9%	4.0%
	Weekly	44.0	14.0	30.0
		12.4%	18.2%	10.8%

Monthly	31.0	2.0	29.0
	8.8%	2.6%	10.5%
Less than monthly	100.0	11.0	89.0
	28.2%	14.3%	32.1% A
Never	165.0	47.0	118.0
	46.6%	61.0% B	42.6%
Overall Stat Test of Percentages	< 0.1		

Table 65 - Posting Professional-related Content on Facebook

Upon close examination of Table 66 below, a striking resemblance between the two groups becomes evident. The data reveals that much of their behaviour on social media aligns closely, with only a few notable statistically significant differences standing out (highlighted) between Dentists and DCPs.

One such significant difference is in the aspect of sharing items of interest on social media. A noteworthy 40.8% (n=31) of Dentists, compared to 27.3% (n=73) of DCPs, never indulge in sharing such items. This variance in sharing behaviour might be indicative of their distinct approaches to engaging with online content.

Another marked contrast emerges when it comes to discussing with peers on social media. A considerable 28.8% (n=19) of Dentists report that they never engage in peer discussions through social media channels, whereas this figure is notably lower at 13.1% (n=35) for DCPs. This disparity suggests that DCPs may be more inclined to participate in peer-driven discussions within their online communities.

Interestingly, DCPs display a greater propensity for seeking knowledge and support through social media. They are more likely to ask questions of peers and experts, with 12.9% (n=34) of DCPs always seeking advice from peers, and 10.4% (n=28) seeking guidance from experts. In contrast, only a mere 2.7% (n=2) of Dentists always turn to their peers, and a mere 1.4% (n=1) rely on experts for answers. This divergence in question-asking behaviour might suggest that DCPs place greater trust in the collective wisdom of their professional network.

Beyond these noteworthy differences, the overall similarity between the two groups is quite evident. This similarity may be attributed to the shared background and expertise within the dental profession. Both Dentists and DCPs navigate the realm of social media with a certain level of confidence, driven by their deep understanding of dental practices and experiences.

In conclusion, Table 66 presents a comprehensive snapshot of the behaviours of Dentists and DCPs on social media. While some statistically significant differences arise, showcasing distinct sharing and question-asking tendencies, the overarching similarity between the groups remains pronounced. Their shared professional background and confidence in their abilities contribute to these commonalities, culminating in a cohesive digital presence within the dental community.

Column1	Column2	Total	Dentist	DCP
I follow items of interest	Never	36	8	28
		10.40%	10.80%	10.30%
	Sometimes	121	25	96
		34.90%	33.80%	35.20%
	About half the time	37	8	29
		10.70%	10.80%	10.60%
	Most of the time	95	24	71
		27.40%	32.40%	26.00%
	Always	58	9	49
		16.70%	12.20%	17.90%
I search out items I am interested in	Never	16	3	13
		4.70%	4.10%	4.80%
	Sometimes	134	29	105
		39.10%	39.70%	38.90%
	About half the time	39	12	27
		11.40%	16.40%	10.00%
	Most of the time	91	19	72
		26.50%	26.00%	26.70%
	Always	63	10	53
		18.40%	13.70%	19.60%
I share items of interest	Never	104	31	73
		30.30%	40.80%	27.30%

	Sometimes	149	33	116
		43.40%	43.40%	43.40%
	About half the time	33	6	27
		9.60%	7.90%	10.10%
	Most of the time	37	5	32
		10.80%	6.60%	12.00%
	Always	20	1	19
		5.80%	1.30%	7.10%
I connect with those who are experts	Never	89	24	65
		26.30%	32.90%	24.50%
	Sometimes	145	33	112
		42.90%	45.20%	42.30%
	About half the time	31	6	25
		9.20%	8.20%	9.40%
	Most of the time	48	8	40
		14.20%	11.00%	15.10%
	Always	25	2	23
		7.40%	2.70%	8.70%
I discuss with my peers	Never	54	19	35
		15.90%	26.80%	13.10%
	Sometimes	145	30	115
		42.80%	42.30%	42.90%

	About half the time	41	9	32
		12.10%	12.70%	11.90%
	Most of the time	59	9	50
		17.40%	12.70%	18.70%
	Always	40	4	36
		11.80%	5.60%	13.40%
I ask questions of peers	Never	66	20	46
		19.50%	27.00%	17.40%
	Sometimes	161	39	122
		47.60%	52.70%	46.20%
	About half the time	28	4	24
		8.30%	5.40%	9.10%
	Most of the time	47	9	38
		13.90%	12.20%	14.40%
	Always	36	2	34
		10.70%	2.70%	12.90%
I ask questions of experts	Never	94	23	71
		27.60%	31.50%	26.50%
	Sometimes	158	40	118
		46.30%	54.80%	44.00%
	About half the time	30	4	26
		8.80%	5.50%	9.70%

	Most of the time	30	5	25
		8.80%	6.80%	9.30%
	Always	29	1	28
		8.50%	1.40%	10.40%

Table 66 - Comparison Between Dentists and DCP's Usage of Social Media

Section 4.5 Figure 60 and Table 46 showed that there was a statistically significant relationship between Dentists and DCPs whether they agreed that social media allowed them to collaborate with their peers. In their collaboration with experts, this was also reflected in Figure 62 and Table 48, in that the difference was statistically significant.

In conclusion, although there are not substantial variations between the two groups in their use of social media, differences do indeed exist, as evidenced by the data. Nevertheless, both groups demonstrate confidence in their ability to find the information they seek on the Internet (figure 23 & Table 9) and agree that cross-checking information is necessary (figure 24 & Table 10). An important consideration, however, is the issue of "Loud Voices" (Sections 5.4 & 5.5) where certain participants in social media discussions tend to assert their opinions vigorously. This phenomenon can impact how some individuals perceive social media and the credibility of the information it contains.

6.3. What, if any, is the effect of age on the use of social media?

Table 67 shows the comparison of age groups in their usage of social media, with the statistically significant results highlighted. The table presents the usage of social media across different age groups for various activities related to professional content, such as accessing, posting, sharing, connecting, discussing, and asking questions.

Accessing Professional Content on Facebook:

The highest percentage of daily access to professional content on Facebook is seen among the 30-45 age group (68.8%), followed by the over 60 age group (51.4%).

The under 30 age group has the lowest percentage of daily access (16.0%).

There is a statistically significant difference in the accessing frequency between age groups (p-value = 0.16).

Posting Professional Content on Facebook:

The over 60 age group has the highest percentage of daily posts (14.3%).

The under 30 age group has the lowest percentage of daily posts (0.0%).

There is a statistically significant difference in the posting frequency between age groups (p-value = 0.23).

Following Items of Interest:

The most common response across all age groups is "sometimes" (ranging from 31.3% to 34.9%).

The under 30 age group has the highest percentage of "always" (31.3%).

The over 60 age group has the lowest percentage of "always" (5.7%).

There are statistically significant differences in the following items of interest behaviour between age groups (e.g., under 30 vs. over 60, p-value = 0.10).

Searching Out Items of Interest:

The most common response across all age groups is "sometimes" (ranging from 32.1% to 48.6%).

The under 30 age group has the highest percentage of "always" (31.3%).

The over 60 age group has the lowest percentage of "always" (17.1%).

There are statistically significant differences in the searching out items of interest behaviour between age groups (e.g., under 30 vs. over 60, p-value = 0.05).

Sharing Items of Interest:

The most common response across all age groups is "sometimes" (ranging from 31.4% to 43.4%).

The under 30 age group has the highest percentage of "never" (50.0%).

The over 60 age group has the lowest percentage of "never" (28.6%).

There are statistically significant differences in the sharing items of interest behaviour between age groups (e.g., under 30 vs. over 60, p-value = 0.03).

Connecting with Experts:

The most common response across all age groups is "sometimes" (ranging from 41.7% to 44.1%).

The under 30 age group has the highest percentage of "never" (62.5%).

The over 60 age group has the lowest percentage of "never" (29.4%).

There are statistically significant differences in the connecting with experts behaviour between age groups (e.g., under 30 vs. over 60, p-value = 0.01).

Discussing with Peers:

The most common response across all age groups is "sometimes" (ranging from 34.6% to 50.0%).

The under 30 age group has the highest percentage of "always" (31.3%).

The over 60 age group has the lowest percentage of "always" (11.4%).

There are statistically significant differences in the discussing with peers behaviour between age groups (e.g., under 30 vs. over 60, p-value = 0.08).

Asking Questions of Experts:

The most common response across all age groups is "sometimes" (ranging from 33.2% to 52.1%).

The under 30 age group has the highest percentage of "always" (13.5%).

The over 60 age group has the lowest percentage of "always" (6.4%).

There are statistically significant differences in the behaviour of asking questions of experts between age groups (e.g., under 30 vs. over 60, p-value = 0.05).

Asking Questions of Peers:

The most common response across all age groups is "sometimes" (ranging from 37.1% to 53.4%).

The under 30 age group has the highest percentage of "always" (14.2%).

The over 60 age group has the lowest percentage of "always" (8.2%).

There are statistically significant differences in the behaviour of asking questions of peers between age groups (e.g., under 30 vs. over 60, p-value = 0.09).

Overall:

Overall, the majority of respondents from all age groups reported engaging with professional content on Facebook, with the highest engagement observed among users under 30. This younger age group displayed a higher tendency to always or to often interact with professional content, suggesting an active interest in seeking knowledge and professional development on the platform.

When it comes to connecting with experts, a significant portion of respondents across all age groups reported doing so, albeit with some variations. Users under 30 were more likely to connect with experts on Facebook compared to older age groups, indicating a stronger inclination to seek guidance from professionals in their respective fields.

The survey also examined the behaviour of asking questions, distinguishing between asking questions of experts and asking questions of peers. The findings showed that both types of questioning occurred across all age groups, but with varying levels of

frequency. Younger users were more inclined to frequently ask questions of both experts and peers, indicating a proactive approach to seeking advice and knowledge-sharing within their professional networks on Facebook. This may in part be due to the younger age group having less experience and doubting their knowledge or just less practical experience thus not encountering scenarios previously. The flip side of this is the older respondents who may not be asking question but may be answering them and sharing their experience and knowledge.

Age emerged as a differentiating factor in these behaviours, with statistically significant differences observed between age groups. The under 30 age group consistently demonstrated the highest engagement levels across all analysed aspects, while the over 60 age group exhibited relatively lower levels of interaction with professional content and fewer instances of connecting with experts or asking questions.

In summary, the survey highlights the prevalence of engaging with professional content on Facebook and the varying behaviours across different age groups. The results suggest that younger age groups (under 30) are more active in accessing and engaging with professional content on Facebook, while the older age groups (over 60) display higher interest in following relevant material. The findings may indicate a shift in behaviour based on generational preferences, with older individuals relying more on observing rather than actively participating in professional discussions on social media. This data sheds light on the patterns of accessing and engaging with professional content on Facebook among different age groups. The data highlights the diverse behaviours exhibited by respondents across age categories, providing valuable insights for businesses and marketers aiming to tailor their content and engagement strategies on social media platforms. Understanding these trends can lead to more effective and targeted approaches to cater to the needs and preferences of distinct age groups within the digital landscape. These findings emphasise the evolving role of social media as a platform for professional networking, knowledge sharing, and seeking guidance,

with age playing a role in these behaviours. However, these results need to be approached with caution due to the small number of respondents in the under 30 age group and the over 60 age group where it may only take a few respondents in either group to skew the figures.

	Total Count (Answering)	353	16	138	164	35
How often do you access professional related content in the following social media sites? | Facebook						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Daily	193	11	82	82	18
		54.70%	68.80%	59.40%	50.00%	51.40%
	Weekly	51	2	16	29	4
		14.40%	12.50%	11.60%	17.70%	11.40%
	Monthly	16	2	6	6	2
		4.50%	12.50%	4.30%	3.70%	5.70%
	Less than monthly	15	0	7	4	4
		4.20%	0.00%	5.10%	2.40%	11.40%
	Never	78	1	27	43	7
		22.10%	6.30%	19.60%	26.20%	20.00%
How often do you POST professional related content in the following social media sites? | Facebook						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Daily	14	0	5	4	5
		4.00%	0.00%	3.60%	2.40%	14.30%

	Weekly	44	1	16	21	6
		12.50%	6.30%	11.60%	12.80%	17.10%
	Monthly	31	1	13	14	3
		8.80%	6.30%	9.40%	8.50%	8.60%
	Less than monthly	100	4	43	46	7
		28.30%	25.00%	31.20%	28.00%	20.00%
	Never	164	10	61	79	14
		46.50%	62.50%	44.20%	48.20%	40.00%
I follow items of interest						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	36	4	11	19	2
		10.40%	25.00%	8.10%	11.90%	5.70%
	Sometimes	121	5	47	57	12
		34.90%	31.30%	34.60%	35.60%	34.30%
	About half the time	37	1	14	18	4
		10.70%	6.30%	10.30%	11.30%	11.40%
	Most of the time	95	1	37	46	11
		27.40%	6.30%	27.20%	28.80%	31.40%
	Always	58	5	27	20	6
		16.70%	31.30%	19.90%	12.50%	17.10%
I search out items I am interested in						
		Total	Under 30	30 - 45	46 - 60	Over 60

	Never	16	1	6	8	1
		4.70%	6.30%	4.60%	5.00%	2.90%
	Sometimes	134	7	42	68	17
		39.10%	43.80%	32.10%	42.20%	48.60%
	About half the time	39	1	19	16	3
		11.40%	6.30%	14.50%	9.90%	8.60%
	Most of the time	91	2	37	44	8
		26.50%	12.50%	28.20%	27.30%	22.90%
	Always	63	5	27	25	6
		18.40%	31.30%	20.60%	15.50%	17.10%
I share items of interest						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	104	8	35	51	10
		30.30%	50.00%	26.30%	32.10%	28.60%
	Sometimes	149	3	58	77	11
		43.40%	18.80%	43.60%	48.40%	31.40%
	About half the time	33	4	14	10	5
		9.60%	25.00%	10.50%	6.30%	14.30%
	Most of the time	37	1	14	17	5
		10.80%	6.30%	10.50%	10.70%	14.30%
	Always	20	0	12	4	4
		5.80%	0.00%	9.00%	2.50%	11.40%

I connect with those who are experts						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	89	10	24	45	10
		26.30%	62.50%	18.20%	28.80%	29.40%
	Sometimes	145	4	55	71	15
		42.90%	25.00%	41.70%	45.50%	44.10%
	About half the time	31	0	16	12	3
		9.20%	0.00%	12.10%	7.70%	8.80%
	Most of the time	48	2	24	21	1
		14.20%	12.50%	18.20%	13.50%	2.90%
	Always	25	0	13	7	5
		7.40%	0.00%	9.80%	4.50%	14.70%

I discuss with my peers						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	54	5	15	28	6
		15.90%	31.30%	11.30%	17.90%	17.60%
	Sometimes	145	7	46	78	14
		42.80%	43.80%	34.60%	50.00%	41.20%
	About half the time	41	1	18	16	6
		12.10%	6.30%	13.50%	10.30%	17.60%
	Most of the time	59	1	32	22	4
		17.40%	6.30%	24.10%	14.10%	11.80%
	Always	40	2	22	12	4

		11.80%	12.50%	16.50%	7.70%	11.80%
I ask questions of peers						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	66	4	21	36	5
		19.50%	25.00%	15.80%	23.20%	14.70%
	Sometimes	161	8	51	82	2 0.0
		47.60%	50.00%	38.30%	52.90%	58.80%
	About half the time	28	0	15	12	1
		8.30%	0.00%	11.30%	7.70%	2.90%
	Most of the time	47	2	28	13	4
		13.90%	12.50%	21.10%	8.40%	11.80%
	Always	36	2	18	12	4
		10.70%	12.50%	13.50%	7.70%	11.80%
I ask questions of experts						
		Total	Under 30	30 - 45	46 - 60	Over 60
	Never	94	7	30	47	10
		27.60%	43.80%	22.40%	29.90%	29.40%
	Sometimes	158	5	59	80	14
		46.30%	31.30%	44.00%	51.00%	41.20%
	About half the time	30	1	15	12	2
		8.80%	6.30%	11.20%	7.60%	5.90%
	Most of the time	30	2	15	9	4

		8.80%	12.50%	11.20%	5.70%	11.80%
	Always	29	1	15	9	4
		8.50%	6.30%	11.20%	5.70%	11.80%

Access Professional content Facebook		0.16
Post Professional content Facebook		0.23
(I follow items of interest)		0.37
(I search out items I am interested in)		0.66
(I share items of interest)		0.03
(I connect with those who are experts)		0.01
(I discuss with my peers)		0.04
(I ask questions of peers)		0.04
(I ask questions of experts)		0.38

Table 67: Comparison of Age Group Usage of Social Media

6.4. How does the Dental Professionals' use of social media for personal use affect professional use?

Table 55 in 4.7.2 shows a strong statistical relationship between those who access Facebook for personal use and those who access professional-related content on Facebook, this is further strengthened by the statistically significant relationship between the respondent's belief that technology will become more important in healthcare and their accessing professional-related content on Facebook (Table 56).

This would suggest that those who use social media for their personal use and so are comfortable with its use are more likely to use it in their professional domain and that this may also be affected by their belief that technology is becoming more important to them professionally. This was examined by tabulating the results of two questions in the survey. Participants were asked to indicate their agreement or disagreement with the statement "Technology will become more important in healthcare." Additionally, they were asked about their social media usage patterns regarding accessing professional content on Facebook. The data obtained from the survey responses were then tabulated and analysed (Table 68).

Of the total respondents, 321 individuals provided answers to the question about accessing professional-related content on Facebook. Among these respondents, 180 (56.1%) reported accessing such content on a daily basis, while 46 (14.3%) did so weekly, 12 (3.7%) accessed it monthly, another 12 (3.7%) accessed it less than monthly, and 71 (22.1%) reported never accessing professional-related content on Facebook.

In terms of agreement with the statement that technology will become more important in healthcare, the majority of respondents 285 (88.8%) agreed, while 29 (9.0%) neither agreed nor disagreed, and only 7 (2.2%) disagreed.

The findings indicate that healthcare professionals perceive technology as increasingly important in the healthcare sector. The overwhelming majority (88.8%) of respondents agreed with this viewpoint, suggesting a widespread recognition of technology's potential to positively impact healthcare delivery.

The results related to accessing professional-related content on Facebook reveal interesting patterns. A significant proportion (56.1%) of respondents reported accessing such content on a daily basis, indicating a high reliance on Facebook as a platform for professional information sharing. This finding highlights the role of social media, particularly Facebook, as a valuable resource for healthcare professionals to access relevant content, stay updated on industry developments, and engage with

their peers. Indicating a self-organising behaviour among healthcare professionals to seek and share information through this platform. This emergent behaviour demonstrates the adaptive nature of the healthcare system, where professionals utilise social media as a tool to stay informed, connect with peers, and navigate the complexity of their practice.

While the majority of respondents reported regular access to professional-related content, a non-negligible percentage (22.1%) indicated that they never accessed such content on Facebook. This variability in usage patterns reflects the complex nature of individual decision-making within a networked system. Factors such as information preferences, concerns about data privacy, or alternative sources of professional content may influence these diverse behaviours, highlighting the need for a nuanced understanding of the system dynamics.

Complexity theory emphasises the interconnectedness, nonlinearity, and adaptive nature of complex systems. This perspective acknowledges that the interactions between technological advancements, healthcare professionals, patients, and social systems can result in emergent behaviours and outcomes that are challenging to predict or control.

The analysis highlights the increasing importance of technology in healthcare, as evidenced by the strong agreement among healthcare professionals. Additionally, it underscores the prevalence of social media, particularly Facebook, as a platform for accessing professional-related content in the healthcare domain. These findings have implications for healthcare organisations and policymakers, emphasising the need to harness technology effectively and support the integration of social media platforms in the professional lives of healthcare professionals. Future studies could delve deeper into the factors driving the different usage patterns and attitudes towards technology and social media in healthcare, aiding the development of strategies to maximise their benefits in the industry.

		Technology will become more important in healthcare			
		Total	agree	neither	disagree
How often do you access professional related content in the following social media sites? | Facebook	Total Count (Answering)	321.0	285.0	29.0	7.0
	Daily	180.0	166.0	10.0	4.0
		56.1%	58.2% B	34.5%	57.1%
	Weekly	46.0	43.0	3.0	0.0
		14.3%	15.1%	10.3%	0.0%
	Monthly	12.0	9.0	2.0	1.0
		3.7%	3.2%	6.9%	14.3%
	Less than monthly	12.0	8.0	4.0	0.0
		3.7%	2.8%	13.8% A	0.0%
	Never	71.0	59.0	10.0	2.0
		22.1%	20.7%	34.5%	28.6%
	Overall Stat Test of Percentages	0.02			

Table 68:Relationship Between Accessing Professional-related Content on Facebook and the Belief that Technology Will Become More Important in Healthcare

6.5. How do Dental Professionals prefer to determine their learning needs?

Each of the next three tables and figures grouped the outputs from strongly agree and agree into one, the same was done with strongly disagree and disagree.

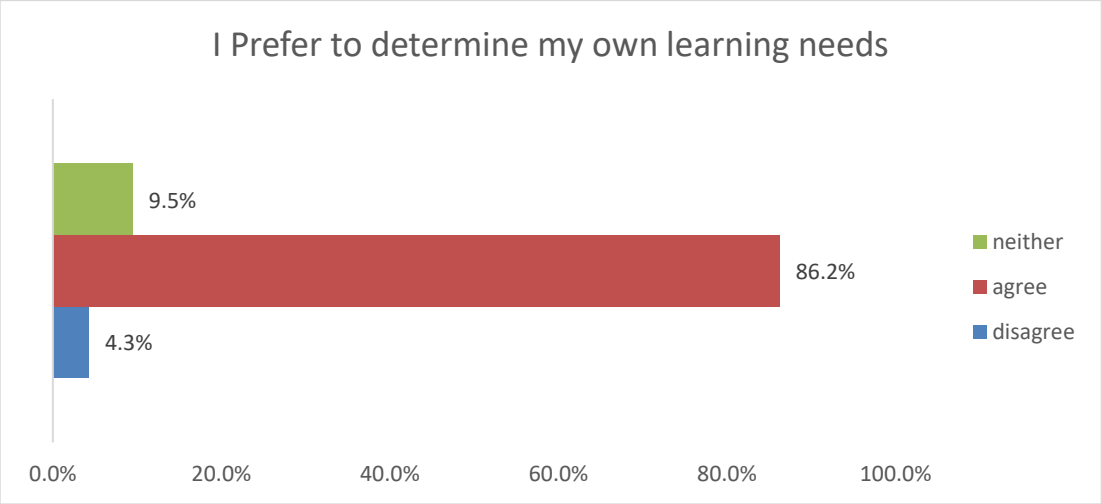


Figure 69 - Preference to Determine Own Learning Needs

I prefer to determine my own learning needs		
	Count	Percentage
disagree	14	4.3%
agree	282	86.2%
neither	31	9.5%

Table 69:Preference to Determine Own Learning Needs

The Table 69 & Figure 69 presents the results of a question conducted to determine the extent to which individuals agree or disagree with the statement "I prefer to determine my own learning needs.

In total, there were 327 responses to the question. The majority of respondents (86.2%) agree that they prefer to determine their own learning needs. This high level of agreement suggests a shared belief among the surveyed individuals regarding the importance of personal autonomy in shaping their learning journey. This emergent

behaviour indicates a degree of coherence within the professional community, potentially influenced by the recognition of the value of self-directed learning and individual agency.

In contrast, a small minority of respondents (14 respondents, or 4.3%) disagreed with the statement, indicating a preference for being guided in their learning process by external sources. This may suggest that some individuals may feel more comfortable with a more structured approach to learning and prefer to have more guidance.

A further 31 respondents (9.5%) selected the option "neither" which suggests that they do not strongly agree or disagree with the statement. It is possible that these individuals have not given much thought to their preferred learning style or may have mixed feelings about the topic.

Overall, the table provides insight into the attitudes and preferences of individuals towards self-directed learning. The high percentage of respondents who agreed with the statement highlights the importance of providing opportunities for individuals to take ownership of their learning process, while the minority who disagreed indicated the need to provide guidance and support for those who prefer a more structured approach to learning.

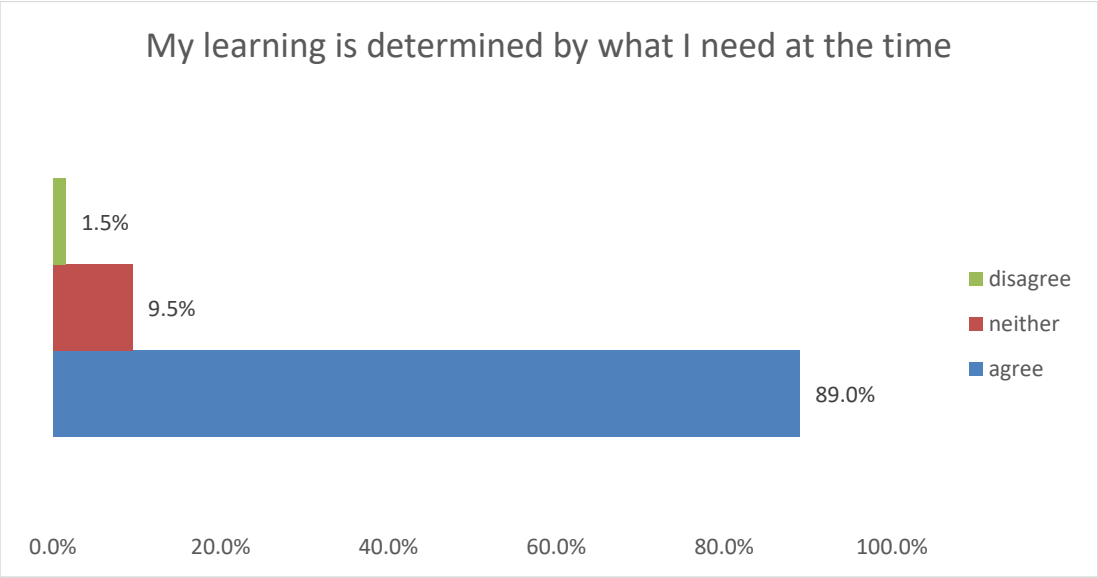


Figure 70 - Learning Determined by Need at the Time

My learning is determined by what I need to know at that particular time		
	Count	Percentage
agree	291	89.0%
neither	31	9.5%
disagree	5	1.5%

Table 70: Learning Determined by Need at the Time

The majority of respondents (89.0%) agree that their learning is determined by what they need to know at a particular time (Figure 70 & Table 70). This high level of agreement suggests a shared belief among the surveyed individuals regarding the importance of contextual relevance in shaping their learning. This emergent behaviour indicates a degree of coherence within the professional community, potentially influenced by the recognition of the practicality and efficiency of focusing on current learning needs.

While the majority agrees with the statement, a small percentage of respondents neither agree nor disagree (9.5%) or disagree (1.5%). These variations could be

influenced by individual differences, contextual factors, or specific circumstances faced by certain professionals.

The agreement among respondents suggests a positive feedback loop, where professionals who align their learning with their current needs may experience positive outcomes, further strengthening their belief in the importance of contextual learning. Conversely, those who disagree or remain uncertain may lack positive feedback and may not fully recognise the value of tailoring their learning to specific needs.

This finding could have important implications for educators and instructional designers, who may need to consider more flexible and adaptable approaches to teaching and learning that can accommodate learners' changing needs and priorities. Additionally, the relatively low percentage of respondents who neither agree nor disagree with the statement suggests that individuals may have a relatively clear consensus about the importance of flexible, need-based learning.

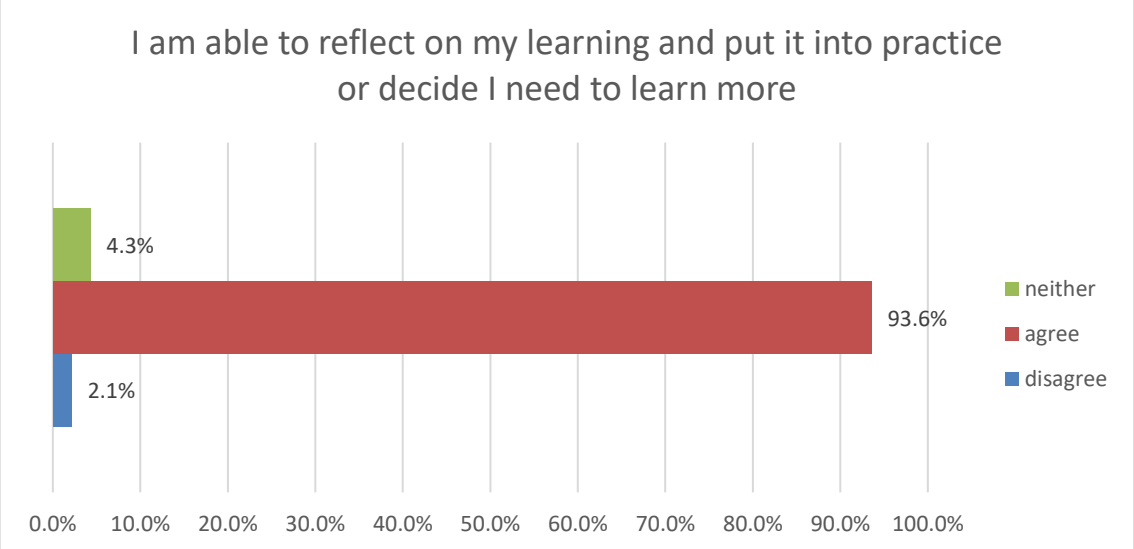


Figure 71 - I am able to reflect on my learning and put it into practice or decide I need to learn more.

I am able to reflect on my learning and put it into practice or decide I need to learn more		
	Count	Percentage
disagree	7	2.1%
agree	305	93.6%
neither	14	4.3%

Table 71:I am able to reflect on my learning and put it into practice or decide I need to learn more.

The overwhelming majority of respondents (93.6%) agree that they are able to reflect on their learning and put it into practice or recognise the need for further learning (Table 71 & Figure 71). This level of consensus suggests a shared understanding among dental professionals regarding the importance of self-reflection and continual learning in their practice. This emergent behaviour indicates a degree of consistency within the professional community, potentially driven by shared experiences, educational practices, or professional standards.

However, while the majority agrees with the statement, it is important to note the small percentage of respondents who disagree (2.1%) or neither agree nor disagree (4.3%). These variations could be attributed to individual differences, contextual factors, or specific challenges faced by certain professionals. Complexity theory emphasises the influence of various factors, such as personal experiences, work environments, or educational backgrounds, which can shape the perceptions and behaviours of individuals within a system.

Complexity theory recognises the presence of feedback loops that shape the behaviour of a system. In this survey, the responses provide feedback to the dental professionals themselves, reinforcing their beliefs and behaviours related to learning. The strong agreement among respondents suggests a positive feedback loop, where professionals who reflect on their learning and put it into practice may experience positive outcomes, further reinforcing their belief in the importance of continual learning. Conversely, those who disagree or remain uncertain may lack positive feedback and may not fully recognise the value of reflection and learning in their professional development.

The data shows that the majority of Dental Professionals agree that they are the best person to determine their learning needs. Although section 4.3 shows some variation between the two groups and between age groups, there was not found to be a variance of statistical significance. The agreement in each of these tables above shows that 86 – 93 % either strongly agreed or agreed with the statements. This intentional self-directed learning I would argue resides within heutagogy, with the learner using their own experiences to develop their skills and practices (Blaschke, 2012; Hase & Kenyon, 2000) This self-directed learning runs counter to the professional development arrangements currently enforced upon Dental Professionals, which encourages a reductionist view of professional development (Boud & Hager, 2011)and does not sit well with the concept of professional autonomy.

6.6. How do Dental Professionals collaborate with others in their learning?

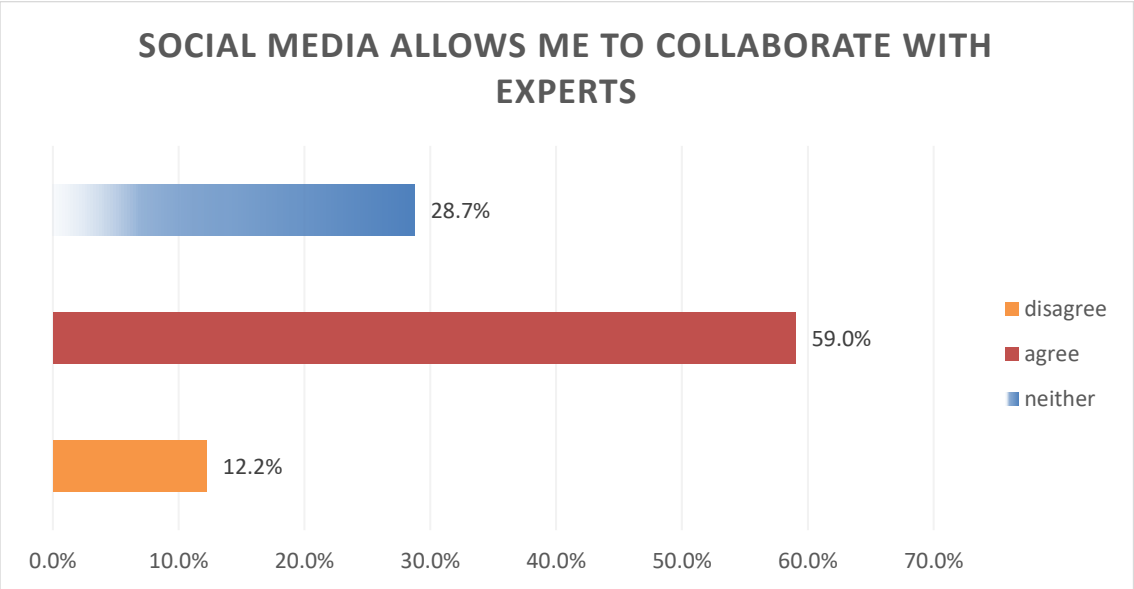


Figure 72 - Social media allows me to collaborate with experts.

Social media allows me to collaborate with experts			
	Count		Percentage
disagree	40	disagree	12.2%
agree	193	agree	59.0%
neither	94	neither	28.7%

Table 72: Social media allows me to collaborate with experts.

Table 72 and Figure 72 presents responses categorised into three options: "disagree," "agree," and "neither." The respondents' responses were bucketed with Strongly Agree and Somewhat Agree into the Agree group, the same was done with the Strongly Disagree and Somewhat Disagree bucketed into the Disagree group.

The majority of respondents (59.0%) agreed that social media allows them to collaborate with experts. This suggests that a significant portion of the surveyed population perceives social media as a valuable platform for engaging with experts and potentially fostering collaborative relationships. It implies that they likely find social media platforms effective in connecting with professionals and accessing their expertise.

On the other hand, a notable proportion of respondents (12.2%) disagreed with the statement, indicating that they do not believe social media enables effective collaboration with experts. Their disagreement might stem from various factors such as concerns over the authenticity of information on social media, a preference for more traditional forms of collaboration, or limited personal experiences with successful collaborations on social media platforms.

The remaining respondents (28.7%) neither agreed nor disagreed, suggesting a level of uncertainty or neutrality regarding the statement. This group may include individuals who have limited experience with social media collaboration or those who are undecided about its effectiveness for engaging with experts.

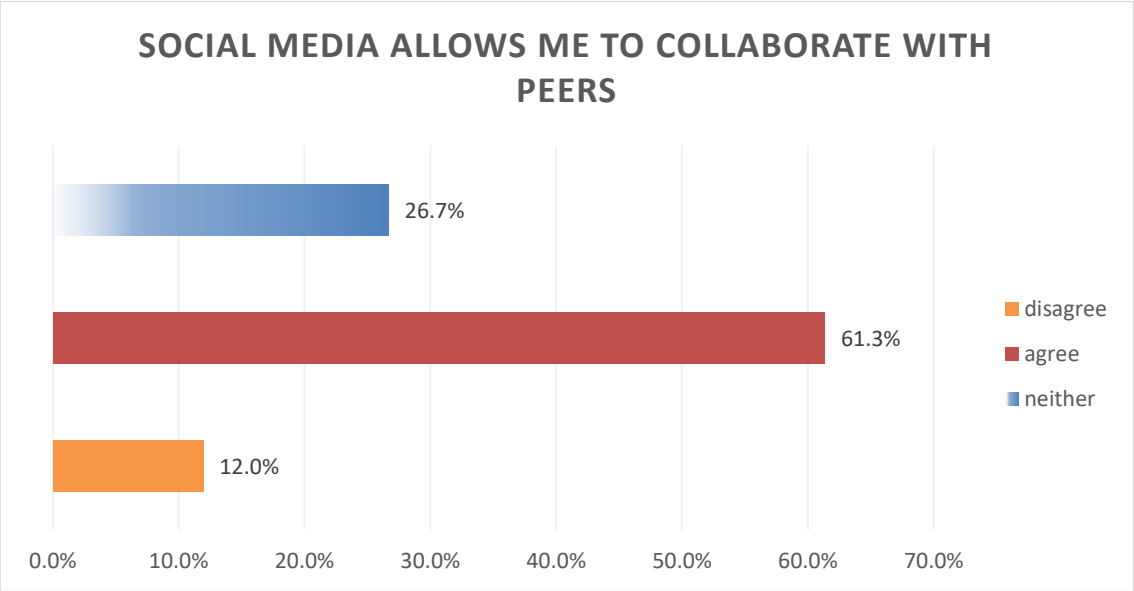


Figure 73 - Social media allows me to collaborate with peers.

Social media allows me to collaborate with peers			
	Count		Percentage
disagree	39	disagree	12.0%
agree	200	agree	61.3%
neither	87	neither	26.7%

Table 73: Social media allows me to collaborate with peers.

Table 73 and Figure 73, presents data on the opinions of dental professionals regarding the use of social media for collaboration with peers. The respondents' responses were bucketed with Strongly Agree and Somewhat Agree into the Agree group, the same was done with the Strongly Disagree and Somewhat Disagree bucketed into the Disagree group.

According to the data, 39 dental professionals (12.0% of the total) disagreed with the statement that social media allows them to collaborate with peers. This suggests that a minority of dental professionals are sceptical or do not find social media platforms useful for collaborating with their colleagues. The reasons for disagreement could vary, such as concerns about privacy, lack of trust in online platforms, or preference for more traditional methods of collaboration.

The majority of dental professionals, with 200 individuals (61.3% of the total), expressed agreement with the statement that social media enables collaboration with peers. This indicates that a significant proportion of dental professionals see value in using social media platforms for collaboration purposes. They likely appreciate the convenience, ease of communication, and access to a larger network of peers that social media can provide.

The "neither" category indicates that 87 dental professionals (26.7% of the total) did not strongly agree or disagree with the statement. This group may have mixed feelings about using social media for collaboration or may not have enough experience or knowledge about its potential benefits. It could also suggest that they have not actively explored social media platforms for professional collaboration purposes.

Overall, it appears that a majority of dental professionals in the surveyed group find social media beneficial for collaborating with their peers. However, it's important to note that this data represents a specific sample and may not be reflective of the entire population of dental professionals. Individual preferences and experiences may vary, and additional research would be necessary to gain a broader understanding of professionals' attitudes towards social media in the dental field.

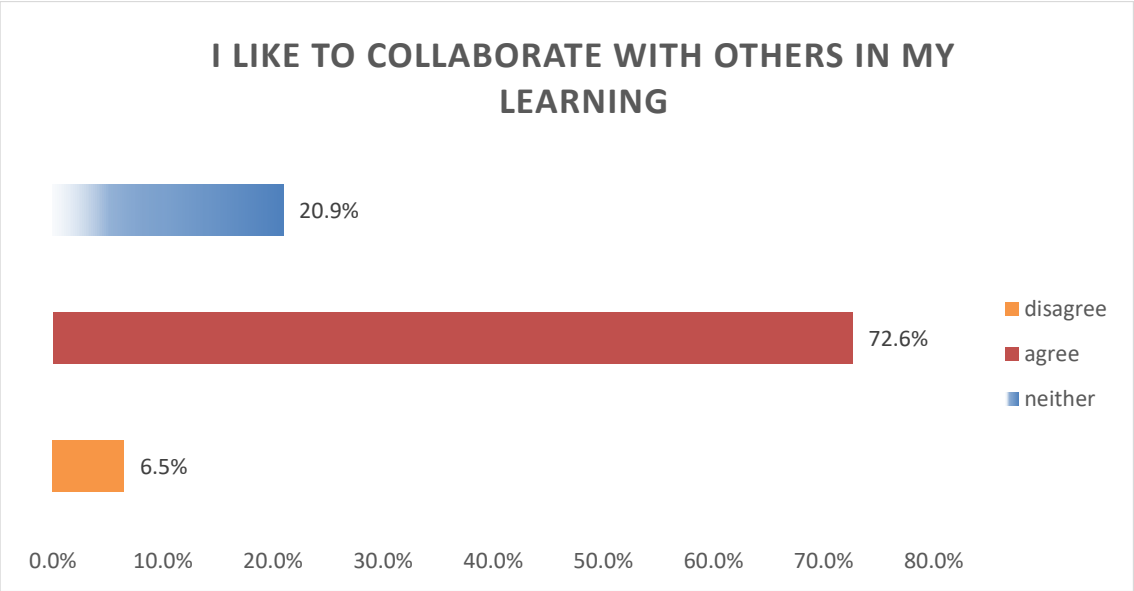


Figure 74 - I like to collaborate with others in my learning.

I like to collaborate with others in my learning			
	Count		Percentage
disagree	21	disagree	6.5%
agree	236	agree	72.6%
neither	68	neither	20.9%

Table 74: I like to collaborate with others in my learning.

According to the data (Figure 74, Table 74), 236 dental professionals (72.6%) agreed that they like to collaborate with others in their learning. This indicates a significant majority of respondents favour collaboration as a learning approach. Collaborative learning can be beneficial in the dental profession as it allows professionals to share knowledge, experiences, and best practices, leading to enhanced learning outcomes and improved patient care.

On the other hand, 21 dental professionals (6.5%) disagreed with the statement, expressing a preference for independent learning. While this is a relatively small percentage, it is important to recognise that some individuals may have different learning preferences or may value individual autonomy in their learning process. It is

essential to respect and accommodate diverse learning styles within the dental profession.

The "neither" category consists of 68 dental professionals (20.9%) who neither agree nor disagree with the statement. This could suggest that they may have mixed feelings or are uncertain about their preference for collaboration in learning. Further exploration or clarification may be needed to better understand their perspectives and motivations.

Overall, the survey results demonstrate that the majority of dental professionals possess a positive inclination towards collaboration in their learning. This finding is encouraging as collaboration fosters a sense of community, facilitates knowledge sharing, and promotes professional growth within the dental field. Moreover, the survey findings indicate that social media and other forms of collaboration, such as forums and face-to-face networking, play a significant role in connecting dental professionals with peers and experts alike. The qualitative responses provided in section 5.3 provide additional insights into the benefits of collaboration, highlighting specific instances where dental professionals have gained valuable knowledge through collaboration.

> “Questioned peers about the latest and best treatment for erosive lichen planus. Learnt 2 new things 1) Often associated with Crohns or other digestive disorders 2) Gengigel is found to be helpful by patients”

> “Constantly learning from others experiences over a wide range of things. From MH, where to get instruments sharpened, new products used & employment/self employment issues. Too many things to list.”

> “There is a dentist forum online where we discuss cases and treatment plans. This is a great learning tool especially for complex cases which are discussed also by specialists”.

The survey findings and the qualitative responses suggest that collaboration is a valuable learning approach for dental professionals. Collaboration can help to promote a sense of community, facilitate knowledge sharing, and promote professional growth. It is important to provide a range of learning opportunities that cater to diverse needs and learning styles, including opportunities for collaboration.

Furthermore, a report commissioned by the GDC reveals that participants in their study “viewed the “demise” of peer review as an unintended consequence of the Enhanced CPD schemes’ removal of non-verifiable (informal learning) CPD” (Bullock, Barnes, Jones, Bartlett, & Russ, 2023). This finding further emphasises the value of collaboration and informal learning opportunities for dental professionals.

In conclusion, the survey findings, along with the qualitative responses and the report commissioned by the GDC, all point towards the significance of collaboration as a valuable learning approach for dental professionals. It is essential to offer diverse learning opportunities that cater to individual needs and preferences, ensuring that collaboration remains an integral part of the dental profession's continuous development.

6.7. What forms of networking do Dental Professionals use for their learning?

	Conferences	Study Groups	Training Days	Courses (lectures)	Courses (hands-on)	Other
A great deal	10.3%	2.4%	8.0%	14.2%	5.7%	3.6%
A lot	10.9%	6.5%	18.3%	20.4%	10.1%	5.4%
A moderate amount	32.8%	15.7%	42.8%	42.6%	28.7%	18.7%
A little	37.0%	34.6%	27.1%	21.6%	40.6%	31.7%
None at all	9.1%	40.8%	3.8%	1.2%	14.9%	40.6%

Table 75: Educational Activities.

Table 75 represents the responses of dental professionals regarding their engagement in different types of educational activities, such as conferences, study groups, training days, courses (lectures), courses (hands-on), and other forms of professional development.

Conferences: The majority of dental professionals (37.0%) reported attending conferences to a little extent, followed by a moderate amount (32.8%), a lot (10.9%), a great deal (10.3%), and finally, none at all (9.1%). This suggests that while a significant portion of dental professionals do attend conferences, there is still a notable percentage who do not participate in this type of educational event.

Study Groups: The highest percentage of respondents (40.8%) indicated that they do not participate in study groups at all. This is followed by a little (34.6%), a moderate

amount (15.7%), a lot (6.5%), and a great deal (2.4%). It appears that study groups are not widely utilised by dental professionals, with a significant number opting not to engage in this form of collaborative learning.

Training Days: The data shows that the majority of dental professionals (42.8%) reported engaging in training days to a moderate amount. This is followed by a lot (18.3%), a little (27.1%), a great deal (8.0%), and none at all (3.8%). This indicates that training days are quite popular among dental professionals, with a substantial proportion of respondents dedicating a moderate amount of their time to this form of professional development.

Courses (Lectures): The largest proportion of respondents (42.6%) reported attending courses in the form of lectures to a moderate amount. This is followed by a lot (20.4%), a little (21.6%), a great deal (14.2%), and none at all (1.2%). It is noteworthy that a relatively small percentage of dental professionals reported not attending any lecture-based courses, suggesting that this form of education is generally valued by the majority.

Courses (Hands-On): The data reveals that courses with hands-on components are primarily attended to a moderate amount (28.7%) and a little (40.6%). The remaining responses include a lot (10.1%), a great deal (5.7%), and none at all (14.9%). This suggests that hands-on courses are popular among dental professionals, with a significant proportion participating to some extent, particularly to a little extent.

Other: The "Other" category includes additional forms of professional development beyond the specified options. The highest percentage of respondents (40.6%) reported not engaging in any other form of educational activities. This is followed by a moderate amount (18.7%), a little (31.7%), a lot (5.4%), and a great deal (3.6%). The lack of participation in other forms of professional development suggests that dental

professionals may not actively seek out alternative avenues for learning beyond the conventional options provided.

Overall, the table provides insights into the educational preferences and engagement of dental professionals in various activities. It reveals that dental professionals tend to participate in training days, lecture-based courses, and hands-on courses to a moderate extent. Conversely, study groups and conferences do not appear to be as widely utilised, with a significant number of respondents indicating limited or no involvement in these activities. The data underscores the importance of considering diverse educational approaches to cater to the varying preferences and needs of dental professionals.

This data shows that the respondents use a variety of social networking for their learning thus developing their Hybrid Social Learning Networks (Thorpe & Gordon, 2012), this is confirmed by comments in the open questions (5.4) such as:

> "I am a member of as many groups as I can be to get a wide range of opinions and information. It has vastly contributed to my knowledge in a way I don't think would have been possible 20 years ago"

> "I would be at a significant disadvantage without social media and access to the internet. It is essential for a clinician to keep up to date, with current trends thoughts and research"

The dental professionals' responses show that they develop their learning in a Heutagogical manner (Hase & Kenyon, 2000), taking control of the subject and how they learn, be it social media, courses, lectures etc. Each dental professional will be different in the way they develop their learning networks rather than a one size fits all, as each has varying needs which can change. This complexity does not work well for learning establishments which tend to have planning needs and therefore not as adaptable.

6.8. What do Dental Professionals learn or share in their social networks?

Figure 75 - Word Cloud- Learnt or Shared.

A word cloud was produced from the open questions (Figure 75), filtered to remove standard words which did not have relevance to learning. Word clouds increase the font size of the word depending on the number of occurrences of that word in the text analysed. From this, it can be seen that the word 'new' was the most mentioned (93 times), and the least number of mentions was filtered at the level of 16 mentions, which included the words 'work' and 'working'. Many of the words were linked together such as 'new information', 'new courses', and 'new knowledge'.

It can be seen, however, that information is shared, in best practice, available courses, guidelines and research. From the responses to the qualitative questions, it may be seen that the respondents found this sharing useful on many levels, whether it be with experts or peers. For example:

> "I have learnt about more complex medical histories and their complexities within dental treatments."

This emerging form of learning is deeply embedded within the heutagogical framework (Blaschke & Hase, 2016), enabling dental professionals to continually accumulate learning experiences in response to the rapidly evolving nature of their workplace. In today's dynamic environment, dental professionals, like many other professionals, are expected to embrace lifelong learning. While this expectation arises partly from regulatory requirements, it primarily stems from the recognition that they operate within an ever-changing field.

Traditionally, post-graduate education has been delivered through established education providers. However, many dental professionals face challenges when attempting to participate in such programs. Time constraints and the need to balance work responsibilities often make it difficult for them to take extended periods away from their practice. Moreover, geographical limitations and the necessity to travel long distances to attend courses further compound the issue. Consequently, the demand for learning in this context is immediate and context specific. Dental professionals require prompt answers and solutions to address their evolving challenges. Each experience they encounter is unique to their circumstances, necessitating a non-linear and reflective approach to learning.

This emphasis on just-in-time learning places limitations on traditional learning providers, who often face difficulties in accommodating the rapidly changing needs of learners. Due to the nature of their course planning process, which typically involves scheduling well in advance, they are constrained in their ability to be responsive to the dynamic requirements of dental professionals. As a result, there exists a mismatch between the immediate learning needs of professionals and the relatively rigid timelines of educational institutions.

Moreover, this emergent form of learning finds its foundation within Communities of Practice (CoPs) (Lave, 1991), where the three essential elements of a CoP—Domain, Community, and Practice—are present. Within these communities, dental

professionals establish their professional identity (Domain), foster relationships and engage in meaningful interactions with their peers (Community), and collectively contribute to the advancement of their field (Practice) Figure 76. CoPs provide a rich social context for learning, as professionals collaborate, share knowledge, and collectively make a difference in their respective practices.

By situating learning within the heutagogical framework and CoPs, dental professionals can leverage the flexibility and contextual relevance that these approaches offer. This empowers them to engage in lifelong learning that is responsive to their immediate needs, reflective, and tailored to their unique experiences. By actively participating in Communities of Practice, dental professionals can tap into the collective wisdom and expertise of their peers, contributing to their professional growth and the continuous improvement of dental practice as a whole.

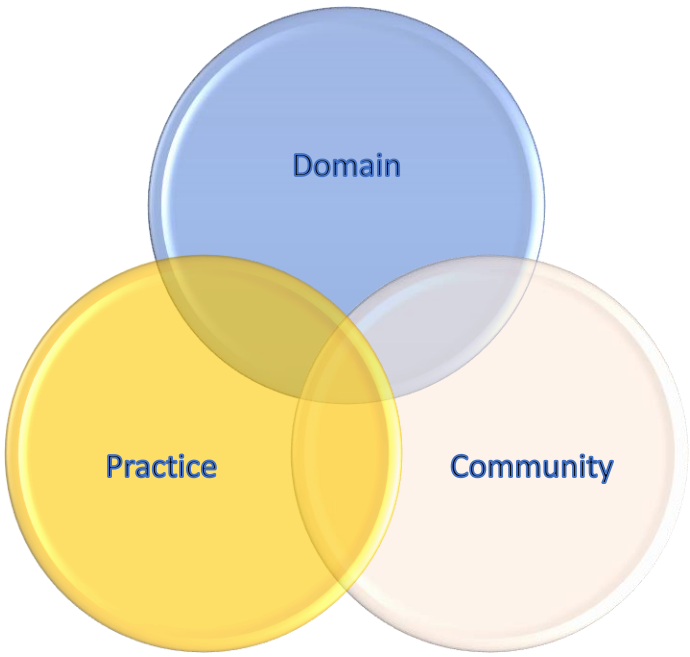


Figure 76 - Community of Practice (Lave, 1991)

The Connections between Heutagogy and Communities of Practice:

Learner Autonomy: Both heutagogy and communities of practice emphasise the importance of learner autonomy. In heutagogy, learners take ownership of their learning and are actively involved in setting goals, choosing learning strategies, and evaluating their progress. Similarly, communities of practice foster self-directed learning, where participants have the autonomy to contribute, explore, and shape their learning experiences within the community.

Social Interaction: Both heutagogy and communities of practice recognise the significance of social interaction in the learning process. Heutagogy encourages learners to engage in collaborative activities, seek feedback, and learn from others through social interactions. Communities of practice inherently involve social interactions as members share their knowledge, provide mentorship, and engage in joint problem-solving, resulting in collective learning.

Contextual Learning: Both concepts highlight the importance of learning in authentic and contextualised environments. Heutagogy promotes real-world, problem-based learning experiences that are relevant to learners' goals and interests. Communities of practice create a social context where learning occurs within the community's domain, allowing members to develop situated knowledge and engage in practical learning experiences.

Knowledge Co-creation: Both heutagogy and communities of practice emphasise the co-creation of knowledge. In heutagogy, learners actively participate in constructing their knowledge through exploration, reflection, and collaboration. Communities of practice foster collective knowledge creation as members share their expertise, experiences, and perspectives, leading to the development of a shared repertoire of knowledge within the community.

6.9. What are the opinions of Dental professionals on the use of social networks and the Internet for professional development?

The opinions of dental professionals on the use of social networks and the Internet for professional development may vary, depending on factors such as the individual dental professional's level of comfort with technology and their willingness to engage in online learning.

Some dental professionals may view social networks and the Internet as valuable resources for professional development. They may see the benefits of using online platforms to connect with peers, share knowledge, and access continuing education resources. They may also appreciate the convenience and flexibility of online learning, which allows them to continue their education at their own pace and on their own schedule.

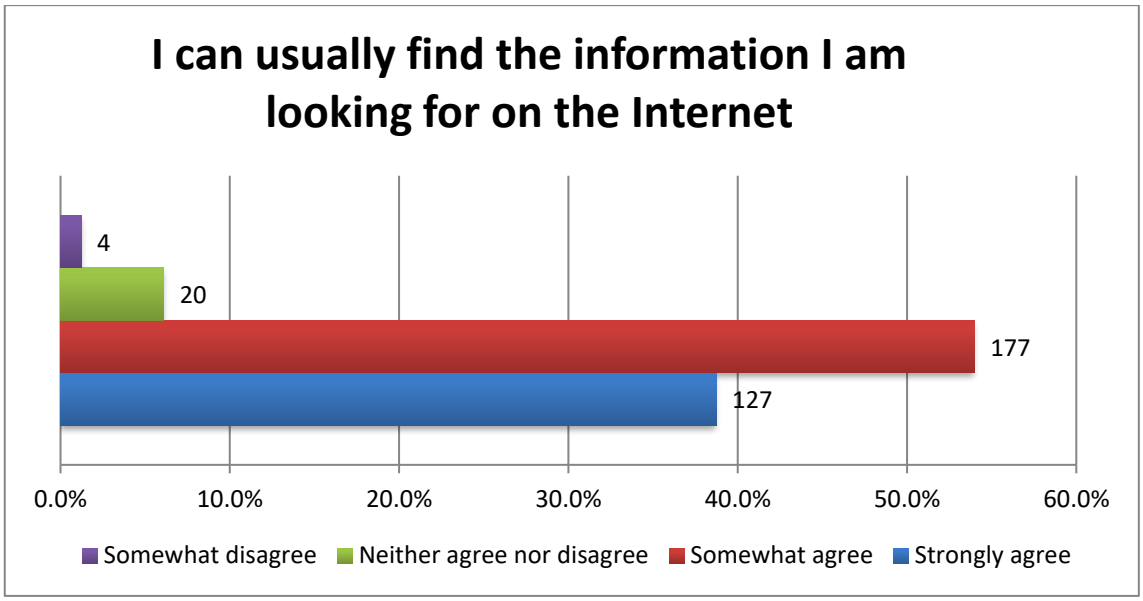


Figure 77 - I Can Usually Find the Information I am Looking for on the Internet.

I can usually find the information I am looking for on the internet	Count	Percent of Data	Confidence Interval (Percent of Data)
Strongly agree	127	38.7%	33.6% to 44.1%
Somewhat agree	177	54.0%	48.6% to 59.3%
Neither agree nor disagree	20	6.1%	4.0% to 9.2%
Somewhat disagree	4	1.2%	0.5% to 3.1%

Table 76 - I Can Usually Find the Information I am Looking for on the Internet.

From the Table 76 & Figure 77, we can observe the following:

- Strongly agree: The table shows that 127 respondents (38.7% of the total) strongly agree that they can usually find the information they are looking for on the internet. This indicates that there is a reasonable level of confidence in the percentage of people who strongly agree.

- Somewhat agree: The data reveals that 177 respondents (54.0% of the total) somewhat agree with the statement. It suggests that a majority of respondents tend to agree, albeit with less certainty compared to the "strongly agree" category.
- Neither agree nor disagree: The table indicates that 20 respondents (6.1% of the total) neither agree nor disagree with the statement. This suggests that a small portion of respondents have a neutral stance on their ability to find information on the internet.
- Somewhat disagree: The findings show that only 4 respondents (1.2% of the total) somewhat disagree that they can find the information they need on the internet. This indicates that a very small percentage of respondents hold a negative view of their ability to find desired information online.

Overall, the findings suggest that a majority of the participants in the study have a positive perception of their ability to find information on the internet. This aligns with the commonly held notion that the internet is a valuable and effective resource for accessing information.

On the other hand, some dental professionals may be hesitant to use social networks and the Internet for professional development. They may be concerned about the quality and reliability of the information available online, or they may be uncomfortable with the idea of learning through online platforms. They may also have concerns about data security and privacy when using online resources.

Additionally, some dental professionals may have concerns about the potential negative effects of social networks and internet use on professional development.

They may worry that the use of social networks and the internet can lead to distraction, procrastination, and an overall reduction in the effectiveness of learning.

In general, the use of social networks and the Internet for professional development is a complex issue and opinions of dental professionals on the subject may vary widely. It's essential for dental professionals to critically evaluate the resources available online and to consider their own learning needs and preferences when deciding whether or not to use social networks and the Internet for professional development. There may also be a need for training in the use of social media and the internet, firstly in their teaching establishments and then in post-graduate training, giving the dental professional confidence in their use.

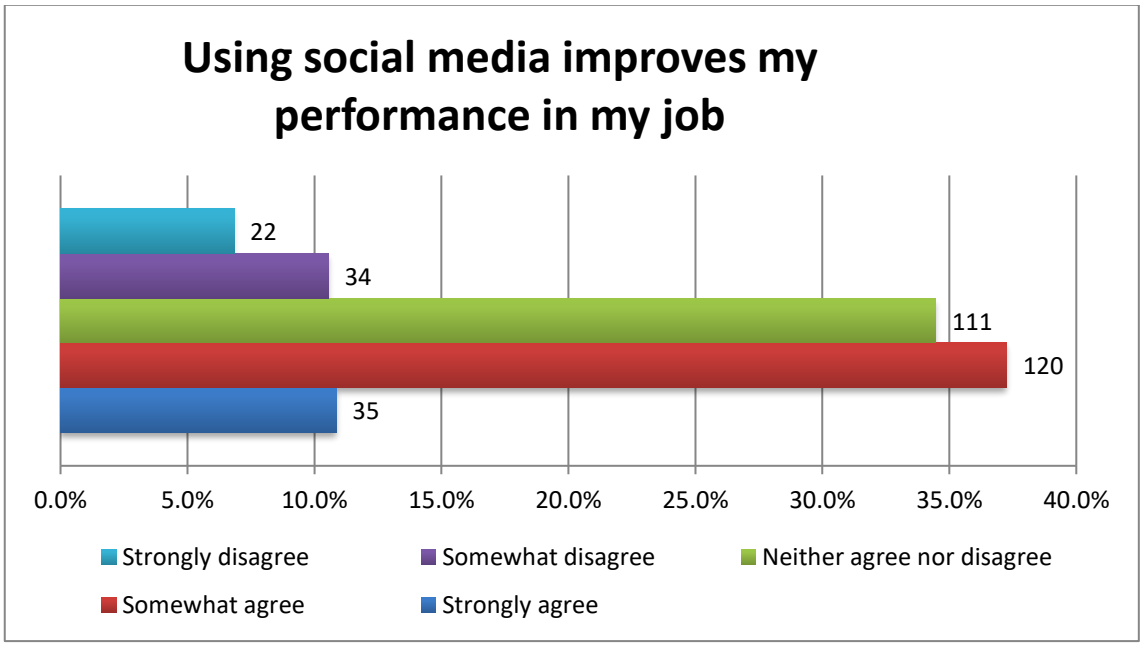


Figure 78 - Using social media improves my performance in my job.

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Using social media improves my performance in my job			
Response Category	Count	Percent of Data	Confidence Interval (Percent of Data)
Strongly agree	35	10.9%	7.9% to 14.7%
Somewhat agree	120	37.3%	32.2% to 42.7%
Neither agree nor disagree	111	34.5%	29.5% to 39.8%
Somewhat disagree	34	10.6%	7.7% to 14.4%
Strongly disagree	22	6.8%	4.6% to 10.1%

Table 77: Using social media improves my performance in my job.

The results (Table 77 & Figure 78) reveal that a substantial proportion of dental professionals perceive social media usage as beneficial to their job performance. Among the respondents, 10.9% strongly agreed and 37.3% somewhat agreed that using social media improves their performance as dental professionals. This suggests that approximately half of the surveyed dental professionals have a positive perception of the impact of social media on their work.

However, a significant number of respondents (34.5%) expressed a neutral stance, indicating neither agreement nor disagreement with the statement. This neutral response suggests that a considerable portion of dental professionals may have limited experience or awareness of the potential benefits or drawbacks of social media in their professional practice. It highlights the need for further education and exploration of social media's role in enhancing job performance among this group.

On the other hand, a smaller percentage of respondents (10.6% somewhat disagree and 6.8% strongly disagree) expressed a negative perception regarding the influence of social media on their job performance. These individuals may have concerns about distractions, privacy issues, or the reliability of information obtained through social media platforms. Their reservations may stem from a lack of familiarity with social media or a preference for traditional communication channels.

These findings are highlighted in some of the qualitative data, such as:

> "I'm very grateful for access to the internet at work to help with my learning needs. It enables me to connect with others in the profession, that I would not be able to do so as regularly."
>
> "I use the internet daily for researching topics and for watching educational lectures and demonstrations on YouTube."
>
> "There is a lot of fake news and self proclaimed experts so Facts need to be checked and evidence based. SM is a great platform form for knowledge sharing and discussion"

The findings of this data indicate that a substantial proportion of dental professionals perceive social media usage as beneficial to their job performance. However, a significant portion remains uncertain about the impact of social media, and a smaller but noteworthy group expresses negative perceptions. These findings highlight the need for education and training initiatives to enhance the understanding and effective utilisation of social media among dental professionals. Additionally, policymakers and professional organisations should consider developing guidelines and policies that promote responsible and ethical use of social media in the dental profession. By addressing these issues, dental professionals can leverage the potential benefits of social media while minimising potential drawbacks in their pursuit of enhanced job performance.

7. Conclusions

Informal learning refers to learning that occurs outside of a formal educational setting, such as through personal experiences or interactions with others. Hybrid social learning networks promote connections that combine formal and informal learning elements, such as online courses and discussions with peers.

In the context of CPD for dental professionals in the UK, a hybrid social learning network could provide opportunities for informal learning through peer-to-peer discussions and sharing experiences. At the same time, the network could also offer formal CPD opportunities through the use of online courses and other educational resources. By providing a platform for both formal and informal learning, a hybrid social learning network for dental professionals in the UK could help to enhance the effectiveness of CPD and support ongoing professional development for dental professionals.

7.1. Professionalism:

The use of social media for personal use by dental professionals or healthcare professionals can potentially have an impact on their professional use of social media. Some of the ways in which personal use of social media may affect professional use include:

- **Professionalism:** Personal social media use can potentially reflect on a professional's level of professionalism, as others may view it as unprofessional if they post inappropriate or offensive content.

- **Privacy:** Dental professionals should be aware of their privacy settings and the information they share online, as personal information or photographs can be accessed by others, potentially compromising their professional reputation.

- **Confidentiality:** Dental professionals are bound by a duty of confidentiality to their patients, so they should be careful not to share any information about their patients online unless having obtained patient permission first, even if it is not directly identifiable.

- **Professional reputation:** Personal social media use can also affect a professional's reputation if they post controversial or offensive content, it can impact their professional reputation and could lead to loss of patients or job opportunities.

Overall, dental professionals should be mindful of how their personal use of social media may affect their professional reputation and should be aware of any guidelines or policies set by their professional organisations or employers regarding the use of social media in a professional context.

7.2. Learning Needs:

Dental professionals employ a variety of methods to identify their learning needs, based on individual preferences and available resources. Some common approaches include:

- **Self-reflection:** Reflecting on their skills and knowledge, they pinpoint areas for improvement or further knowledge acquisition.
- **Professional development plans:** Creating plans that outline learning goals, objectives, and the steps needed to achieve them.
- **Feedback from colleagues and supervisors**: Receiving valuable feedback on performance, aiding in identifying areas requiring improvement or further knowledge.
- **Observation of best practices**: Learning from the exemplary approaches of fellow dental professionals to identify areas of growth.
- **Professional organisations and associations:** Seeking guidance and accessing resources and support for professional development from relevant organisations.
- **Keeping up with the latest advancements**: Staying abreast of the latest field advancements through reading journals, attending conferences, workshops, or engaging in continuing education.

Ultimately, a combination of these methods enables dental professionals to determine their learning needs and craft a comprehensive plan for their ongoing professional development.

7.3. Collaboration:

Dental professionals have diverse avenues to collaborate with others in their learning, tailored to available resources and specific learning needs. Common collaborative approaches include:

- **Peer-to-peer learning:** They engage in knowledge and experience-sharing with peers, offering constructive feedback for improvement and further knowledge acquisition. Social learning networks, offering access to peers' and experts' experiences, prove ideal for this purpose.

- **Mentoring:** Collaborating with experienced colleagues or supervisors, dental professionals seek guidance and support to achieve their learning goals.

- **Online learning communities:** Participation in online learning communities like discussion forums, webinars, and social media groups fosters connections within the dental field, promoting resource-sharing and experiential learning.

- **Professional organisations and associations:** Involvement in professional organisations and associations facilitates networking, the exchange of best practices, and participation in continuing education programs.

- **Team-based learning**: Dental professionals collaboratively tackle cases, discuss, practice, and learn from one another in a team-based learning approach.

- **Simulation-based learning:** Collaboration in simulation-based learning allows dental professionals to practice procedures in a safe, controlled environment and provide feedback to peers (Cochrane et al., 2017).

In summary, dental professionals recognise that collaborating with others in their learning significantly enhances their skills, knowledge, and overall professional development.

7.4. Contribution to Knowledge

The concept of Hybrid Social Learning Networks promotes the connections between professionals and resources, people connect and interact via a hybrid network of technology and physical, co-constructing knowledge and practices (Cook et al., 2016).

Primary care dentistry in the UK stands out in numerous aspects, although it does encounter certain challenges shared by other healthcare professionals, such as a sense of professional isolation. Nevertheless, the findings from this survey unveil the development of a hybrid social learning network among the respondents, whether they are aware of this or not. Nonetheless, it is crucial to highlight the nonlinearity inherent in complex systems, where even minor alterations in one component can yield significant effects in other areas. While the survey data captures the

professionals' perspectives at a specific moment, it is imperative to recognise that the dynamics of the system may evolve over time due to various factors. These factors may include the evolution of educational approaches, technological advancements, or shifts in professional expectations, such as changes by the regulators. Hence, it becomes vital to continually evaluate and adapt educational strategies and support systems to accommodate the evolving preferences and needs of dental professionals.

The research data not only provides valuable insights into informal learning in primary care dentistry but also reveals a level of complexity that cannot be unravelled by examining a singular aspect in isolation. The intricate nature of the system allows for the emergence of several interconnected areas from the data. These areas can shed light on various aspects such as collaboration, social learning, professional networks, and the potential impact of environmental factors on the dental profession. By comprehensively understanding these interconnected areas, it becomes possible to develop a more holistic approach to enhancing primary care dentistry in the UK.

Furthermore, as we delve deeper into the subject matter, it becomes increasingly evident that the recognition of the system's complexity is not only crucial but also serves as a foundation for embracing a dynamic perspective while analysing the survey findings. In the ever-evolving landscape of healthcare, constant vigilance through continuous monitoring, assessment, and adjustment of educational strategies and support systems becomes paramount. This adaptability is the cornerstone that ensures healthcare professionals receive the essential resources and guidance necessary to thrive in their professional journeys and deliver optimal care to their patients.

Acknowledging the multifaceted nature of the system empowers dental professionals, educators, and policymakers to unite in a collaborative effort to create an environment that fosters perpetual improvement and lifelong learning. By working in harmony, they can implement reforms and innovative initiatives that better serve the needs of the dental community and, by extension, the overall well-being of patients.

Notably, regulators must adapt to the changing landscape of dentistry and acknowledge the significant role that informal learning plays within the profession. Embracing the transformations brought on by the pandemic and the pervasive use of networking tools like social media, regulators must consider innovative ways to integrate informal learning into their regulatory frameworks. This acknowledgment recognises the modern ways in which dental professionals seek out knowledge and expertise, demonstrating their proactive approach to identifying learning needs and fulfilling them effectively.

The research underscores the proactive nature of Dental Professionals, who actively engage in determining their learning requirements and actively seek out suitable avenues to enhance their knowledge and skills. This initiative is often done through collaboration with both peers and subject matter experts, reflecting their dedication to providing the best possible care for their patients.

While the research specifically focused on dentistry, its implications extend beyond the dental field. Many other healthcare professionals also work in isolated environments and adopt similar approaches to learning, making this research universally relevant to various healthcare disciplines.

In the digital age, the utilisation of social media platforms offers numerous benefits and opportunities for connecting people, fostering discussions, and sharing diverse perspectives. However, amidst this virtual landscape of open dialogue and exchange, moderators of online forums and communities must remain vigilant and astute, recognising the potential disruptive influence of individuals wielding "Loud voices" to dominate discussions without encountering opposition.

While social media facilitates democratic communication, empowering individuals to voice their opinions and engage with a global audience, it also grants unprecedented visibility and amplification to those who possess forceful personalities and assertive communication styles. Such individuals, commonly referred to as having "Loud voices," may utilise their online presence to overshadow and suppress the contributions of others, leading to imbalanced and one-sided discussions that stifle the richness of diverse perspectives.

Moderators, therefore, bear a profound responsibility in maintaining the integrity and inclusivity of their digital communities. They must actively monitor and intervene when necessary, ensuring that all voices are heard and respected. This requires establishing clear community guidelines that promote constructive and respectful dialogue while discouraging any form of harmful or oppressive behaviour.

By creating a safe and supportive environment, moderators can foster an atmosphere where individuals feel empowered to express their thoughts and ideas without fear of retribution. Encouraging active participation from all members, regardless of their communication style or background, leads to a more robust and well-rounded exchange of knowledge and viewpoints.

Additionally, moderators can implement techniques to manage and balance conversations effectively. For instance, they can employ "threaded discussions" or "sub-topic channels" to compartmentalise conversations and prevent a single dominating voice from monopolising the entire discourse. Timely interventions in instances of disruptive behaviour are crucial to maintain a level playing field and uphold the principles of fair and equitable communication.

Furthermore, encouraging constructive dissent and open debate can also be instrumental in countering the influence of "Loud voices." When diverse perspectives

are encouraged and nurtured, it helps prevent the undue dominance of any individual, fostering a dynamic exchange of ideas and facilitating a deeper exploration of complex topics.

In conclusion, while social media platforms offer a valuable space for meaningful interaction and exchange, the potential for certain individuals with "Loud voices" to silence others cannot be ignored. Moderators must embrace their role as guardians of open and inclusive dialogue, actively curating a space that values and welcomes diverse voices. By establishing clear guidelines, intervening when necessary, and promoting constructive dissent, moderators can ensure that discussions on social media platforms remain vibrant, respectful, and enriching for all participants.

7.5. Framework

The conceptual framework developed in Chapter 2, section 2.8 does not simply serve as an abstract notion; rather, it proves to be an indispensable tool for researchers seeking to delve into this domain of knowledge. With its aid, scholars can bring to life the intricate patterns of connectivity, observing how various components interact and influence each other within these networks. This capacity to visualise the interconnections grants researchers the ability to attain a deeper, more profound understanding of the phenomena they are investigating.

Beyond its impact on research, this conceptual framework assumes a role of significance in the realm of education, particularly in healthcare education, where the fusion of informal and formal aspects is paramount. As educators venture to construct Hybrid Social Learning Networks, this framework becomes an indispensable guide. It offers a roadmap to bridge the gap between the organic, informal exchange of knowledge and the structured, formal methods of education.

7.6. Limitations

This study possesses various limitations that should be acknowledged. Firstly, the use of a self-reported questionnaire means that the data collected reflects the participants' perspectives at a specific moment in time. It is essential to recognise that the dynamic nature of complex systems, as previously discussed, may result in changes over time that are not captured in the responses. Furthermore, self-reporting introduces the potential for response bias, as individuals may provide answers based on their own perceptions or expectations.

However, it is worth noting that the inclusion of qualitative responses in the study helps to mitigate some of the limitations associated with self-reported data. By allowing participants to provide detailed explanations, insights, and personal experiences, the study gains a richer understanding of the subject matter. Qualitative responses offer a more nuanced and context-dependent perspective, providing valuable insights that quantitative data alone may not capture.

Another limitation to consider is the potential bias introduced by the survey's distribution method. The majority of respondents accessed the survey through social media platforms, which may introduce selection bias. The demographics and characteristics of individuals who actively engage with social media may differ from those who do not. Therefore, the findings may not be fully representative of the entire population of UK-based Dental Professionals. To address this limitation, future research could employ a more diverse range of recruitment strategies, such as reaching out to professional organisations or utilising random sampling methods, to ensure a broader representation of the target population.

Additionally, increasing the sample size would be beneficial in improving the demographic coverage of the study. With a larger sample, researchers can obtain a

more diverse and representative pool of participants, allowing for a more comprehensive exploration of the various perspectives and experiences within the UK-based Dental Professional community. A larger sample size would enhance the generalisability of the findings and provide a more robust foundation for drawing conclusions and making recommendations.

7.7. Areas for Future Research

The identified limitations in this study present several avenues for future research, highlighting the need to expand the scope of responses to encompass a broader range of demographics among UK-based Dental Professionals. For instance, it would be beneficial to include other groups of Dental Care Professional, such as Dental Technicians and Dental Nurses, in order to obtain a more comprehensive understanding of their perspectives and experiences.

Another area that requires further investigation pertains to the recording and monitoring of CPD. This study reveals that a significant portion of CPD activities undertaken by dental professionals are informal in nature and are not currently acknowledged by the regulator, the GDC, as contributing towards professional development. Therefore, it is crucial to delve deeper into how CPD is currently being documented and assessed, as well as explore potential ways to incorporate informal learning into the regulatory framework.

Furthermore, there is a need to explore the measurement of improved patient care and outcomes resulting from the informal and collaborative learning that occurs within HSLNs. Assessing the impact of these learning networks on patient care could potentially highlight the necessity for changes in the regulations governing CPD. By examining the relationship between informal learning, collaborative practices, and patient outcomes, researchers can provide valuable insights that can inform the

development of more effective CPD regulations, ultimately enhancing the overall quality of patient care in the UK.

7.8. COVID-19

Since completing the original survey, we have suffered a global pandemic of the COVID-19 virus. This is part of the complex system, by keeping people isolated, it has forced professions and learning establishments into distance learning (Kang, 2021). The reliance on the use of technology has increased in ways that would in normal circumstances have taken years.

In the realm of education and professional development, the advent of the COVID-19 pandemic has undeniably instigated a paradigm shift, demanding innovative approaches to learning and adaptation. Particularly within the field of dentistry in the United Kingdom, this unprecedented crisis has compelled the population and professionals to embrace novel methods of acquiring knowledge and expertise.

First and foremost, the pandemic necessitated a swift departure from traditional face-to-face learning environments to a predominantly remote or online mode of education. In response, dental educational institutions across the UK swiftly transitioned to virtual platforms, harnessing technology to deliver lectures, tutorials, and even hands-on demonstrations. Asynchronous learning materials, webinars, and virtual simulators emerged as indispensable tools, fostering engagement and interactive learning from the confines of homes and offices. By embracing these digital solutions, both students and professionals in dentistry could continue their educational journey without substantial disruptions.

Furthermore, the pandemic has galvanised the importance of interdisciplinary collaboration and knowledge sharing in dentistry. Recognising the need to adapt to the ever-evolving circumstances, dental professionals engaged in virtual conferences, webinars, and forums, facilitating a vibrant exchange of ideas and experiences. These platforms not only allowed for the dissemination of cutting-edge research and clinical practices but also fostered a sense of camaraderie and solidarity among dental practitioners, despite the physical distance imposed by the pandemic. This is confirmed in a recent report carried out on behalf of the GDC by Cardiff University, suggesting that the flexibility of online activities was welcomed by many registrants (Bullock, Barnes, Jones, Bartlett, & Russ, 2023).

Should this research be repeated now, there would most certainly be a difference in the data, and it may be useful to carry out to ascertain the changes brought about by the pandemic. Whilst life may return to near normal and many return to their face-to-face learning, the shift to online may have altered the perceptions of both learner and provider in a way not previously planned for. This emphasises the problem of complex systems and the need to study them as systems rather than from a reductionist viewpoint.

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Appendix 1

Informal Learning using Hybrid Social Networked Learning

Survey Flow

Standard: Validation (2 Questions)

Standard: Demographics (4 Questions)

Standard: Social Media (5 Questions)

Standard: Other Networking (1 Question)

Standard: Opinion (3 Questions)

Standard: Technology (1 Question)

Page Break

Start of Block: Validation

Q1 Welcome to the research study! We are interested in understanding informal learning for your professional development. You will be presented with information relevant to your informal learning and asked to answer some questions about it. Please be assured that your responses will be kept completely confidential and we do not collect information that can identify you.

The survey should take you around 15 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the survey, for any reason, and without any prejudice up to the point of submission. If you would like to contact the Principal Investigator in the study to discuss this research, please e-mail John Stanfield j.stanfield@lancaster.ac.uk.
By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age or over.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

- ○ I consent, begin the survey (1)
- ○ I do not consent, I do not wish to participate (2)

Skip To: End of Survey If Welcome to the research study! We are interested in understanding informal learning for your ... = I do not consent, I do not wish to participate

Q3 Are you a Dental Professional on the GDC register?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Are you a Dental Professional on the GDC register? = No

End of Block: Validation

Start of Block: Demographics

Q4 In which group of Dental Professional are you? (you may only select one)

- ○ Dentist (including specialist) (1)
- ○ Dental Therapist (including dual qualified) (2)
- ○ Dental Hygienist (3)
- ○ Orthodontic Therapist (4)
- ○ Clinical Dental Technician (5)
- ○ Dental Technician (6)
- ○ Dental Nurse (7)

Q5 Which gender group do you identify with?

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)
- ○ Prefer not to say (4)

Q6 In which age group are you?

- ○ Under 30 (1)
- ○ 30 - 45 (2)
- ○ 46 - 60 (3)
- ○ Over 60 (4)

Q7 In which year did you first qualify for entry onto the GDC register? (YYYY)

_____

End of Block: Demographics

Start of Block: Social Media

Q9 How often do you access the following social media sites for personal use?

	Daily (1)	Weekly (2)	Monthly (3)	Less than monthly (4)	Never (5)
Blogs (1)	○	○	○	○	○
Facebook (2)	○	○	○	○	○
Twitter (3)	○	○	○	○	○
Whatsapp (4)	○	○	○	○	○
Linked-In (5)	○	○	○	○	○
Google+ (6)	○	○	○	○	○
YouTube (7)	○	○	○	○	○

Tumblr (8)	○	○	○	○	○
Digg (9)	○	○	○	○	○
Instagram (10)	○	○	○	○	○
Flickr (11)	○	○	○	○	○
Pintrest (12)	○	○	○	○	○
Wikipedia (13)	○	○	○	○	○
Snapchat (14)	○	○	○	○	○
Professional Forums (15)	○	○	○	○	○
Other internet media (16)	○	○	○	○	○

Q19 How often do you access professional related content in the following social media sites?

	Daily (1)	Weekly (2)	Monthly (3)	Less than monthly (4)	Never (5)
Blogs (1)	○	○	○	○	○
Facebook (2)	○	○	○	○	○
Twitter (3)	○	○	○	○	○
Whatsapp (4)	○	○	○	○	○
Linked-In (5)	○	○	○	○	○
Google+ (6)	○	○	○	○	○
YouTube (7)	○	○	○	○	○
Tumblr (8)	○	○	○	○	○

Digg (9)	○	○	○	○	○
Instagram (10)	○	○	○	○	○
Flickr (11)	○	○	○	○	○
Pintrest (12)	○	○	○	○	○
Wikipedia (13)	○	○	○	○	○
Snapchat (14)	○	○	○	○	○
Professional Forums (15)	○	○	○	○	○
Other internet media (16)	○	○	○	○	○

Q10 How often do you POST professional related content in the following social media sites?

	Daily (1)	Weekly (2)	Monthly (3)	Less than monthly (4)	Never (5

Blogs (1)	○	○	○	○	○
Facebook (2)	○	○	○	○	○
Twitter (3)	○	○	○	○	○
Whatsapp (4)	○	○	○	○	○
Linked-In (5)	○	○	○	○	○
Google+ (6)	○	○	○	○	○
YouTube (7)	○	○	○	○	○
Tumblr (8)	○	○	○	○	○
Digg (9)	○	○	○	○	○
Instagram (10)	○	○	○	○	○
Flickr (11)	○	○	○	○	○

Pintrest (12)	○	○	○	○	○
Wikipedia (13)	○	○	○	○	○
Snapchat (14)	○	○	○	○	○
Professional Forums (15)	○	○	○	○	○
Other internet media (16)	○	○	○	○	○

Q11 Please indicate the way in which you use Social Media in your Professional domain

	Never (1)	Sometimes (2)	About half the time (3)	Most of the time (4)	Always (5)
I follow items of interest (1)	○	○	○	○	○
I search out items I am	○	○	○	○	○

interested in (2)					
I share items of interest (3)	○	○	○	○	○
I connect with those who are experts (4)	○	○	○	○	○
I discuss with my peers (5)	○	○	○	○	○
I ask questions of peers (6)	○	○	○	○	○
I ask questions of experts (7)	○	○	○	○	○

Q12 Could you please give an example of something you have learnt or shared with other Dental Professionals via social media or forums.

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End of Block: Social Media

Start of Block: Other Networking

Q13 Many of us use other forms of networking other than social media in which we interact with colleagues, peers and experts, please indicate how much you do each of these

	A great deal (1)	A lot (2)	A moderate amount (3)	A little (4)	None at all (5)
Conferences (1)	○	○	○	○	○
Study Groups (2)	○	○	○	○	○
Training Days (3)	○	○	○	○	○
Courses (lectures) (4)	○	○	○	○	○
Courses (hands on) (5)	○	○	○	○	○
Other (6)	○	○	○	○	○

End of Block: Other Networking

Start of Block: Opinion

Q14 This section looks at your evaluation and opinion of formal and informal learning. (Formal is organised and is certificated)

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
I prefer to determine my own learning needs (1)	○	○	○	○	○
I prefer that my learning needs are determined for me (2)	○	○	○	○	○
I prefer a formal course of learning (3)	○	○	○	○	○

I like to pick and choose what I learn (4)	○	○	○	○	○
My learning is determined by what I need to know at that particular time (5)	○	○	○	○	○
I like to plan my learning (6)	○	○	○	○	○
I learn better when the subject is something I want to learn about (7)	○	○	○	○	○
I am the best person to evaluate what I need to learn (8)	○	○	○	○	○
I am able to reflect on	○	○	○	○	○

my learning and put it into practice or decide I need to learn more (9)					
I like to collaborate with others in my learning (10)	○	○	○	○	○
Social media allows me to collaborate with peers (11)	○	○	○	○	○
Social media allows me to collaborate with experts (12)	○	○	○	○	○

Q15 This question relates to information available on the internet and your opinion on the validity of the information as it relates to your profession

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
I can usually find the information I am looking for on the internet (1)	○	○	○	○	○
The resources I use for information are reliable (2)	○	○	○	○	○
Cross-checking the information found is always needed (3)	○	○	○	○	○
I am a confident computer user (4)	○	○	○	○	○

Q16 Please describe your thoughts about how you use the internet and social media in keeping abreast of developments and new knowledge in your profession.

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End of Block: Opinion

Start of Block: Technology

Q17 This section looks at how you use technology and your perceptions of it.

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
Using social media improves my performance in my job (1)	○	○	○	○	○
Using social media in my job increases	○	○	○	○	○

my productivity (2)					
Using social media enhances my effectiveness in my job (3)	○	○	○	○	○
I find social media to be useful to my job (4)	○	○	○	○	○
My interaction with social media is clear and understandable (5)	○	○	○	○	○
Interacting with social media does not require a lot of my mental effort (6)	○	○	○	○	○
I find social media easy to use (7)	○	○	○	○	○
I find it easy to get the apps to	○	○	○	○	○

do what I want them to do. (8)					
I am able to control the apps (9)	○	○	○	○	○
I have the resources necessary to use the apps (10)	○	○	○	○	○
Given the resources, opportunities and knowledge it takes to use the apps, it would be easy for me to make the most of the apps (11)	○	○	○	○	○
I find computers easy to use (12)	○	○	○	○	○
I tend to show others how to use computers (13)	○	○	○	○	○

I love technology and what it can do (14)	○	○	○	○	○
Technology will become more important in healthcare (15)	○	○	○	○	○
It is important for me to be able to use technology competently (16)	○	○	○	○	○
I want to improve my use of technology in my job (17)	○	○	○	○	○

End of Block: Technology

Appendix 2

Ethical Approval:

Educational Research | Lancaster University

10th April, 2019

Dear John Stanfield

Thank you for submitting your ethics application and additional information for "Informal Learning using Hybrid Social Networking for Professional Development Amongst Dental Professionals in the UK" The information you provided has been reviewed and I can confirm that approval has been granted for this project".

As principal investigator your responsibilities include:

- ensuring that (where applicable) all the necessary legal and regulatory requirements in order to conduct the research are met, and the necessary licenses and approvals have been obtained;
- reporting any ethics-related issues that occur during the course of the research or arising from the research (e.g. unforeseen ethical issues, complaints about the conduct of the research, adverse reactions such as extreme distress) to your Supervisor.
- submitting details of proposed substantive amendments to the protocol to your supervisor for approval.

Please do not hesitate to contact me if you require further information about this.

Kind regards

Alice Jesmont
TEL Programme Administrator

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Professors
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