The role of social media in dental education

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

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Abstract

Objectives: knowledge and skills that dental students develop are mainly dependant on their interaction either between each other or between them and their tutors. The interaction between the students subsequently promotes collaborative and student-centred learning. Moreover, as information resources increase and vary, there is a critical need for information to be accessible and available for sharing amongst dental students and peers. At the meantime, social media (SM) are ubiquitous in society. Originally used for socialising between individuals, they are increasingly used for educational purposes, and they are potentially useful supplementary learning tools that facilitate communication and interaction amongst dental students and between them and their teachers. Also, they serve as a big source of information. SO, the aim of this study was to explore the role of SM in dental education in the UK and Egypt, as they are used by both dental and dental care professional (DCP) students and their teachers.

Methods: An online Google Forms based questionnaire was developed and emailed to dental students and their teachers from two UK and three Egyptian dental schools. Questions including open- and closed- ended, multiple-choice and Likert-scale based; and enquired about demographic information, and the use of SM for communication and education. Completed questionnaires were returned and data were collated using Microsoft Excel 2010 and analysed using Chi-squared and Fisher`s exact tests (SPSS v26.0). This was followed by 17 semi-structured online interviews that were conducted with dental (n=7) DCP (n=3) students and their teachers (n=7). The interviews included open-ended questions about participants` definitions of SM, and their use of SM for educational purposes. Data analysis was carried out using a thematic framework technique.

Results: 923 students and 192 dental teachers responded to the questionnaire. Facebook, WhatsApp, Instagram, and YouTube were the most frequently used platforms. The participating students strongly agreed that SM helped them with communication (n=433, 46.9%) and searching for information (n=393, 42.5%). However, the majority (n=82, 42.7%) of dental teachers showed neutral perceptions regarding the accuracy of information published on social media. The thematic analysis of the interviews revealed that SM were seen by the interviewees as online and unofficial tools for communication. The participants referred to some advantages such as ease of use, accessibility, and the speed of communication. However, the participants expressed a number of social concerns related to the privacy, professionalism, distraction, and the need for motivation and some technical facilities.
Conclusion: SM are potentially useful and effective educational tools that could supplement classroom teaching and encourage collaborative, student-centred, and unofficial learning. However, both students and teachers should be aware about their drawbacks and the requirement for training to use them positively.
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<tr>
<td>UGC</td>
<td>User Generated Content</td>
</tr>
<tr>
<td>SMS</td>
<td>Short Message Service</td>
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<tr>
<td>SNSs</td>
<td>Social networking sites</td>
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<tr>
<td>WWW</td>
<td>World Wide Web</td>
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<td>SM</td>
<td>Social media</td>
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<td>PBL</td>
<td>Problem based learning</td>
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<td>SCL</td>
<td>student-centred learning</td>
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<td>CoP</td>
<td>Community of practice</td>
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<td>vCOP</td>
<td>Virtual community of practice</td>
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<tr>
<td>MSU</td>
<td>Michigan State University</td>
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<tr>
<td>CE</td>
<td>Continuing education</td>
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<tr>
<td>COVID</td>
<td>Coronavirus disease</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>CSSE</td>
<td>Centre for Systems Science and Engineering</td>
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<tr>
<td>DCP</td>
<td>Dental Care Professional</td>
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<tr>
<td>PRISMA</td>
<td>Preferred Reporting Items for Systematic Reviews and Meta-Analyses</td>
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<tr>
<td>PICO</td>
<td>Population, Intervention, Comparison, Outcome</td>
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<tr>
<td>ERIC</td>
<td>Educational Resources Information Centre</td>
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<tr>
<td>BEI</td>
<td>British Education Index</td>
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<tr>
<td>RDRB WEB</td>
<td>Research and Development Resource Base in Continuing Medical Education on the Internet</td>
</tr>
<tr>
<td>EDS</td>
<td>EBSCO-host Discovery Service</td>
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<tr>
<td>MMAT</td>
<td>Mixed Methods Appraisal Tool</td>
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<tr>
<td>GPA</td>
<td>Grade Point Average</td>
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<td>GDC</td>
<td>General Dental Council</td>
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<tr>
<td>MSA</td>
<td>October University for Modern Science and Arts</td>
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<td>UPDA</td>
<td>University of Portsmouth Dental Academy</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
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<tr>
<td>OR</td>
<td>Odds ratio</td>
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<tr>
<td>CI</td>
<td>Confidence intervals</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>FACE</td>
<td>Fast, Accessible, Cheap, Easy</td>
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Declaration

Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award.

Word count = 86075
Dedication

First of all, it is for Allah and his prophet Muhammad (peace be upon him). Secondly, I would like to dedicate my thesis to my beloved family, friends, teachers, and my honest companions throughout this long journey.
Acknowledgment

I would like to convey my endless gratitude to my first supervisor Prof. Chris Louca who was my honest companion throughout this long journey that started on the 29th of August 2018 when he firstly interviewed me. Wholeheartedly, I consider myself so lucky to have you as my supervisor. I can’t thank you enough for your so kind attitude, help, support and continuous motivation. You are my role model. It is a big honour to have met you. I will never forget you over my entire life.

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Very special thanks to my colleagues and the staff members at University of Portsmouth Dental Academy. You were the cherry upon the cake. Thank you for making my life easy.

It is said that friendship is the ship that carries you through the storm. Thanks to my friends, the angels who believed in me and accompanied me through my journey. Thanks for never letting me alone especially through the hard times. You represent a boon from the lord and a treasure in the earth.

Last but not least, a very warm gratitude to my father (Ahmed) and mother (Nadia) who believed in me, had my back and paid for my studies and accommodation tuition fees. All my achievements in my entire life would never be real without you. May God bless you in life and heaven. Thanks to my older brothers; Alaaeldin and Abdelrahman. I am happy for having you in my life.
About the author

My name is Amr Elraggal. I achieved a bachelor`s degree of dental surgery (BDS) from the Faculty of Dentistry, Modern Science and Arts University, Egypt in 2010. After that I completed a master`s degree (MSc) in paediatric dentistry from the Faculty of Dentistry, Tanta University, Egypt in 2017. In October 2018, I started my PhD program in dental education research at the University of Portsmouth Dental Academy, UK.

List of publications during my PhD:


- Submitted for publication to the European Journal of Dental Education: Using social media in dental education: a systematic review (publication number EJE-21-4963).
Introduction
1 Introduction

The knowledge, skills and techniques that dental students develop during their learning are highly dependent on their interactions with their teachers who serve as their coaches, mentors, and evaluators (Henzi et al., 2006). In addition, many scholars (Powell et al., 2009; Neville and Heavin, 2013; Durairaj and Umar, 2015) highlighted the positive impact of social interaction among learners in order to promote knowledge construction. That is why promoting communication and collaboration amongst dental students and between them and their teachers has become one of the main aims for some educational developers (Lewis, 2010; Arnett, Christensen and Nelson, 2014; Llorent-vaquero, Tall and Heras, 2020; Saldo and Walag, 2020).

Social media offer an opportunity for both dental students and their teachers to promote communication and interaction between them in a way which is independent of time or location (Spallek et al., 2015). This subsequently supports the learning process to be collaborative, social and student-centred (Lewis, 2010; Access, 2014; Sood, 2015). Elen et al. (2007) argued that student-centred learning environments are more effective than teacher-centred learning versions. A teacher-centred learning environment discourages students from adopting a deep approach to learning (Entwistle, 2003). Gow and Kember (1993) argued that a student-centred learning environment is less likely to induce surface learning approaches. Consequently, many researchers claim that a transition in curricular and instructional approaches is needed; from teacher-centred to student-centred learning environments (Elen et al., 2007; Lea et al., 2010; Parkinson and Turner, 2014; Tangney, 2014).

Social media allow learners to take ownership of their teaching and learning. With this type of technology, learners can be actively involved in the teaching and learning phase and they also no longer have excuses for not being able to obtain information (Jackson, 2016). That is why the traditional method of teaching and learning must be revised and adapted regularly to utilise information communication technology in the education system (Beer and Greyling, 2021).

As information resources increase and vary, there is a critical need for information to be accessible and available for sharing amongst students and peers. Social media provide an opportunity for an accessible and wide source of information (Smith and Lambert, 2014; Cordos, Bolboacă and Drugan, 2016), and allow the students to share this information with each other, and allow the teachers to share with them some educational materials as well (Murumba and Micheni, 2017). The diversity of learning needs amongst dental students requires varying the educational approaches, often to be independent of time and place.
(Mattheos et al., 2008). Social media support the concept of self-learning and allow the students to learn in their own pace, space and time (O’Connor et al., 2018).

The problem with learning through social media is that they put students and teachers under pressure as this technology changes regularly and it is challenging for both the students and their teachers to always keep up to date with this regular change (Galiatsatos et al., 2016). In addition, learning through social media is relatively new and dental institutions may not be fully aware of the most optimal ways to utilize these relatively new technologies for educational purposes. Moreover, they have to be familiar with the positive and negative aspects of using social media in dental education.

1.1 Aim of the work
The aim of this research was to explore the role of social media in dental education in the UK and Egypt by both undergraduate dental and dental care professional students, and their respective teachers.

1.1.1 Objectives:

a. To provide a novel definition of social media.

b. To find what social media were used by undergraduate dental students and their teachers for educational purposes.

c. To find how social media were used by undergraduate dental students and their teachers for educational purposes.

d. To explore perceptions of undergraduate dental students and their teachers regarding using social media in dental education.

e. To find the positive and negative aspects regarding using social media in dental education.

f. To provide recommendations for the appropriate use of social media in dental education.

 g. To develop a model for using social media in dental education.
These objectives will be targeted using an approach depicted in Figure 1.1 and itemised below:

1. Narrative review of literature (chapter two): to investigate the pedagogical value of using social media as educational tools to improve learning in higher education generally and dental education especially.

2. Systematic review of literature (chapter three): to systematically synthesize the relevant literature on the use of social media in dental education by undergraduate dental students (including dental care professionals) and their teachers.

3. Quantitative study (chapter four and five): to investigate perceptions of some dental students and their teachers regarding using social media for learning and teaching purposes through an online questionnaire. This questionnaire aims to build a general understanding of the research dilemma. Additionally, it aims to find what social media are used by undergraduate dental students and their teachers. It also aims to explore participants’ perceptions regarding using social media for communication, sharing educational materials, interaction with educational blogs and wikis, and as a source of information, and their prevalence of using social media for educational purposes.

4. Qualitative study (chapter four and five): to find out more details about dental students’ and their teachers’ current use of social media in dental education and their perceptions regarding weaknesses and strengths of using social media as pedagogical tools. The qualitative study, also, aims to explain some of the quantitative results.

Figure 1.1 stages of the research at this thesis
For better understanding of the pedagogical value of using social media as educational tools, the next chapter (the narrative review) aims to identify how social media have influenced some of the basic concepts of learning, such as active, collaborative, problem based and blended, approaches and their role in the overall education process. In addition, the historical development of social media and the various definitions that have arisen, will be discussed. Several authors have considered how the use of social media can be integrated into existing educational theories and these will also be discussed. This review will consider the use of social media across secondary and higher education generally and will also focus on dental education where applicable. It will also address both the positive and negative aspects of social media particularly in higher education.
Narrative review about using social media in education
2 Narrative review

2.1 Introduction

Improving the learning environment and how to make it more beneficial and meaningful for undergraduate students have become the main point of interest for some educational innovators (Day, 2009). Hiemstra (2006, p.8) defined learning environment as “all of the physical surroundings, psychological or emotional conditions, and social or cultural influences affecting the growth and development of an adult engaged in an educational enterprise”.

Higher education like all education faces regular change due to continuous educational innovations, technological developments, and changing social norms (Arnett, Loewen and Romito, 2013). The role of educators has changed from “sage on the stage” to the guiding and facilitating of students’ independent acquisition of information (Parkinson and Turner, 2014). Learners are provoked into critical analysis and application of theories to real or simulated experience. Students’ roles have also changed during this time frame from passively sitting in traditional classrooms where they are spoon-fed facts and theories, to being responsible for constructing the necessary knowledge in an active setting and demonstrating their ability to critically analyse the validity and strength of information sources (Parkinson and Turner, 2014).

Social media applications are a dynamic and evolving technology with hundreds of platforms and millions of users. Using social media is becoming increasingly ubiquitous. They were initially used as a means for communication and socializing between people who are both known and unknown to each other. Social media are increasingly used for educational purposes (Phua, Jin and Kim, 2017). Social media have been defined as web-based platforms that enable users to create personal profiles, content, and share messages, images, audios or videos by connecting with other users in the system (Boyd and Ellison, 2007).

The growing popularity of social media among students has encouraged faculty members in various health science disciplines to try to take advantage of students’ engagement with social media for educational purposes and thus enhance learning, teaching, collaboration, and communication (Parkinson and Turner, 2014). Some studies (George and Dellasega, 2011; McAndrew and Johnston, 2012; Zanon et al., 2018) have found that integrating social media tools into traditional university class activities offered many benefits to students in the form of active learning enhancement, problem solving and students` collaboration.
2.2 Social Media

2.2.1 Background and definition

The task of defining social media is becoming more challenging because it is constantly in a state of change. A certain definition of social media requires drawing a line between two related concepts that are usually named in conjunction with social media: Web 2.0 and User Generated Content (Web, 2007; Selwyn, 2007; Kaplan and Haenlein, 2010). Web 2.0 is a term that describes a new way whereby content and applications are no longer created and published by individuals, but instead are continuously modified by all users in a participatory and collaborative fashion. Web 2.0 was considered as the technology for the evolution of social media. User Generated Content (UGC) are the sum of all ways in which individuals use social media. The term is usually used to describe the various forms of media content that are publicly available and created by end-users. According to the Organisation for Economic Cooperation and Development (Web, 2007) UGC needs to fulfil three basic requirements in order to be considered as such:

1. It needs to be published either on a publicly accessible online source such as an accessible website or a social networking site. This condition excludes content exchanged in emails or short message service (SMS).

2. It needs to show a certain amount of creative work; instead of replicating an already existing content (e.g., posting a copy of an existing newspaper article on a personal blog without any modifications or commenting).

3. It needs to be created outside professional practices.

Based on these clarifications of Web 2.0 and UGC, social media were defined by Kaplan and Haenlein (2010, p.61) as “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content”.

Kaplan and Haenlein (2010) classified social media into 5 categories:

1. Collaborative projects (e.g., Wikipedia): these platforms enable the joint and simultaneous creation of content by many users.

2. Blogs (e.g., WordPress): they are often text-based and allow for a relatively simple exchange. Blogs are usually managed by one person only but provide the ability to interact with others through the addition of comments.
3. **Content communities** (e.g., YouTube): the main objective of content communities is the sharing of media content between users. Content communities exist for a wide range of media types, such as: text (e.g., Book Crossing) photos (e.g., Flickr) videos (e.g., YouTube) and PowerPoint presentations (e.g., Slideshare).

4. **Social networking sites** (SNSs) (e.g., Facebook, MySpace) beside text-based communication, enable the sharing of pictures, videos, and other forms of media. Social networking sites are applications that enable users to connect by creating personal information profiles and inviting friends and colleagues to have access to those profiles. These personal profiles can include any type of information, including photos, video, audio files, and blogs.

5. **Virtual game and social worlds** (e.g., World of Warcraft, Second Life): they try to replicate face-to-face interactions in a virtual environment.

Social media have evolved innovatively, creating new or enhanced features to meet the desires of users. Some social media tools are tailored to meet the demands of some particular users. For example, Match.com and eHarmony.com are social media platforms that serve as dating agencies. Also, Ning.com allows users to create their own social networks (Tess, 2013). As it seems that a specific definition for social media may be elusive, they are often described by example. Blogs, tweets, wikis, multi-media platforms, virtual social worlds and virtual gaming worlds are among the applications typically included in recent illustrations (Kaplan and Haenlein, 2010; McEwan, 2012).

Since their introduction, social media such as Twitter, Facebook, YouTube, and Wikipedia have attracted millions of people who have integrated these platforms into their daily activities. Social media have gained in importance as they allow individuals to interact with each other in seamless fashions (Boyd and Ellison, 2007). For instance, most of social media allow users to create distinct profiles, whereby they can show a range of identification markers (e.g., name, career, age) images, and other personal components. Social media also enable users to produce interactive content (e.g., images, videos, articles, comments, statistics) that can be shared and exchanged between peers (McAndrew and Johnston, 2012). Exploring social media has become a daily routine for most university students (Smith and Lambert, 2014).

2.2.2 **History**

Web 1.0, that refers to the World Wide Web (www) pages that are linked to each other, is a communication and publication medium that allows for some control over prechecked content. It is characterized by the defined status of experts and specified boundaries that are regulated by law and policies. In contrast, Web 2.0 (social media applications like Facebook, Twitter,
YouTube and Wikipedia) has a different set of operating principles: these include relationship, community, participation, access, sharing, spontaneity and building knowledge and experience, making this medium distinctly difficult to organize (Spallek et al., 2015).

Since the 1990s, many social media sites have been launched globally (Boyd and Ellison, 2007). Some examples include SixDegrees, LiveJournal, MiGente, BlackPlanet, MoveOn and AsianAvenue. These were the first recognized social media that gave their users the ability to create personal profiles and interact with each other. Then, Classmates.com was launched to allow students to be engaged with their high school or universities. In 2001 Ryze was launched to allow its users to expand their business networks (Chaikin, 2007).

Starting from 2003, many social media were launched. Most of them were “profile-centric” websites like Myspace and Tagged or professional websites that focus businesspeople like Linkedin, Visible Path, and Xing (Shirky, 2007). After that, many social media platforms (such as YouTube) were found focusing on the concept of videos creating and sharing. Many social media sites like Elgg, Wikipedia, RSS and Blogs were created for knowledge purposes. In early 2004, Facebook initially began as a Harvard-only social media platform. Students at Harvard University only could use Facebook, using their university email. In late 2005, Facebook expanded to include everyone. Individuals were able to sign up using any email address then create their personal profile and start adding people. People had to accept “friend request” to be allowed to see profile contents, communicate and share media content with each other (Guraya et al., 2018).

In 2006, Twitter was launched and gained high popularity between individuals. Twitter is known also as microblogs, and it allows people to comment using “Tweets” which should not be more than 140 characters. In Twitter, the “#” symbol is used to categorize a message or topic and called “Hashtag”. The advantages of Twitter are that it is suitable for real time discussions and networking without poking (a Twitter term which means to provoke a response) friends, tagging photos or playing games (Arnett, Loewen and Romito, 2013). Twitter proved its efficacy as a supplementary tool for learning in terms of students’ collaboration enhancement and encouraging active learning between university students (George and Dellasega, 2011; Prince, et al., 2018). Instagram was launched in 2010 for sharing photos and videos and since then, it has gained an increasing popularity among social media platforms. It has been used initially for entertainment, but recently, many accounts have been created for educational purposes (Phua, Jin and Kim, 2017).

Social media are used by millions of people. By April 2020, Facebook was the first social
networking website with almost 2.5 billion monthly active users followed by YouTube and WhatsApp with almost 2 billion monthly users for each (Statista, 2020). Social media are used for many reasons, such as entertainment, building social relations, personal or professional communication or work-related reasons (Brandtzæg and Heim, 2011; Kalmus, Realo and Siibak, 2011; Voorn, 2012). Recently, social media have been utilized increasingly for educational purposes (Phua, Jin and Kim, 2017).

2.3 The effect of social media on the learning environment

Integrating social media, along with the traditional classroom, in higher education institutions is not only for knowledge transfer but, more importantly, for the learning environment to be more active (Levy, 2012), collaborative (Voorn and Kommers, 2013), and problem based (Buus, 2012). Additionally, it promotes blended learning (McCarthy, 2010), student-centred learning, (Lea et al., 2010; O’Connor et al., 2018), and flipped classroom (Seo et al., 2018). (Figure 2.1)

Figure 2.1 what using social media in higher education can promote

2.3.1 Active learning

In 1984, the National Institute of Education in Washington, DC urged universities and higher education institutions to actively engage and involve students in the process of learning (National Institute of Education, 1984) (Bonwell and Eison, 1991). Active learning is one of the key principles illustrated in a study conducted by Chickering and Gamson (1991) on meaningful educational practices in higher education. The authors suggested that students should not merely listen, but also discuss, criticise, synthesise, evaluate, and be engaged in higher order thinking tasks. Within this context, Bonwell, and Aison (1991, p.5) defined active learning as “any instructional method that engages students in the learning process”. Active
Learning involves a variety of teaching and learning practices, such as lively debates between teachers and students, peer-to-peer discussions, project work, reflective writing, and teamwork, all of which allow students to analyse, synthesise, improve and apply knowledge through engagement (Bonwell and Eison, 1991; Meyers and Jones, 1993; McKinney and Heyl, 2008).

Dewey (1938) argued that students’ experiences are an essential factor in their learning process. In the same way, other educators (Bonwell and Eison, 1991; Chickering and Gamson, 1991; Conlon, 2004; Greenhow and Robelia, 2009) have called for the invention, improvement, and implementation of learning activities that engage students and connect classroom settings with real-life experiences. In addition, Anthony (1996) argued that active learning mainly included knowledge construction instead of knowledge absorption, and it allowed for building on the existing knowledge of the learner. This happens through a range of learning activities including addressing certain scientific questions, analysing results, correlating the evidence with the pre-existing theories, drawing conclusions and making reflections. This way of learning allows students to build up deeper and more skilled levels of understanding than the passive way of learning (Hmelo-Silver, 2004; Stes and Al, 2012; Von Stumm and Furnham, 2012; Ellis, 2016). In passive learning, knowledge development is unidirectional, controlled by a "sage on the stage" (McWilliam, 2008, p.267).

Levy (2012) described active learning as an interrogative process that pushes students to develop their own answers to problems, instead of answers being delivered by their teachers. For Edelson, Gordin and Pea (1999) this means that students become autonomous agents of the learning process, where they can identify new knowledge, use it to build on their existing knowledge structures, and then use that to solve problems. Roberts (2018, p.202) summarized some key features of the active learning process which includes:

1. “Stimulation of curiosity and a desire to know more”.
2. “Provocation of inquiry”.
3. “Presentation of problems to be solved”.
4. “New knowledge construction from existing foundations of knowledge”.

For many educators, the lack of appropriate tools was often perceived as a barrier for engagement with an active learning environment (George, Dreibelbis and Aumiller, 2013; Roberts, 2018). Social media technologies provided educators with the technical platforms to provide a more complete active learning experience. Social media technologies have the potential to support and enhance active teaching and learning in higher education providing
learners with the necessary tools to access a wide variety of freely available educational content, to create their own studying handouts, to connect learners with each other and with their teachers, and to support a collaborative learning environment (Neville and Heavin, 2013).

George, Dreibelbis and Aumiller (2013) assessed the use of Google Doc and SurveyMonkey to enhance active learning at medical lectures for first-year medical students (N=154) at Penn State College of Medicine, USA. At the beginning of the semester, course coordinators were advised to use Google Doc and SurveyMonkey inside the classroom to ask students course relevant questions and get real-time feedback. At the end of the course students` perceptions were explored through a survey including Likert scale and open-ended questions. The results revealed that over 50% of the students used Google Doc and SurveyMonkey. The students generally appreciated both technologies, but they preferred Google Doc over SurveyMonkey. Students valued the anonymity of Google Doc. This encouraged more in-class questions. Students pointed to the need for a facilitator when they used these technologies.

Mi and Gould (2014) evaluated wiki technology to enhance active learning for first-year medical students (n=44) at Oakland University. Most of the students reported a high level of comfort using Google Docs and Wikis. The majority of the students mentioned that Wikis encouraged group learning and found it useful for learning in general. However, some students showed some resistance to any “extra work” out of the classroom. Dahdal (2020) evaluated using WhatsApp for active learning enhancement at a university in the UAE. The author revealed that 88% of the interviewed media students felt motivated to contribute to the pre- and post-lecture discussions in WhatsApp. Additionally, 90% checked the links sent before the classes to have an idea about the lecture topics.

2.3.2 Collaborative learning

Vygotsky (1978) suggested three ways of learning through which, information can be passed from one individual to another. The first one was imitative learning, where one person tries to imitate or copy another. The second way is by instructional learning which involves remembering the instructions of a teacher and then using these instructions to self-regulate. The final way was the mobilization of information between individuals through collaborative learning, which involved a group of peers who work together to learn a specific skill or acquire some knowledge (Tomasello, Kruger and Ratner, 1993; McLeod, 2007). Collaborative learning is not a new idea. Learners have adopted informal learning in groups for hundreds of years (Roberts, 2004). Gaillet (1994) argued that collaborative learning was experienced in the late 18th Century when George Jardine adopted this approach in his philosophy classes at...
Collaborative learning could be defined as “any instructional method in which students work together in small groups toward a common goal” (Prince, 2004, p.226). Interestingly, although when applying formal learning at universities in an environment where students are asked to learn individually, students often create their own informal study settings to assist their learning (Gaillet, 1994). Collaborative learning encourages learners to think systematically and to learn actively in peers or groups. This can be achieved through some activities such as: information exchange, imaging best or worst scenarios, visual presentations, group discussions, introducing debates and arguments, negotiations and finding solutions (Wilson and Morren, 1990; Roberts, 2004; Gaillet, 1994).

Throughout the collaborative learning process, learners talk with and learn from each other in groups of various sizes. This process may use a “2-4-8” approach to improve knowledge. This means that when one individual develops a certain knowledge, he or she discusses this knowledge with another learner. Those two individuals, then, stay with another two learners to discuss each person’s knowledge. Those four then join another four learners and the process continues. Within these discussions, active listening, questioning, and argument are respected. Learners clarify and refine their knowledge through dialogue. So, this means that knowledge is not delivered to students, but rather, it emerges from active dialogue among learners who seek to understand and apply concepts and techniques (Hiltz and Wellman, 1997).

Social media tools (e.g., blogs, wikis and media sharing tools like Facebook, WhatsApp, and Twitter) can be used to foster collaboration between learners (Ford, Bowden, and Beard, 2011). These technologies help to create online social networks, that are based around common interests to start informal learning (Bisgin, Agarwal and Xu, 2012; LaRue, 2012). A variety of social media tools offer chances for collaborative learning in different ways. For example, wikis can be used for collaboratively writing project documentations. In the same way, blogs allow for posting about the project progress, experience exchange and also allow for critical and constructive feedback to peers (Popescu, 2014).

Many educational pages and closed groups that were created by university students or colleges on Facebook, Twitter, and WhatsApp were used for university students’ collaboration, interaction, conducting of discussions and sharing of educational material with each other (Chu et al., 2017; O’Connor et al., 2018; Dahdal, 2020). Mistry (2011) explored the effectiveness of Twitter as a teaching tool at the clinical Simulation Centre at the University of
Glamorgan, UK. Four short clinical scenario videos were posted on a twitter group and participants (n=24) were asked to comment (tweet) on the videos. At the end of the study, students` perceptions were surveyed through focus group discussions and semi-structured interviews. The students felt that Twitter was a good way for interactive and collaborative learning. Online discussions helped students in critical thinking. Students liked the ease of using Twitter and the flexibility of learning provided by it. Some participants thought combining the class with Twitter would be more engaging. Social media offered various ways for communication among the students themselves, between the students and their teachers or among the teachers. Consequently, they enabled both students and their teachers to create scaffolding contexts to connect them all together (Devi, Gouthami and Lakshmi, 2019).

Gonzalez and Gadbury-Amyot (2016) created a Twitter account and shared it with undergraduate dental students before starting two radiology courses. The account was used to post radiographs and receive questions and answers from the students. At the end of the semester, a questionnaire was delivered to the students to explore their perceptions about using Twitter as an educational tool. Most of the students believed that Twitter helped them to learn the course and recall the information.

2.3.3 Problem based learning

Problem based learning (PBL) has been defined as a “learning process of working with problems, which involves identification, analysis, and solution” (Mann et al., 2021, p.30). In the PBL approach, knowledge is mastered in the same pattern in which it will be applied. PBL is seen as a student-centred process in which the student sets the pace, and the role of the teacher is to guide, to generate resources and to help when needed (Donner, 1993). PBL, evolved from innovative science curricula introduced in North America in 1969 for the first time in the Medical faculty at McMaster University in Canada (Neville, 2009). It introduced the tutorial process, not merely as an instructional method but also as a philosophy for structuring an entire curriculum promoting student-centred, multidisciplinary learning and lifelong educational practice (Boud and Feletti, 1997). According to Boud and Feletti (1997) students must have responsibility toward their learning. This happens through engagement of the students with well-structured problems and using their own knowledge or experiences to find solutions to those problems. In addition, learners should be able to access, study and integrate knowledge from all the resources and disciplines that may be useful to solve those problems (Savery, 2015).

Some forms of PBL offer a more individualised setting where learners work on their own, while others promote a more collaborative setting among learners such as forming coupled learning
sets, or group work on a common project. Therefore, various technologies and environments have been introduced to support such different settings of PBL (Savin-Baden, 2007). Thus, there can be considerable variety of PBL practices and activities developed to support these (Tambouris et al., 2012). Some of the core concepts associated with social media, such as collaboration, engagement, student-centred learning, participation and sharing, are well aligned with PBL. Consequently, it made good sense to connect web 2.0 with a problem-based approach to learning (Buus, 2012).

Social media can help by creating an active learning environment in which students can learn by solving problems (Murumba and Micheni, 2017). This can be achieved by providing online communication platforms that are capable of connecting learners together, with instructors, and with communities of practitioners in various fields irrespective of the distance or location (McAndrew and Johnston, 2012; Murumba and Micheni, 2017). The wide range of online tools that social media provide are useful in PBL for problem structuring, analysis, planning, design, and information sharing in ways that enable learners to perform sophisticated and complex tasks and solve problems in creative ways (Murumba and Micheni, 2017). The successful integration of social media has been, however, influenced by teachers’ knowledge, experience, approaches to teaching and learning, and information technology literacy skills (Murumba and Micheni, 2017).

Ekarattanawong and Thuppia (2015) explored second year medical students’ (n=177) perceptions of using a Facebook page to support problem-based learning in an integrated preclinical year course. The Genitourinary System course committee introduced a Facebook page for the second-year medical students who enrolled, and also the instructors involved in the course. The aim of the page was to support learning and communication between the students. At the end of the study, most of the participants mentioned that the Facebook page encouraged problem based and self-directed learning.

### 2.3.4 Blended learning

Educating students in classrooms, where traditional teacher-centred learning is implemented, is becoming increasingly hard. The reason is that the traditional classroom, where the teacher acts as the “sage on the stage”, does not allow students to critically think, analyse information, construct knowledge or solve problems. Moreover, learning at the students’ own pace is not an option as the teacher solely disseminates knowledge and the students act only as information receivers. Thus, students graduate with superficial knowledge they memorize (Bybee, 2000; Akınoğlu and Tandoğan, 2007; Akınoğlu, 2013). The rapid progress in internet technology has encouraged many educational innovators to ask to utilise this technology in
education (Garrison and Kanuka, 2004; Moore, 2013; Clark and Mayer, 2016; Katz and Kim, 2017). Internet technology affects learning and teaching methods positively and creates new learning modalities. Two of these learning modalities are blended learning and social media supported learning.

Blended learning is a pedagogical mode that integrates traditional face-to-face classroom settings along with internet learning activities (Al-Alwani, 2014; Razep and Abel, 2014; Peeraer and Van Petegem, 2015). Blended Learning allows the students to create their own learning experience at their own pace. In addition, it allows students to not merely access learning materials at the university, but also at home, as well as anywhere else (Thorne, 2003). In addition, Osguthorpe and Graham (2003) argued that blended learning provided benefits such as pedagogical development, increased accessibility to knowledge, provision of social interaction, independent learning, reduced costs, less effort, easier correction of work and facilitation of feedback. With blended learning practices students can be engaged in the learning environment from anywhere and can share virtual or audio knowledge materials without any time or place limits. McCarthy (2010) assumed that integrating social media settings into a blended learning mode could help collaboration and coordination among students. Furthermore, interactions between students that take place outside classrooms can provide much pedagogical value such as student-centred learning (Neill and Mcmahon, 2005), social learning (Khechine, Raymond and Augier, 2020) and community of practice (Wenger, McDermott and Snyder, 2002).

2.3.5 Student-centred learning

A student-centred learning (SCL) approach has been increasingly adopted in higher education (Lea, Stephenson and Troy, 2003). The idea of student-centred learning was first put forward by Rogers and Freiberg’s book "Freedom to Learn" (Rogers and Freiberg, 1994; Burnard, 1999; Neill and Mcmahon, 2005; Cowan, 2006). Many policies, research, and practices claim to take a student-centred learning approach to be continued to grow (Felder and Brent, 1996; Biggs, 1999; Cannon and Newble, 2000; Lea, Stephenson and Troy, 2003). However, one of the main concerns about using SCL in higher education is the real meaning behind it (Neill and Mcmahon, 2005). Moreover, it was found that some other terms have been linked to SCL, such as, flexible learning (Taylor, 2000), experiential learning (Burnard, 1999), and self-directed learning (Neill and Mcmahon, 2005). This has led to a confusion in the implementation of SCL.

A range of potentially different definitions of SCL may be identified (Brandes and Ginnis, 1986; Cannon and Newble, 2000; Neill and Mcmahon, 2005). Cannon and Newball (2000, p. 16)
defined student-centred learning as, “ways of thinking and learning that emphasize student responsibility and activity in learning rather than what the teachers are doing”. Basically, SCL has student responsibility and activity at its core, in contrast to the strong emphasis on teacher control and coverage of academic content in traditional and didactic teaching.

Lea, Stephenson and Troy (2003, p.322) suggested some tenets that could be achieved by an SCL approach. These include: “the reliance on active rather than passive learning”, “an emphasis on deep learning and understanding”, “increased responsibility and accountability on the part of the student”, “an increased sense of autonomy in the learner”, “an interdependence between teacher and learner”, “mutual respect within the learner teacher relationship” and “reflexive approach to the teaching and learning process on the part of both teacher and learner”. Student-centred learning can help students to develop their own way of learning, especially the social constructivist one (Niaz, 2010).

2.3.6 Flipped classroom

The flipped classroom is a form of teaching and learning in which students watch educational videos online in advance of and in preparation for, the main teaching episode; thereby allowing the teacher to concentrate on in-depth learning activities in class through actual problem-solving and clinical exposure (Wallace, 2013; Seo et al., 2018). Class time is used to engage learners in problem-based, collaborative learning and advancing concepts. This approach has an advantage of allowing the learner to control the pace and time it takes to learn the material (Bates, Almekdash and Gilchrest-Dunnam, 2017). This means that flipped classroom is active and student-centred (Suebsom, 2020). Alharbi (2015) adopted the flipped classroom approach to deliver a course of health informatics to undergraduate medical students (n=14) using WhatsApp. At the end of the course, a focus group discussion was conducted to explore the students’ perception about the course. Almost all students agreed that the flipped learning activities held through WhatsApp helped them to understand the concepts of the course in an interactive and collaborative learning environment. Additionally, many students believed that this approach supported self-regulated learning as they were able to watch videos at their own pace and could ask questions at any time and receive instant feedback from the instructor and other students in the discussion group over WhatsApp. Seo et al., (2018) used YouTube in a flipped classroom to deliver periodontology lectures to second year dental students (n=69) in Dankook University College of Dentistry, Korea. At the end of the study, students were surveyed using a questionnaire. The results revealed that 82.6% of the students believed that the video lectures were easier to understand than the classroom lectures and 73.9% thought that they would like to view the videos again after graduation.
2.4 Theories of education

Many learning theories explained the value of integrating social media in education to support active, collaborative, and student-centred learning (Table 2.1).

2.4.1 Social Constructivist Learning

Social constructivism is a learning theory based on the ideas of Vygotsky (1962) who believed that “human development is socially situated, and knowledge is constructed through interaction with others” (Oun-or, Viriyavejakul and Tuntiwongwanich, 2018, p.208). Lev Vygotsky, the founding father of social constructivism believed in learning through social interaction. Social constructivism is based on the social interactions between the students inside and outside the classroom along with a personal critical thinking process (Kalina and Powell, 2009). Students’ collaboration and interaction, creating one’s own knowledge, building upon prior knowledge, and discovering learning and reflection, are all some effective ways of learning that can be achieved by social constructivism (Perkins, 1999; Poerksen, 2004; Tangney, 2014).

The theory of social constructivist learning includes different forms that were more active than passive. In the traditional teacher-centred pedagogy, learning is viewed as being conveyed from the tutor to the learner. While, in the social constructivist setting, learning is considered more to be active and student-centred in which the students are supported and directed in their own development of comprehension within their sociocultural setting and work together effectively with others on their learning (Ginns and Ellis, 2007). Hence, when individuals develop knowledge during the active experience, collaboration, exploration, reflection, and discovery of the learning process, social constructivist learning takes place (Kiraly, 2012).

The social setting where collaborative efforts are used to develop the knowledge is the best place to locate such a learning style. In order to achieve this, the learners share their knowledge and help each other. Social media offer a useful setting that allow for online collaboration, interaction and sharing of knowledge (Yang and Wu, 2012). Social media are participative web tools which contain interactive content and involve action and reaction simultaneously. For example, if an individual posts a blog about any subject, others can read it and comment on it based on their experience and knowledge. This feedback and interaction with different users enable the learners to obtain new ideas and thoughts which facilitate the process of collaborative learning (Tang and Liu, 2012; Zafarani, Abbasi and Liu, 2014).

The elements of social constructivism and the benefits of social media seem to be well matched. Technological advancement and growth of online web tools are continuously progressing and enable people to interact, to explore new ways of thinking and to exchange
ideas and information, which ultimately will evolve into learning experiences (Amin, 2018). At university, a shift from a transmission pedagogical mode, pre-packaged content, and lecturers as authority figures, towards an informal, constructivist mode that foregrounds knowledge construction and student control of learning, presents diverse pedagogical opportunities for deep learning (Rambe, 2012).

Social media have the potential to change the higher education model from the traditional structure of classrooms to a 24/7 asynchronous structure. McLoughlin and Lee (2010) argued that theory of social constructivism could be applied to teaching with social media as learning is conversational in nature, that includes dialogue and sharing of activities. Moreover, social networking can become a motivation for student-centred learning approaches and collaboration. The authors also pointed out that social software applications promote active participation and student self-direction.

2.4.2 Social learning theory

The concept of social learning took its roots from the social learning theory which was developed in the early 1960s by the Canadian psychologist Albert Bandura. According to this theory, sharing mutual interests allows sharing implicit knowledge and skills through interaction (Bandura, 1977; Langley, 2007; Khechine, Raymond and Augier, 2020). Bandura (1977) argued that most of our knowledge is generated from our physical social environment. This means that there is a robust relationship between the learner and his or her environment (Bandura, 1971). Social learning theory introduced the concept of observational learning and the cognitive processes that follow it (Landers, Mahony and McCarthy, 2020). New knowledge can be developed through directly experiencing situations or by observing the behaviour of others in a situation. Bandura (1977) suggested that people learn by observing others like parents, friends, classmates, and colleagues.

Students extend learning outside classrooms to learn from each other’s backgrounds, knowledge, and experiences. Knowledge is not only transmitted between them, but also constructed by means of the collaborative activities of learning (Popescu and Cioiu, 2011). In this context, knowledge is constructed through the social interaction among the students themselves and between them and their teachers (Khechine, Raymond and Augier, 2020).

The social learning theory was extended to the virtual world by replacing the “physical social environment” with the “virtual” one using Web 2.0 technologies (Smith and Berge, 2009; Raspopovic et al., 2017). Teachers who still deliver face-to-face in-classroom courses realized the effect of utilizing online social interacting tools on the success of blended courses. Coping with a generation of students that is always connected to social media, the teachers tried to
integrate social learning in face-to-face courses, as in blended learning. According to Popescu and Cioiu (2011) instructors should adapt traditional teaching methods to respond to the needs of what is called the “Internet generation” and this can be done by adopting online social learning.

2.4.3 Communities of practice

Communities of practice (CoP) is a learning theory founded through observing apprenticeship learning (Lave and Wenger, 1991). It encouraged education innovators to focus on factors such as culture, activities, and the context in which learning happens. A community of practice occurs when a group of members share a concern, a set of problems or a passion, and improve their knowledge or skills by interaction through an activity (Wenger, 1991). Consequently, participants become able to gain knowledge and feedback from their peers (Bourdieu, 1991). Traditionally, CoP was based on face-to-face communications (Wenger, McDermott and Snyder, 2002) but in the world of globalization and information technology, holding face-to-face meetings on a regular basis is slow, time consuming, and costly. New communication technologies have allowed CoPs to become easier using virtual platforms (Dubé, Bourhis and Jacob, 2005).

A CoP is called “virtual” when its members use information and communication technology (ICT) as their main method of interaction. A new terminology has arisen, called Virtual Community of Practice (VCoP). Using virtual methods does not replace the use of face-to-face meetings, but many factors, including geographical distances and busy schedules, made communication through ICT much more useful. Face-to-face meetings, however, have been shown to be important for building relationships and trust among members, and most VCoPs use them on a regular basis (Storck and Hill, 2000). A VCoP may use a large variety of traditional media (phone, fax, teleconferencing, etc.), sophisticated technological tools (e-mail, videoconferencing, common databases, intranet, web sites, etc.) and recently social media to support its members’ interactions (Dubé, Bourhis and Jacob, 2005; Smith and Lambert, 2014; Thoma et al., 2018).

Duncan et al. (2013) explored the impact of using Facebook in higher education courses on developing a community of practice and how it affected students’ sense of classroom community. The authors revealed that incorporating Facebook into a course’s instructional design enhanced students’ collaboration and interaction. This most likely is due to the nature of Web 2.0 technology. It was found that students were able to engage in group discussions and communicate with classmates in their Facebook group. They were also able to find and
share educational materials and to promote the sharing knowledge. The authors concluded Facebook improved a CoP that was supplementing to both teaching and learning.

2.4.4 Situated Learning Theory

Situated learning theory states that learning process takes place not only within the individual learner’s mind, but also among learners within an interactive community. Group knowledge is not only the property of individuals to gain knowledge, but also of the interactive community or the social network in which such knowledge is negotiated and discussed (Lave and Wenger, 1991; Hutchins, 1993; Glynn, Lant and Milliken, 1994). Group learning is a collective experience in which group members generate, retain, and transfer knowledge among themselves (Argote and Ingram, 2000).

Situated learning theory moved attention from an individual’s mind to connections among different minds; and from the property of one learner to the interaction among a group of learners, in addition to the cognitive effect of the environment upon learners (Lave and Wenger, 1991; Greeno and Moore, 1993; Weick and Roberts, 1993; Glynn, Lant and Milliken, 1994; Lant and Phelps, 1999). Learners are not isolated individuals but participants within communities (Lave and Wenger, 1991). Bandura (1977) argued that individual learning is not separate from collective learning; and situated learning should be applied as an evolving approach within an interactive context (Lant and Phelps, 1999).

In line with social constructivism, situated learning theory appears to support social networking platforms as educational tools in the classroom (Hung and Yuen, 2010). The theory views learning as set in a participatory social context. According to Lave and Wenger (1991) situated learning expanded the model of knowledge construction by proposing that learning is situated in a specific context and embedded in a particular social environment. In this context, social media offered an opportunity to allow for learners` collaboration and knowledge construction through this collaboration.

2.4.5 Connectivism

Internet-connected devices have enabled seamless interactions between individuals and information at a scale that benefits educational developers. Siemens (2005) and Downes (2007) recommended changing learning behaviours based on the explanations available from previous learning theories. Connectivism learning reported that the use of networking tools facilitated connections between human and non-human information resources at three levels: the cognitive, conceptual, and social. Networks of individuals and groups can be developed through meaningful incorporation of information gathered from interactions with resources. Learning comes from the active learner participation (supported by technology) resulting in
the formation of cognitive, conceptual or social networks (Campbell, Craig and Collier-Reed, 2020). Connectivism learning activities should widen the learning networks of students. Social media allowed for some activities such as accessing online educational resources, synthesizing information, critical evaluation, and developing self-generated content through blogs, wikies, videos and comments (Campbell, Craig and Collier-Reed, 2020).

2.4.6 The theory of weak ties

Granovetter (1973) collected data from 282 individuals who started new jobs in the previous year in Boston. The findings of his study showed that most of the respondents had heard about those new jobs from contacts that were considered not to be close friends. Thus, the author introduced the theory of “the strength of weak ties”. The term “ties” is defined as our connections with other people. Ties were classified by Granovetter (1973) into strong and weak variations. Strong ties are those kinds of relations that connect us with close people such as close friends, relatives, or family members. Conversely, weak ties act as relations with further apart contacts. Granovetter (1973) introduced the term “bridge” to describe the connections (weak ties) between separate groups. The theory of weak ties stated that “networks saturated with ‘weak’ ties, social relationships, which are typified by infrequent interaction, short history, and limited (emotional) closeness, are particularly valuable to the production of creative ideas because they allow for enhanced access and exposure to socially distant pockets of information—information that is likely to be novel and, therefore, likely to spur the combinatory process underlying the production of creative ideas” (Baer, 2010, p. 592). Nowadays, social media are based on different groups of people that are connected to each other, mainly, through weak ties (Kavianpour, Ismail and Shanmugam, 2014).

The role of weak ties in the diffusion of innovation and information was illustrated by Rogers (2003). The author stated that one’s far acquaintances are more useful as a channel for obtaining such information. Far acquaintances are more likely to possess information that an individual does not already possess, such as information about a new job or about an innovation. Some scholars proposed that social media allowed for enlarging social networks between people, and so, it increased their chances of mobilizing information (Gil de Zúñiga, Jung and Valenzuela, 2012; Tang and Lee, 2013). Larger networks may increase exposure to information about how and why an individual should become active. Larger networks are also more likely to contain more weak ties, which facilitate information flow between individuals (Verba, Schlozman and Brady, 1995; McPherson, Smith-Lovin and Brashears, 2006; Musick and Wilson, 2008).
Most social media mainly depend on the strength of weak ties. LinkedIn for example is a social networking site that helps individuals to find new jobs. It depends mainly on the weak ties between individuals on the website. Most of the ties on Facebook are weak. Ties between close friends on Facebook are considered as strong ties, but what is the ratio of close friends one has on Facebook in comparison with those that one may not have strong connections with? That is the role of weak ties in the developing of social networks (De Meo et al., 2014).

Table 2.1 learning theories

<table>
<thead>
<tr>
<th>Authors</th>
<th>The theory title</th>
<th>Theory stating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vygotsky (1962)</td>
<td>Social Constructivist Learning</td>
<td>Human development is socially situated, and knowledge is constructed through interaction with others.</td>
</tr>
<tr>
<td>Bandura (1977)</td>
<td>Social learning theory</td>
<td>Sharing mutual interests allows sharing implicit knowledge and skills through interaction.</td>
</tr>
<tr>
<td>Lave and Wenger (1991)</td>
<td>Communities of practice</td>
<td>A community of practice (CoP) is a group of people who &quot;share a concern or a passion for something they do and learn how to do it better as they interact regularly.&quot;</td>
</tr>
<tr>
<td>Lave and Wenger (1991)</td>
<td>Situated Learning Theory</td>
<td>Learning process takes place not only within the individual learner’s mind, but also among learners within an interactive community.</td>
</tr>
<tr>
<td>Siemens (2005)</td>
<td>Connectivism</td>
<td>The use of networking tools facilitated connections between human and non-human information resources at three levels: the cognitive, conceptual, and social.</td>
</tr>
<tr>
<td>Granovetter (1973);</td>
<td>The theory of weak ties</td>
<td>The strength of weak ties: &quot;networks saturated with &quot;weak&quot; ties, social relationships, which are typified by infrequent interaction, short history, and limited (emotional) closeness, are particularly valuable to the production of creative ideas because they allow for enhanced access and exposure to socially distant pockets of information—information that is likely to be novel and, therefore, likely to spur the combinatory process underlying the production of creative ideas&quot;</td>
</tr>
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</table>
2.5 The use of social media in education

The critical transformation of the internet into a social web has been due to many technological innovations, such as the use of browsers instead of desktop platforms, the evolution of smartphone technology, and the widespread use of computers (Kimmerle et al., 2015). As a result, tools, technologies and services like wikis, blogs, social networking sites, online forums, and social tagging tools have been utilized not merely in everyday routine activity, but also in the educational context (O’Reilly, 2005). These tools, technologies and services also have an impact on the way people learn, share information, and build knowledge (Kolbitsch and Maurer, 2006). Social media provide meaningful ways that support interaction and collaboration among individuals, allowing them to build connections and exchange useful content. This phenomenon has inspired many educational innovators and researchers to think about the optimal ways to utilize social media for teaching and learning purposes (Friesen and Lowe, 2012; Ravenscroft et al., 2012; Mao, 2014).

In the early days of introducing social media tools to educational settings, there was an insistence to transfer Internet students’ and teachers’ enthusiasm to the classroom (Baird and Fisher, 2005). At that time, the differences between formal and informal educational settings were not clear. More recently, most educational researchers and designers have become aware of these issues and their circumstances and have accordingly started to utilize social media in educational settings more carefully (Friesen and Lowe, 2012; Ravenscroft et al., 2012; Andersson et al., 2014).

Utilizing social media may cause some changes in the formal learning settings, for example, when a class of students creates a Facebook group for sharing course-related announcements, documents, or educational materials (Wang et al., 2012; Wodzicki, Schwämmlein and Moskaliuk, 2012). From an educational point of view, this development is highly relevant, as it may influence how students learn. On one hand, students may benefit from the huge quantity of the accessible information found on social media using different devices and mobile technologies. On the other hand, social media provided an easy channel for the students to collaborate for educational purposes. In addition, social media could be used to organize meetings, manage project groups (Madge et al., 2009) or to share information about instructions or deadlines (Greenhow and Robelia, 2009).

2.6 Teachers’ role in learning through social media

Learning through social media gave an opportunity for students to take responsibility and regulate their own collaborative learning environment. This means that the teacher is no longer the main controller. The teacher acts as a guide, while students are encouraged to be the
active controllers of their own learning environment. Students set a plan for their activities and assume different roles within a group, which means that everyone in this group is considered as both learner and tutor. Here, the role of teachers is to support and set the right tone for the discussion, and to participate in developing a meaningful learning community (Devi, Gouthami and Lakshmi, 2019). The teacher’s role was described by De Laat et al. (2007) as rich and delicate. The teacher has to use his/her pedagogical experience to create a supportive climate for learning, but in a balanced performance, which means that, the teacher does not interfere with the activities of the students directly. Instead, he/she should keep his/her eyes on the group without immediate interference, but he/she should be ready to assist anytime. This needs a kind of trustable relation between the teachers and their students. This also helps students to seek their own rhythms and ways of collaboratively learning (De Laat et al., 2007).

Mistry (2011) explored the effectiveness of Twitter as a teaching tool at the clinical Simulation Centre at the University of Glamorgan, UK. Four short clinical scenario videos were posted on a twitter group and participants (n=24) were asked to comment (tweet) on the videos. At the end of the study, students’ perceptions were surveyed through focus group discussions and semi-structured interviews. The students felt that Twitter was a good way for interactive and collaborative learning. Online discussions helped students in critical thinking. Students liked the ease of using Twitter and the flexibility of learning provided by it. Some participants thought combining the class with Twitter would be more engaging. Social media offered various ways for communication among the students themselves, between the students and their teachers or among the teachers. Consequently, they enabled both students and their teachers to create scaffolding contexts to connect them all together (Devi, Gouthami and Lakshmi, 2019).

2.7 Formal and Informal Learning
Various researchers have identified that social media somehow caused a tension between formal and informal learning (Buckingham, 2007). Researchers have also highlighted that the debate about formal and informal learning is still questionable among educational institutions. According to a review research conducted by Dabbagh and Kitsantas (2012) who evaluated the personal learning environment and its relation to social media, the factor that resulted in unclear boundaries between formal and informal learning was social media. A sense of unease and discomfort could be experienced by the instructors, learners, and the institution due to the unclear nature these boundaries caused by social media. In today’s competitive environmental setting, we meet obstacles and overcome them through a process of assimilation. Assimilating means dealing with the obstacle and interpreting it. In order to deal with a task, it is necessary to reorganize the mental structures to understand it and find a
solution. Dabbagh and Kitsantas (2012) suggested that formal frameworks should be found in order to use social media within the higher education context.

Mcloughlin and Lee (2010) argued that the use of social media for educational purposes was required by some learners. In order to strengthen their learning in more formal environments, some of these technologies, that are already in use, could be further used by most learners.

**Summary**

The adoption of social media as popular communication forms could be a tool that brings learners together enabling active and collaborative learning. Therefore, it is becoming more essential for educators and institutions of higher education. Students will prefer the university that is student-centred and accumulates the time of study around the needs of the students rather than the needs of the institution (Laurillard, 2002). However, the adoption of social media needs to come with an understanding of what social media are and what features of social media appeal to students. The institutes of higher education might fail to see the benefits provided by social media due to the imposition of directions and regulations. This is indeed a paradox and a conflict. The following section will look at the potential issues of using social media in higher education.

### 2.8 Conflict and Paradox

In order to explore, discover and learn, social media were considered as exciting networking tools where people interact, exchange, and develop understandings. However, this approach is still relatively unknown. In addition, higher education institutions have a rigid hierarchical structure which is not flexible in terms of adopting this new mode of instruction (Larsson and Kalsnes, 2014). This means that adopting any change can become a source of conflict. New practices have highlighted the fact that social media are a “disruptive technology” and in this context, it challenges traditional behaviour and learning (Ting, 2015). The concept of “disruptive technology” has evolved to explain the accumulation of value by entrants to new technology and their replacement by traditional technology in existing markets (Rambe, 2012). In academia, a technological disruption arose when educators used technology in ways that the original inventors and designers might never have imagined (Gower *et al.*, 2001). Despite all of the previously mentioned benefits of using social media in higher education, many authors, students, and teachers expressed some concerns related to using social media for educational purposes (Figure 2.2).
2.8.1 Distractive tools

Research on social media highlighted some academic concerns regarding its distractive nature (Indu, Cherian and Kandoul, 2018; Al-rabab et al., 2019). Social Media perceivably distracts the less academically motivated students from learning (Pierce and Vaca, 2008; Watters, 2011; Weiler et al., 2015). Watters (2011) argued that instant messaging encouraged off-task behaviours inside classrooms, the same way exchanging off-topic messages and informally passing of notes can be distractive. The ubiquity of social media-enabled smart phones at universities associated with students` “texting culture,” generate chaos and a lack of concentration. The volume of exchanged tweets, students` limited attention spans, loss of context as information flows across different interactants and platforms are some of the drawbacks of communication through social media (Fincham, 2011).

Liew (2010) argued that despite the social constructivist learning abilities of social media, the blurring of formal and informal spaces with blogs and their diverse back-talk actions (from joking, slander, vicious grievances and rumour) complicated universities` potential use of social media for learning. Weiler et al. (2015) evaluated the use of social media by pharmacy students (n=948) at five different pharmacy schools in the USA. At the end of the study, the results revealed that 99.5% of participants reported watching other students using social media during the classroom time. The average amount of time participants reported using social media during 50-minute lectures was 9.3 minutes. These results reflected the distractive nature of social media.
Lee et al. (2016) reported that approximately one third of the participating undergraduate dental students (n=188) at a private university in Malaysia used mobile texting and Facebook “excessively”. “Excessive mobile texting and Facebook use” were defined by the authors of that study as: “if two or more of the following conditions are present: the feeling that he or she should reduce texting habits or Facebook usage; feelings of annoyance when he or she is criticised with regard to his or her texting habits or Facebook usage; and feelings of negativity or guilt about texting habits or Facebook usage; individuals partake in mobile texting or Facebook usage first thing in the morning to steady nerves or as a remedy for a hangover” (Lee et al., 2016, p. 219). In the light of this study, the authors recommended exploiting this “excessive” usage of Facebook by dental students for educational purposes. However, “excessive” engagement of dental students in mobile texting and Facebook may have a negative impact on students` performance during classroom lectures, observing clinical procedures or clinical practice or patient interactions, and subsequent examination performance. As “excessive” use can lead to an addiction of Facebook and mobile texting, the authors recommended to create awareness among students regarding the meaningful use of social media through health education and promotion. Meanwhile, students have been advised to train themselves for self-control in terms of mobile texting and Facebook usage to avoid “excessive” use of these two forms of media (Lee et al., 2016).

2.8.2 Quality concerns

Accreditation and quality concerns were considered among the main values held by the academic institution in order to guarantee a high-quality education (Cartledge, Miller and Phillips, 2013). Institutions have established boards of accreditation and quality assurance measures to ensure that the traditional standards are achieved (Hiemstra, 2006). In this context, learning through social media is considered non-traditional and can produce new outcomes that might be problematic for institutions of higher education (Tess, 2013). Assessing these outcomes is required. McConnell (2006) argued that in order to evaluate e-learning potential in higher education, the crucial issue was the quality of the learning experience of the students. McGee and Begg (2008) warned that the standards of learning in higher education institutions are affected by the challenges created by social media. For this reason, policies related to social media adoption require careful examination. Although the students might be actively engaged with social media, using it as part of a learning method requires considerable modification along with assurances that the learning of the students can still be accredited. Preparing the students to overcome the challenges, they will face in their professional life is very important (McGee and Begg, 2008).
2.8.3 Academic dishonesty
The increased incidences of plagiarism, inappropriate citations, and breaking copyright laws account for academics' hesitation to utilise social media in higher education. The "copy-cut-and-paste" students frequently take advantage of social media's technologies to re-organise, edit, remix and recreate content for republication, thus plagiarising texts with impunity (Rambe, 2012). Seitz, Orsini and Gringle (2011) searched the video sharing website www.YouTube.com for the presence of academic cheating contents involving posting of instructional cheating videos online. A total of 43 videos were included in this study. Most of the viewers were male (79%) and at a school or university educational stage. The analysis of comments under each video revealed many positive feedbacks from the students encouraging and motivating them to adopt the cheating methods revealed in the videos. Their findings suggested the presence of technologically aided instructional cheating on exams, homework and assignments, and the popularity of cheating videos, judged by the positive feedback they received from viewers. The authors have advised the educators to be familiar with the different cheating ways published on YouTube videos, which could be used by students.

Szabo and Underwood (2004) identified fear of failure and the appeal of using freely available information on the Internet as credible reasons for student engagement in academic dishonesty. Their study reported that more than 30% of the 291 participants surveyed admitted to copying information from the Web and incorporating it into their assignments without acknowledging their sources. Threats of using social media to copy information or duplicate peers' work in progress and projects, often discourage educators from using them in higher education.

2.8.4 Professionalism
Unprofessional behaviours of health care students using social media were highlighted in many studies that revealed that they violated professional standards when posting information on social media sites (Lagu et al., 2008; Thompson et al., 2008; Chretien et al., 2009). Examples of unprofessional behaviour included illegal postings of photographs of patients; sexually related content; negative perceptions related to their universities, faculty members, courses, and/or colleagues; and content that included illicit substance use (Chretien et al., 2010; Henry and Pieren, 2014; O'Connor et al., 2018). The negative perceptions these postings may create can affect not only the individual, but also the educational institution in general. Teenagers' critique and public embarrassment of educators and academic authorities on their blogs compel universities to question their academic value. Similarly, despite Facebook's ability to enhance peer-based academic communication and collaborative inquiry, Selwyn (2007) reported its use by academically challenged students to rival unequal teacher-
student relationships offline. Thus, the unprofessional actions of a few individuals on social media can negatively affect the trust of the public in the entire profession or the institution (Oakley and Spallek, 2012).

Some scholars (Ofri, 2011; Spallek et al., 2015) argued that health care professionals should eliminate social media for personal use as it seems to be hard to separate this from their professional use. This, however, appears to be unreasonable and unfair to deprive health care professionals from the benefits of social media. It seems much more reasonable to understand the principles controlling the professional use of this technology and use those principles to develop guidelines for helping health care professionals safely negotiate their personal and professional roles through social media (Ofri, 2011).

Contract law principles were utilized by many medical institutions and universities. Manuals and handbooks act as a useful guide for both health care students and staff members to identify acceptable behaviour and actions and form a basis for applying disciplinary action when necessary. Many student handbooks and manuals now are available to determine policies governing the use of social media and patient confidentiality sections in order to make school policy clear and to make these provisions part of the “contract” with the student. Many students and staff members may not be aware that, by agreeing to follow the faculty handbook or manual, they are essentially signing a contract with which they agree to comply to the faculty’s guidelines and policies. These polices are also essential to govern the privacy and security of private information about the patients (Parkinson and Turner, 2014). (Figure 1.2)

2.9 Using social media for education in secondary schools

Scholars have shown that teenagers and young adults used social media technology for various social purposes, such as personality reflections (Back, 2010) emotional disclosure and life satisfaction (Manago, Taylor and Greenfield, 2012). Social media have been used for learning and teaching at various levels of education in secondary schools (Konieczny, 2012; Parker and Chao, 2007; Mak and Coniam, 2008). Chu et al. (2017) examined the use of wikis to support collaboration in a secondary school group writing project in Hong Kong. Based on the analysis of several interviews and questionnaires, it was found that group writing performance was enhanced through the wikis promoting collaboration. This study showed the pedagogical value of online technologies and their positive impact on the learning process. This was supported by Yunus et al. (2013) who found that secondary school students gained more vocabulary knowledge and improved their writing skills as a result of their participation on social media sites such as Facebook and Twitter.
In a study conducted by Bermudez et al. (2016) social media sites such as YouTube, Google Doc, Google Plus, Vimeo and Facebook acted as useful tools to help secondary school students in developing countries to learn the English language. They played an important role in developing their listening, writing, and reading skills. As a result, this improved the students’ academic performance. The benefits and risks of the use of social media by secondary school students were highlighted in a study created by Mulisa and Getahun (2018). The results from five secondary schools in Ethiopia (5879 participants) showed that students used social media for entertainment and social interactions rather than educational purposes. The benefits of social media could be recreation, relational drives, academic activities, or information seeking, while risks were represented by academic fatigue, economic constraints, emotional detachment, social isolation, health related issues or cyberbullying (Mulisa and Getahun, 2018).

2.10 Using social media in higher education

Recent years have witnessed an increased interest in utilizing social media with teaching and learning courses in higher education (Devi, Gouthami and Lakshmi, 2019). Because of the prevalence of social media in general, many higher education instructors have recommended to use this technology to improve and enhance the learning process in higher education (Anderson et al., 2007; Fernstrom et al., 2008; Mcloughlin and Lee, 2010; Selwyn, 2010). The new educational tools offered by social media have created a growing phenomenon in public and academic use, changed the way institutions and students engage, and changed the way of sharing existing or newly produced information through multi-way communication. With the use of social media, interaction through computer and mobile devices has become easier (Teclehaimanot and Hickman, 2011).

Of course, using social media may require the instructor to consider not only the practical integration of these tools into course goals, but also the theoretical framework for utilisation of the new technology as a learning tool (Alber et al., 2014). Social media allowed university students to seamlessly contact each other and collaborate for their projects and assignments. Students also could work on group assignments and tasks at their own pace. In addition, social media provided a solution for students who have difficulties with participating inside the classroom. They can, instead, get involved in the learning process through online platforms. This helps to build their confidence levels as well. Any doubts can be clarified by posting a message through social media. Platforms like Facebook, Twitter, WhatsApp etc. helped the teachers to stay in contact with their students. Social media also offered the freedom for university students to connect and collaborate outside of formal institutional boundaries as well as to gain practical experience (Devi, Gouthami and Lakshmi, 2019).
Selwyn (2010) argued that three interrelated concepts should motivate the use of social media in higher education:

a. The changing nature of the student who comes to the university nowadays as he/she has become highly connected, collective, and creative.

b. The changing relationship between the university student and knowledge construction, knowledge consumption, and formal education.

c. The de-emphasis of institutionally based learning and emergence of “user-driven” education.

Bosslet et al. (2011) found that 90% of medical students in the United States of America used Facebook, a figure which has most likely grown since. Using Facebook in medical education was found to encourage collaboration and provided quick feedback because of its ease of use. It is also well tailored to sharing media from other sites such as Instagram and YouTube (Jaffar, 2014). A study in Michigan State University (MSU) (Ellison, Steinfield and Lampe, 2007) included 286 undergraduate medical students and revealed that Facebook had a very positive psychological impact on students’ wellbeing, especially for those with low self-confidence and low life satisfaction. The participants perceived that Facebook helped to maintain relationships between students, even when life changed, and they moved away from each other. These findings demonstrated a strong relationship between Facebook usage and the bridging of social capital.

Bourdieu and Wacquant (1992, p.14) defined social capital as “the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition”. However, in a systematic review involving 39 articles, Hew (2011) suggested that Facebook had a limited educational use and students used Facebook mainly to keep in touch with each other. This study also revealed that students tend to post their personal information on Facebook which may impact adversely on their privacy.

2.11 The use of social media in healthcare education

A range of social media platforms have been used for learning and teaching different healthcare disciplines such as medicine (Jaffar, 2014; Alsuraihi et al., 2016; Barry et al., 2016; C. M. Hennessy et al., 2016; Reames et al., 2016; El Bialy and Ayoub, 2017; Masood et al., 2017; Guraya et al., 2018) Pharmacy (Cordos, Bolboacă and Drugan, 2016; Hamilton et al., 2016; Desselle, 2017) and Nursing (Tower, Latimer and Hewitt, 2014; Ferguson et al., 2016). The efficacy of social media as supplementary educational tools in healthcare education have
attracted many scholars to assess the perceptions of healthcare students and to discover how they use social media in healthcare education. Social media platforms like Facebook, Twitter, Instagram, YouTube, WhatsApp, Google+, Pinterest and SurveyMonkey have been used by healthcare students and their teachers for learning and teaching purposes.

Jaffar (2014) assessed second-year medical students’ (n=157) use of a Facebook page and their perceptions of the page as a supplementary anatomy educational tool. The results revealed that 89% of the students perceived that the Facebook page was useful to contribute to their learning experience and 84% agreed that Facebook could be a suitable learning environment, but there were concerns about distraction, privacy, and safety issues. This was agreed by Tower, Latimer, and Hewitt (2014) who explored undergraduate nursing students’ (n=89) perceptions about using Facebook as an adjunctive learning tool in nursing education. Students enrolled in a “Medications and Safe Administration” course and were invited to join a Facebook group that was created by the course instructors to help students’ collaboration within the course. At the end of the study, 88.6% agreed or strongly agreed that Facebook supported their examination preparation. 88.9% felt taking part in the Facebook group improved their knowledge about the subject. 92% received help from other students via the group. 83% believed that Facebook encouraged students’ collaboration and interaction.

Barry et al. (2016) evaluated undergraduate medical and radiation therapy students’ (n=75) use of online social media in relation to anatomy learning. At the end of the study, the statistics revealed that 78% used YouTube as their main source of anatomy-related video clips and the same ratio highlighted the usefulness of those videos. However, 59% of students preferred in class communication with the tutor compared to online communication through social media. Reames et al. (2016) evaluated the use of Twitter as an educational tool in a medical school surgery clerkship. The authors created a Twitter account for third year medical students (n=66) and posted approximately 3 educational tweets per day consisting of succinct surgical facts. At the end of the study, 59% of the participants believed that Twitter influenced their educational experience positively. However, no significant differences were found between the scores of the students and those of the historical records. This was supported by Hennessy et al. (2016) who assessed using Twitter to enhance second year medical students’ (n=155) learning experience in anatomy. The results revealed that only 33% reported that they engaged with the hashtag by contributing with tweets.

Ferguson et al. (2016) explored first year nursing students’ (n=10) experiences with social media to support transition and engagement at the Faculty of Health, University of Technology, Australia through three focus group discussions. The participants reported their interaction
through Facebook to work on group assignments, share educational resources, get advice and support from peers and exchange clinical information. In the same line, Alsurfaihi et al. (2016) assessed how undergraduate medical students (N=657) from 23 different Saudi Arabian medical schools used social media for educational purposes. The statistics revealed that 87.7% used social media in their education. YouTube was the most common platform used for educational purposes (42.3%). 95% of participants believed that social media were useful for medical education. Females used social media to communicate with their tutors significantly more than males. 40% thought that social media were distracting platforms. Another study (Guraya et al., 2018) was conducted in two Saudi and one Kuwaiti medical schools to determine the educational use of social networking sites by undergraduate medical students (n=1312). The results showed that 90% used SNSs. 37% used SNSs for educational purposes. 27% used SNSs for sharing educational materials with their peers once a day. 52% used Facebook for educational purposes. 38% used SNSs for sharing lectures with each other.

El Bialy and Ayoub (2017) explored pre-clerkship medical students` (N = 160) use of social media, particularly Facebook, in medical education at University of Ottawa, Canada. The results of this study revealed that 94% of respondents used social media to facilitate their learning. The students mostly used Facebook groups for histology (30%) physiology (21%) etc. 60% of students used social media to communicate with their colleagues. 59.8% stated that they preferred Facebook groups over pages. However, some participants expressed some concerns related to the risk of distraction in addition to some privacy concerns. This was agreed by Masood et al. (2017) who examined the effectiveness of social media as tools for learning, communication and knowledge, among final year medical students (n=400) from different Lahore, India based medical colleges. At the end of the study, 75% expressed that social media were useful tools for communication. 85% believed that social media facilitated sharing healthcare information. 90.7% believed that social media promoted academic activities. Participants reported that social media improved the communication-quality with patients (80%) and professionals (75%). 82% described social media as useful sources of health care information. 80% mentioned that SNSs offered medical students a learning platform.

2.12 The use of social media in dental education

Social media have shaped the interpersonal behaviours of dental students and thereby have influenced the dental education system in many dental schools (Spallek et al., 2015). For example, social media have provided dental students and their teachers an alternative informal information system. This new system allowed for fast and easy communication
among both students and their teachers. Through social media platforms, students who skip a lecture can identify what they have missed and what kind of information they need to know before the teacher has even concluded the lecture (McAndrew and Johnston, 2012). Kraut et al. (1990) argued that an informal networking system could be more useful for university students than the formal one, because of the fast, easy, and accessible communication that can be offered by such informal settings.

Many social media platforms have shown their usefulness for learning and teaching purposes in the dental education context. For example, dental teachers were able to use Twitter as a way to engage large groups of students and collect their feedback (Arnett, Loewen and Romito, 2013). The ease, flexibility, accessibility and ability of sharing and communication can also encourage peer and group learning and teaching and can connect students to their colleges and coursework (McAndrew and Johnston, 2012). McAndrew and Johnston (2012) reported that many dental students used to share educational YouTube videos with each other to improve their knowledge. Moreover, it was reported that dental students tend to create wikis for educational purposes and a user-generated online encyclopaedia to demonstrate the integration of basic and clinical sciences (Philip, Unruh, Lachman, 2008). Other online web tools for dental education have included peer-reviewed settings that allow for self-assessment, such as Mededportal (www.mededportal.org) and applications like Quizdojo (quizdojo.com) and Quizlet (quizlet.com). In addition, social media offered an opportunity to inform and recruit patients, not merely for clinical care but also for scientific studies and clinical trials (Spallek et al., 2015).

An audit investigating current Instagram accounts focusing on anatomy education in medicine and dentistry found a variety of successful educational methods, including case studies, clinical images, descriptive videos, new treatment techniques in dentistry, new dental materials, multiple-choice questions, and cartoons. Some accounts have shown a wide popularity among users. The same investigation, that was conducted in January 2018, revealed that educational Instagram accounts like “dentistmyworld” had 332,000 followers and “dentistry.world” had 277,000 followers (Douglas et al., 2019). The authors recommended to utilise Instagram for educational purposes and suggested that benefits such as ease of use, accessibility, hashtags, and its effectiveness in illustrating visual topics should be weighed up against some limitations such as passive learning and the requirement of committed staff to oversee its use.

Social media can foster professional networking (Giordano, 2011) and promote the achievement of clinical excellence (Batt-Rawden et al., 2014). Continuing education (CE)
videos on YouTube, virtual study clubs and blogging can diminish the knowledge gap between general dental practitioners and specialists who can provide clinical advice through some online platforms (Farnan and Arora, 2011). “Dentaltown”, a division of “Farran Media”, LLC (www.dentaltown.com) and “David Dodell’s Internet Dental Forum” (www.internetdentalforum.org/) are global educational sites that host dental forums, message boards, CE courses, and dental information news. Dentists can discuss clinical topics, such as management of oral diseases, techniques of treatment or innovated dental materials and the impact on their clinical practice (Song et al., 2013).

Many scholars (Donahue, 2012; Ramo and Prochaska, 2012; Kapp, Peters and Oliver, 2013; Morgan, Jorm and Mackinnon, 2013) advised dental schools and institutions to monitor social media “chatter,” comprised of postings by patients, students, and staff members about their organization. Such monitoring can give schools an overview of their impact on the community and help discover potential problems. Thus, it would be beneficial for schools to frequently conduct online searches of the organization’s name and related keywords and to establish “Google Alerts” so they can respond to inaccurate and/or potentially damaging information posted online (Spallek et al., 2015).

2.13 The role of social media in dental education during the COVID-19 pandemic

In December 2019, a series of cases with acute atypical respiratory disease were diagnosed in Wuhan, China. This rapidly spread from Wuhan to other surrounding areas. It was soon discovered that a novel coronavirus was the responsible micro-organism. The novel coronavirus disease that was found initially in 2019 was named as the COVID-19 pandemic. The “pandemic” characteristic was declared by the World Health Organization (WHO) in early 2020. COVID-19 has been impacting a large number of people worldwide. In April 2020, around 1,400,000 cases worldwide were reported according to the Centre for Systems Science and Engineering (CSSE) at John Hopkins University (Yuki, Fujiogi and Koutsogiannaki, 2020).

The COVID-19 pandemic has impacted social life globally. Most of the countries around the world have adopted firm regulations in order to avoid the spread of the virus. These regulations aimed to limit face-to-face communication. To achieve that, most governments have set some rules to obligate social distancing among individuals, wearing face masks out of homes, and learning and working from home whenever possible (Chang, Hong and Paganelli, 2021). Consequently, most dental schools, as other university disciplines, around the world directed the educational process online instead of using classroom settings. Additionally, at the beginning of the pandemic, clinical and preclinical activities were suspended for an initially
unpredictable time. Dental schools used many online platforms like Zoom, Microsoft Teams, WebEx, Google Meet and Google Classroom to deliver dental lectures to the students (Machado et al., 2020). However, the lockdowns in pre-clinical and clinical settings, limited accessibility to clinical learning opportunities for students, which meant no available treatment for patients in university based dental clinics. Some dental schools allowed for emergency patient treatments only (Alzahrani, Alrusayes and Aldossary, 2020). The social isolation, lockdown, the physical disconnection with dental schools and the feeling of uncertainty have led to some psychological impacts on dental students and their teachers. Many students and teachers felt isolated, anxious, stressed, and confused (Geirdal et al., 2021).

Many social media platforms, such as Facebook and WhatsApp, were used for communication between the dental students and their teachers in some Saudi Universities (Rajeh et al., 2020). The ministry of education in Saudi Arabia encouraged Saudi dental schools to create YouTube channels to deliver pre-recorded lectures to their students (Rajeh et al., 2020). Since the COVID-19 pandemic is relatively novel, there is insufficient published literature about the impact of social media on dental education throughout the pandemic.

2.14 Conclusion

Integrating social media, along with the traditional classroom, in higher education institutions can help to promote more active, collaborative, problem based, blended and student-centred learning. This means that the role of teachers has become that of facilitating and guiding the students who have become able to learn collaboratively at their own pace through different social media platforms. Some educational theories such as social constructivism, social learning, community of practice, situated learning, connectivism, and the theory of weak ties help to explain how social media allowed for knowledge construction through virtual social interaction among learners. The learning process takes place not only within the individual learner’s mind, but also among learners within an interactive community.

Despite all the benefits of using social media for educational purposes, many higher education institutions have a rigid hierarchical structure which is not flexible in terms of adopting this new mode of instruction. In addition, some teachers are concerned about the distracting nature of social media, the quality of information published on social media, and some unprofessional attitudes that take place on social media by dental students and other dental professionals. However, social media are potentially useful as a way of communication and collaboration amongst learners and as an accessible source of information in secondary schools, higher education institutions, healthcare, and dental education.

Since the use of social media in dental education is relatively new, the aim of the next chapter
is to systematically review the research literature on the use of social media in dental education and assess the research protocols utilized. Understanding the current behaviours and practices in education will help to determine the optimal ways to incorporate these technologies into the dental educational process.
Systematic review about using social media in dental education
3 Systematic review

3.1 Introduction
Technology-enhanced learning in healthcare education can be both instructive and constructive (Moule, 2007). Instructive learning is mainly a teacher–centred approach that suggests “knowledge exists independently of the learner, and is transferred by the teacher, to the student, who is viewed as a passive recipient”. In contrast, constructive learning is student-centred. The student constructs new knowledge themselves with the aid of the teacher through analysis of information and reference to experience and understanding (Moule, Ward and Lockyer, 2010). E-learning technology has been reported to enhance constructive learning as well as social learning through a range of available tools that allow students to interact with each other and with their staff for learning purposes (Langley, 2007). E-learning technology is dramatically changing the face of healthcare education. It has the advantages of allowing healthcare students to study at their own pace, providing more flexibility, helping students to access a variety of educational resources and convenience of use (Atack, 2003; Sit et al., 2005). In addition, it helps to deliver teaching and assessment in academic and clinical settings (Moule, Ward and Lockyer, 2010).

Social media represent a significant evolution in e-learning and information technology (Parkinson and Turner, 2014). By means of social media, all users of the internet can participate in a collaborative information-shared environment (Thalluri and Penman, 2015). A variety of social media platforms are available for healthcare students and their teachers, including social networking sites (Facebook, Twitter, WhatsApp, etc.), podcasts, webcasts, blogs, wikis (Wikipedia), media-sharing sites (YouTube, Instagram, Snapchat, etc.) and virtual reality platforms. These platforms provide healthcare students with tools to share information, debate healthcare learning dilemmas and clinical practice issues. In addition, they help to promote health behaviours and to engage with a collaborative learning environment through a seamless interaction amongst the students themselves and between the students and their teachers (Chretien and Kind, 2013; Fogelson, Rubin and Ault, 2013; Bernhardt, Alber and Gold, 2014; Ventola, 2014; Lee et al., 2016).

Previous systematic reviews have reported about the use of social media in medical (Cartledge, Miller and Phillips, 2013; Cheston, Flickinger and Chisolm, 2013; Smith and Lambert, 2014; Cordos, Bolboacă and Drugan, 2016; Guraya, 2016; Madeline Sterling et al., 2017; Whyte and Hennessy, 2017) and nursing (O’Connor et al., 2018) education. A
systematic review conducted by Cheston, Flickinger and Chisolm (2013) aimed to discover the use of social media in medical education. After reviewing 14 relevant studies, the authors suggested some opportunities related to incorporating social media in medical education such as: promoting students’ engagement (71% of studies), feedback (57%) and collaboration and professional development (both 36%). The most commonly cited challenges were technical issues (43%), variable learner participation (43%) and privacy/security concerns (29%).

Another systematic review was conducted by Cartledge, Miller and Phillips (2013) to investigate the use of social networking sites in medical education. The authors reviewed nine papers. Eight papers reported medical students’ satisfaction with using social media in medical education. No paper reported any concerns regarding the professionalism of using social media in medical education.

Smith and Lambert (2014) conducted a systematic review to investigate the use of Twitter and Facebook in healthcare education. After reviewing 16 papers, the results indicated that Facebook and Twitter are perceived as potentially useful adjuncts in healthcare education. Their use as part of a “blended” approach to classroom teaching has been employed to enhance interaction and increase accessibility of students to “real-world practices” and expertise. Although students perceived this to be of value, some had concerns regarding the possibility of faculty staff to eavesdrop on their “virtual” social community. Faculty staff expressed some concerns regarding how students would perceive the boundaries between themselves and their teachers. These observations were corroborated by Cordos, Bolboacă and Drugan (2016) who conducted a systematic review of 33 papers to evaluate social media as a source of medical information for healthcare students (pharmacy, medicine and nursing). The results revealed that Facebook, Podcasts, Multiplayer virtual worlds, Blogs, and Twitter were identified as being the social media platforms most used by medical students for learning and teaching purposes. Twitter was used to enhance active learning. Facebook was found to be a useful way to facilitate learning by enabling discussions. However, both privacy and professionalism concerns were highlighted by the literature.

A systematic review conducted by Guraya (2016) aimed to explore the use of social media by medical students for educational purposes. After reviewing ten papers, social media were reported by the literature to improve real-time communication among students and between them and their teachers. Additionally, social media were found as useful tools to encourage collaborative and active learning and to facilitate the sharing of educational material among learners. Privacy and ethical concerns were also highlighted by the review. This has been supported by O’Connor et al. (2018) who conducted a systematic review of 12 papers in order to explore the role of social media in nursing and midwifery education. The results of the study
highlighted the ability of social media to develop an interactive learning environment for nursing students by facilitating communication and sharing educational materials among the students themselves and between the students and their teachers. The study also highlighted the role of social media to enhance student-centred learning through students’ collaboration on different social media platforms. Some concerns related to the quality of information, privacy and professionalism have also been reported in the literature.

Because the number of available social media is increasing continuously, the literature should also be regularly updated. Moreover, only a limited number of published literature reviews are relevant to the use of social media in dental education (McAndrew and Johnston, 2012; Oakley and Spallek, 2012; Parkinson and Turner, 2014). Therefore, a gap exists in our understanding of the optimal use of social media in supporting learning and teaching among dental (including dental care professional) students and their teachers. Due to the ubiquitous use of using social media by dental students (Parkinson and Turner, 2014), a systematic review was deemed necessary to understand the pedagogical usage of social media and the influence of these relatively new technologies in the context of dental education. In addition, this review could also help identify new approaches for future dental learning and teaching. Therefore, this systematic review focussed on the use of social media by dental (including dental care professional) students and their teachers.

3.2 Objectives

The rationale of this review was to synthesize the relevant literature on the use of social media in dental education by undergraduate dental students (including dental care professionals) and their teachers. The aim was to critique the current relevant literature, explore current best practice in this field, and identify any deficiencies in knowledge with a view to influencing the research question(s) and proposed methodologies in the thesis. Review questions:

2. What social media have been used by undergraduate dental students and/or their teachers for educational purposes?

3. How undergraduate dental students and their teachers have used social media for educational purposes?

4. What are the perceptions of undergraduate dental students and their teachers about incorporating social media in dental education?

5. What are the advantages and disadvantages of using social media in dental education?

6. What are the recommendations for the use of social media in dental education?
3.3 Methods

The systematic review methods were conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher et al., 2009). The PRISMA Statement is an evidence-based reporting guideline designed to improve transparency of systematic reviews and meta-analyses (Page and Moher, 2017). The PRISMA Statement consists of a twenty-seven-item checklist (Appendix 1) and a four-phase flow chart (Figure 3.1). The checklist items were declared to be essential for transparent reporting of a systematic review (Liberati et al., 2009). Since its introduction, the PRISMA Statement has had a very high uptake amongst the biomedical research community. According to citation data in Scopus®, the checklist paper has been cited 19,402 times as of 31 July 2017 (Page and Moher, 2017).

3.3.1 Eligibility criteria

This review followed the eligibility criteria using the PICO (Population, Intervention, Comparison, Outcome) framework (Cullum et al., 2013; Aromataris and Dagmara, 2014). PICO represents essential elements of the research strategy in both evidence-based practice and systematic reviews (Stone, 2002; Akobeng, 2005; Santos, Pimenta and Nobre, 2007). The PICO is an effective method for question construction for the bibliographic search of evidence (Higgins and Green, 2008). In addition, the PICO framework helps to organise searching terms into thematic groups and “laying the pathway for a systematic search strategy” (Sayers, 2008; Cooke, Smith and Booth, 2012). In accordance with the PICO criteria, Population was undergraduate dental students (including dental care professionals) i.e. dental students, dental therapy students, dental hygiene students and dental nursing students and their teachers; Interventions included social media used for educational purposes; No Comparisons were undertaken; Outcomes included the educational efficacy of engaging social media in dental schools (O’Connor et al., 2018).

3.3.2 Inclusion and exclusion criteria

Inclusion: Only English language studies that were published between 2010-2020 were included. This start date included the most recent papers around the topic of this study. Only full text peer reviewed articles were included, that were relevant to the use of social media in dental education. The search was not limited to any specific geographical area, age or methodological type. Studies about social media that were used for educational purposes by undergraduate dental (including dental care professional) students and their teachers were included.
Exclusion: Newspaper articles, letters, editorials, commentaries, and conference abstracts were excluded. Duplicates were excluded as well. Studies assessing the use of social media by postgraduate students, school pupils or non-dental related university students were excluded. Studies only on Web 1.0 (traditional internet use) were excluded. Studies on using social media but not for educational purposes were also excluded.

3.3.3 Search strategy
The search was conducted in March 2019 and updated in March 2020.

3.3.3.1 Search terms detection
The PICO framework was used in order to develop a list of key search terms relevant to social media and dental education (Table 3.1) (Aromataris and Dagmara, 2014). The Population concept included key terms like “dental students”, “dental hygiene students”, “dental therapy students”, “dental nursing students”, “dental teachers”, “dental therapy teachers”, “dental hygiene teachers”, “dental nursing teachers”, etc. The Intervention concept included key terms like “social media”, “social networking sites”, “web 2.0”, “Facebook”, “YouTube”, “Twitter”, “WhatsApp”, “Wikipedia”, “Instagram”, etc. The Comparison concept was not included because no comparisons were carried out. The Outcome concept included key terms like “learning”, “teaching”, “education”, etc. Because the number of available social networking sites is high and increases continuously, the search was limited to the most current and common English applications used by undergraduate healthcare students (McAndrew and Johnston, 2012; Cartledge, Miller and Phillips, 2013; Smith and Lambert, 2014; Cordos, Bolboacă and Drugan, 2016; Guraya, 2016; M Sterling et al., 2017; O’Connor et al., 2018). All the key terms used in this review are illustrated in table 3.1.

3.3.3.2 Database selection
An advanced literature search for the relevant papers was then conducted following the recommendation delivered by Haig and Dozier (2003) about the most appropriate databases focusing on medical education. The databases Medline, PsycINFO, Educational Resources Information Centre (ERIC), CINAHL, Embase, the Cochrane library, the British Education Index (BEI) and the Research and Development Resource Base in Continuing Medical Education on the Internet (RDRB WEB) in addition to PubMed (Cordos, Bolboacă and Drugan, 2016) were all searched from 01 January 2010 to 1 March 2020. The databases were selected because of their comprehensive representation of available peer-reviewed journals, in addition to their dedicated scope in the relevant disciplines to this topic (Rankin, Truskey and Chisolm, 2019). These databases were accessed through the ‘EBSCO-host Discovery Service (EDS)’ (https://library.port.ac.uk/discovery.html) an online literature search engine via the University
of Portsmouth library service. The search was conducted in March 2019 and subsequently updated in March 2020.

Table 3.1 key search words used for the systematic review

<table>
<thead>
<tr>
<th>Concept</th>
<th>Key terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>Undergraduate OR “dental students” OR “dental hygiene students” OR “dental therapy students” OR “dental nursing students” OR “dental teachers” OR “dental hygiene teachers” OR “dental therapy teachers” OR “dental nursing teachers” OR staff OR faculty OR college OR university</td>
</tr>
<tr>
<td>Intervention</td>
<td>“Social networks” OR “Social media” OR “Social networking sites” OR Facebook OR Twitter OR YouTube OR WhatsApp OR Wiki OR Blog OR Instagram OR Google+ OR LinkedIn OR Snapchat</td>
</tr>
<tr>
<td>Outcome</td>
<td>“dental education” OR “dental hygiene education” OR “dental therapy education” OR “dental nursing education” OR “dental care professional education” OR “learning” OR “teaching” OR “education”</td>
</tr>
</tbody>
</table>

3.3.3.3 Searching databases

The previously identified keywords list was divided into 3 levels (Table 3.2) where the first level involved key terms related to undergraduate students and their teachers in addition to the education, learning and teaching processes. The second level included words related to the dental field (dentistry, dental hygiene, dental therapy, and dental nursing). The third level incorporated terms about social media. Additional relevant terms were added in the list as well as in the search engine when noted in the initial screening stage of the literature search. A truncation technique was applied throughout to avoid missing similar terms. For example: searching the term “educat*” captured “education”, “educational” and “educating”. In the same way, searching the term “teach*” captured “teaching” and “teachers”. Also, the term dent* provided data related to “dentistry” and “dental” (Aromataris and Dagmara, 2014). Key search concepts were selected with their Medical Subject Headings [MeSH term] and other vocabulary equivalents, as well as related keywords, for example: “social media” [MeSH term] or “social networking sites” [MeSH term] or “web 2.0” [MeSH term] (Rankin, Truskey and Chisolm, 2019). The reference lists of all full text papers were scanned, and few more papers were identified using a snowball technique (Greenhalgh and Peacock, 2005). Boolean
operators (AND, OR and NOT) have been applied for combinations of descriptors that were used in the search, with AND for a “restrictive combination”, OR for an “additive combination” and NOT for an “excluding combination” (Santos, Pimenta and Nobre, 2007). One example of the use of Boolean operators for a combination of descriptors: “social media” OR “social networking sites” OR “web2.0” AND “dental education” OR “dental hygiene education” OR “dental therapy education” OR “dental nursing” OR “dental care professional education”. The principal investigator managed references using Mendeley.

Table 3.2 search strategy of the database

<table>
<thead>
<tr>
<th>Levels</th>
<th>Search</th>
<th>Terms to be searched</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First</strong></td>
<td>#1</td>
<td>Search undergraduate</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>Search students</td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>Search staff</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>#5</td>
<td>Search college</td>
</tr>
<tr>
<td></td>
<td>#6</td>
<td>Search university</td>
</tr>
<tr>
<td></td>
<td>#7</td>
<td>Search learn*</td>
</tr>
<tr>
<td></td>
<td>#8</td>
<td>Search teach*</td>
</tr>
<tr>
<td></td>
<td>#9</td>
<td>Search educat*</td>
</tr>
<tr>
<td></td>
<td>#10</td>
<td>Search #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9</td>
</tr>
<tr>
<td><strong>Second</strong></td>
<td>#11</td>
<td>Search dent*</td>
</tr>
<tr>
<td></td>
<td>#12</td>
<td>search “dental hygiene”</td>
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<tr>
<td></td>
<td>#13</td>
<td>Search “dental therapy”</td>
</tr>
<tr>
<td></td>
<td>#14</td>
<td>Search “dental nursing”</td>
</tr>
<tr>
<td></td>
<td>#15</td>
<td>Search “dental care professional”</td>
</tr>
<tr>
<td></td>
<td>#16</td>
<td>Search #11 OR #12 OR #13 OR #14 OR #15</td>
</tr>
<tr>
<td><strong>Third</strong></td>
<td>#17</td>
<td>Search “social media” [MeSH term]</td>
</tr>
<tr>
<td></td>
<td>#18</td>
<td>Search “social networking sites” [MeSH term]</td>
</tr>
<tr>
<td></td>
<td>#19</td>
<td>Search “social networks” [MeSH term]</td>
</tr>
<tr>
<td></td>
<td>#20</td>
<td>Search “web 2.0” [MeSH term]</td>
</tr>
</tbody>
</table>
3.3.4 Selection of Studies:
Study selection criteria were intended to identify those primary studies that were directly relevant to the research question (Kitchenham, 2004). Once the potentially relevant primary studies were obtained, they were assessed for their actual relevance. This was undertaken through two main stages. The first stage was an initial screening of titles and abstracts against the inclusion and exclusion criteria. The second stage was screening of the full papers identified against the eligibility criteria. Screening of the studies was completed by the principal investigator and reviewed by the first and the second supervisors. Any disagreements were resolved through discussion until a consensus was reached.

3.3.5 Data extraction:
A data extraction form (Table 3.4) was designed according to the PICO criteria in order to accurately record the obtained information needed to address the review questions from each individual study of the included eligible primary studies. The form gave information about the authors’ names, year and country of publication, the aim of the study, the participants, the study design, the interventions, and the main findings. Data extraction was done by the principal investigator and was checked for accuracy and completeness by the first and second supervisors. The supervisors conducted data extraction to randomly selected studies and their results were cross checked with that of the principal investigator. The necessary amendments were done based on the outcomes and feedback of the supervisors.
3.3.6 Data synthesis

Data synthesis involved collating and summarising the results of the included eligible studies in order to answer each of the specific research questions. A narrative synthesis approach was employed due to the heterogeneity of the quantitative and mixed method studies in terms of methods, participants, and interventions. The narrative synthesis followed the guidelines suggested by Popay et al. (2006) and was completed through two main stages: i) Developing a preliminary synthesis of findings of the included studies; ii) Exploring relationships within and between studies.

3.3.6.1 Developing a preliminary synthesis of findings of included studies:

The purpose of the preliminary synthesis was to develop an initial description of the results of included studies. This initial description gave information about the geographic distribution of the included studies, year of publication, types of social media interventions and types of included study design. During the preliminary synthesis, patterns, perceptions, and factors related to the effect of social media as educational tools for healthcare students were also identified in the form of preliminary themes. A preliminary synthesis was done using four techniques: (a) graphs; (b) groupings and clusters; (c) tabulation; and (d) thematic analysis. Graphs were used to illustrate some quantitative data related to the geographic distribution of the included studies, year of publication, and types of social media intervention. Organising the included studies into groups aided the process of description and analysis and helped to look for patterns within and across these groups. The review questions were used to make decisions regarding how to group the included studies. A tabulation technique was used to develop an initial description of the included studies, to begin to identify patterns across studies (Table 3.5) and to present the recommendations of the included studies (Table 3.6).

3.3.6.2 Exploring relationships within and between studies:

As patterns across study results began to emerge from the preliminary data synthesis, the next stage was to explore relationships either between the characteristics of individual studies and their reported findings or between the findings of different studies. This helped to understand how and why social media interventions had or did not have an effect or why particular barriers and/or enablers to implementation operate. A narrative subgroup analysis was used at this stage.

3.3.7 Quality appraisal

Quality appraisal (also known as critical appraisal, quality assessment or risk of bias assessment) consists of a systematic examination of studies to ensure they are trustworthy, transparent, reliable, and valid (Nha et al., 2018). Critical appraising tools allow reviewers to
appraise study quality in a systematic, transparent, and reproducible manner (Petticrew and Roberts, 2008; Wells and Littell, 2009). Critical appraising tools are available in the form of scales or checklists in which a list of criteria/domains is suggested to appraise the quality of a study critically and systematically (Hong, Gonzales-Reyes and Pluye, 2018). For the purpose of this study, version 2018 Mixed Methods Appraisal Tool (MMAT) was used for quality assessment in this systematic review (Appendix 2 and 3). The MMAT is “a critical appraisal tool that is designed for the appraisal stage of systematic mixed study reviews, i.e., reviews that include qualitative, quantitative and mixed method studies” (Hong et al., 2018, p.1). The MMAT allows for appraising the methodological quality of five sets of criteria for: (a) qualitative (such as case study and narrative research) (b) randomized controlled trials (c) nonrandomized (such as case control studies and cross-sectional studies) (d) quantitative descriptive (such as survey case reports, and case series) and (e) mixed method studies (Hong et al., 2018). Quality appraisal of the included studies aims to evaluate how the research answers the research question, the risk of bias and appropriateness of the outcomes (Souto et al., 2015; Hong et al., 2018).

Version 2018 MMAT includes two screening questions (applied to all of the included studies) and twenty-five questions for the five study categories (five questions for each study). After categorising the included studies, the principal investigator rated the criteria for each study category by answering the related questions with “Yes”, “No” or “Can`t tell”. A “Can`t tell” response means that the paper did not introduce the necessary information to respond with a “Yes” or “No”. When appraising mixed method studies, three sets of criteria were assessed: (a) the quantitative set (randomized controlled, nonrandomized, or quantitative descriptive studies) (b) the qualitative set and (c) the mixed method set. No scoring was applied. Instead, more details were presented about the ratings of each criterion to better inform the quality of the included studies (Hong et al., 2018; Hong, Gonzales-Reyes and Pluye, 2018; O’Connor et al., 2018).

3.4 Results:

3.4.1 Study characteristics:

The initial database search identified 425 potentially relevant citations (Medline: N= 104; CINAHL: N= 67; ERIC: N= 3; Cochrane library: N= 0; RDRWEB: N=0; BIE: N= 2; PsycINFO: 139 N=; Embase: N= 0). Another 5 papers were added after the manual search using the snowball technique by looking at the references of the full text relevant papers. After removing the duplicates, the number of potentially relevant articles reached 286. After analysing titles and abstracts, 222 citations were excluded as they did not match the inclusion criteria. The full texts of 64 citations were analysed for the eligibility criteria using the PICO framework. 48
articles were excluded either because they were not focusing on the educational uses of social media or not related to undergraduate students or not relevant to dental education, and 3 articles were identified as just a literature review. At the end 16 papers were found to be eligible for inclusion (Figure 3.1).

Most of the included studies were conducted in the USA (n=5) followed by India (n=3). The UK and Saudi Arabia had two studies in each. The rest of the studies were published in Syria, South Korea, Jordan, and Brazil with one study in each country (Figure 3.2). The included studies in this systematic review were published between (2013-2020). Most of them were published in 2016 (n=4) followed by 2018 and 2019 with 3 studies in each year. The number of publications in each year between (2013-2020) is illustrated in figure 3.3. After analysing the review, the participants of 14 studies were found to be undergraduate dental (including dental care professional) students, while only two studies included dental and dental hygiene faculty members (Arnett, Loewen and Romito, 2013; Henry and Pieren, 2014). Seven studies were identified as assessing the use of social media in general by undergraduate dental students (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Henry and Pieren, 2014; Kenny and Johnson, 2016; Sen et al., 2016; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020). Four studies were about using Facebook in dental education (Alshiekhly et al., 2015; Kazi, Saxena and VineetVinay, 2016; Naguib et al., 2018; Al-rabab et al., 2019). YouTube (Seo et al., 2018; Aldallal, Yates and Ajrash, 2019) and Twitter (Lee and Gould, 2014; Gonzalez and Gadbury-Amyot, 2016) were assessed in 2 studies for each. While WhatsApp (Indu, Cherian and Kandoul, 2018) was evaluated only once (Figure 3.4). This review included quantitative descriptive (N=13), quantitative randomised control trials (n=2) and mixed method studies (N=3). Study designs included in this review were illustrated in table 3.3.
Figure 3.1 Prisma flow chart showing data analysis for systematic review

Identification

Records identified through database searching
(n = 425)

Additional records identified through other sources
(n = 5)

Screening

Records after duplicates removed
(n = 288)

Records excluded after applying the inclusion and exclusion criteria
(n = 222)

Eligibility

Records screened
(n = 288)

Full-text articles assessed for eligibility
(n = 84)

Included

Studies included in quantitative synthesis
(meta-analysis)
(n = 16)

Full-text articles excluded, with reasons
(n = 48)

- Irrelevant to undergraduate dental students.
- Irrelevant to educational purposes.
- Irrelevant to social media.
- Only literature reviews.
Figure 3.2 Geographic distribution of the included studies

Geographical distribution of the included studies

Number of publications

1

5

Figure 3.3 Years of publication

Number of publications per year

Years

Series 1
Figure 3.4 Social media interventions

Table 3.3 study design of the included studies

<table>
<thead>
<tr>
<th>Study design</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative descriptive</td>
<td>11</td>
</tr>
<tr>
<td>Quantitative randomized control trials</td>
<td>2</td>
</tr>
<tr>
<td>Mixed methods</td>
<td>3</td>
</tr>
<tr>
<td>Authors, year, country, and social media used</td>
<td>Aim of the work</td>
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<tr>
<td>---------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Arnett, Loewen and Romito (2013) USA</td>
<td>To evaluate the using social media applications by dental teachers for educational purpose</td>
</tr>
<tr>
<td>Arnett, Christensen and Nelson (2014) USA</td>
<td>To determine the social media applications used by dental students and the degree of their interest to utilize social media for educational purposes.</td>
</tr>
<tr>
<td>Study</td>
<td>Location</td>
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<tr>
<td>Lee and Gould (2014)</td>
<td>USA</td>
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<tr>
<td>Henry and Pieren (2014)</td>
<td>USA</td>
</tr>
<tr>
<td>Alshiekhly et al. (2015)</td>
<td>Syria</td>
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<tr>
<td>Study</td>
<td>Title</td>
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<tr>
<td>Kenny and Johnson (2016) UK</td>
<td>To assess professional and unprofessional behaviour of dental students on social media.</td>
</tr>
<tr>
<td>Kazi, Saxena and Vineet Vinay (2016) India</td>
<td>To assess the acceptability and behaviour of dental students toward using Facebook as teaching method in learning microbiology.</td>
</tr>
<tr>
<td>Gonzalez and Gadbury-Amyot (2016)</td>
<td>To evaluate dental students’ use of Twitter in an oral radiology course and assess their perceptions about using this platform as an educational tool.</td>
</tr>
<tr>
<td>Sen et al. (2016)</td>
<td>To assess the use of social media in dental education</td>
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<tr>
<td>Study (Year, Location)</td>
<td>Objective</td>
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<tr>
<td>------------------------</td>
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<tr>
<td>Seo et al. (2018) South Korea</td>
<td>To evaluate the applicability of YouTube videos as a learning tool to deliver periodontology lecture videos and to assess students’ behaviour toward using this platform in flipped classroom.</td>
</tr>
<tr>
<td>Indu, Cherian and Kandoul (2018) India</td>
<td>To evaluate the efficacy of WhatsApp as an educational tool for undergraduate dental students. The study also aimed to explore students' prospections toward WhatsApp as an educational tool.</td>
</tr>
<tr>
<td>Naguib et al. (2018) Saudi Arabia</td>
<td>To discover any gender-based</td>
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</table>
differences in students’ perceptions about using Facebook as a learning tool in a biomaterial course.

Abdelaziz University, Saudi Arabia. Cross-sectional)

females) were created before conducting a biomaterials course. Course related educational materials were posted on those groups after each lecture. At the end of the study, quantitative questionnaires have been delivered to students to explore their perceptions.

than the male. No significant differences was found between the two genders regarding the willingness for future use of Facebook as an educational tool. Female students have shown an agreement about how easy was studying through Facebook groups with a significant difference compared to male students.

Aldallal, Yates and Ajrash (2019) UK

Evaluate using YouTube as a learning source for oral surgery by undergraduate dental students Undergraduate dental students (N=169) including 4th (N=83) and final year (N=86) students at Manchester University Quantitative Cross-sectional)

An online questionnaire including 16 close ended questions was sent to dental students.

67% of the participants used YouTube as a study resource. 41% stated that YouTube videos influenced their practice. Materials on YouTube is not always consistent with curriculum. Administration of local anaesthesia was searched for most often.

Al-rabab et al. (2019) Jordon

Explore perceptions and attitudes of undergraduate dental students toward using Facebook as an educational tool 4th (N=105) and 5th (N=30) year undergraduate dental students at the School of Dentistry University of Jordon Mixed methods Cross-sectional)

Paper based questionnaire was delivered to the students at the clinical sessions. This was followed by structured interviews using open questions.

80% of the participants reported using Facebook as a useful source of dental information. The most popular topics students look for in Facebook were cavity preparation, tooth extraction, local anaesthesia injection, implant-related procedures, and crowns and veneers. 51.1% attribute their use of Facebook to the deficiency of demonstrations provided in
<table>
<thead>
<tr>
<th>Study Authors and Location</th>
<th>Objective</th>
<th>Participants</th>
<th>Study Design</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Souza et al. (2019) Brazil</td>
<td>To evaluate dental student perception about using social media as educational tools for teaching infection control.</td>
<td>Students (N=298) enrolled in the discipline of Biosafety and Ergonomics at Federal University of Pernambuco.</td>
<td>Quantitative Cross-sectional</td>
<td>Google form based online questionnaire was delivered to the students through the email. The responses of the students were compared to the results obtained by students who did not access social media platforms for educational aims.</td>
<td>The adherence of using social media applications was 98.3% (Facebook) 100% (WhatsApp) and 90% (Instagram). Students believed that social media were useful educational platforms because of quick and fast accessibility to get information; images make students understand subjects more effectively. There was no significant difference among students' overall scores before and after utilizing social media in the subject.</td>
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<tr>
<td>Saadeh, Saadeh and Torre (2020) Saudi Arabia</td>
<td>To assess using social media by medical and dental students to obtain medical information</td>
<td>856 of medical (N=563) and dental (N=293) students at Jordon University for Science and Technology</td>
<td>Quantitative Cross-sectional</td>
<td>Quantitative online questionnaire including 14 close ended questions was administrated to the students through Facebook groups.</td>
<td>Females used social media more than males with a significant difference. Most of students did not consider social media as trusted source of information.</td>
</tr>
</tbody>
</table>
Table 3.5 concepts within and between the included studies

<table>
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<tr>
<th>Authors, year, and country</th>
<th>Online communication and interactivity</th>
<th>Sharing educational materials</th>
<th>Ease of use and accessibility</th>
<th>Free to use</th>
<th>Student centred learning</th>
<th>Teaching method</th>
<th>Source of information</th>
<th>Effect on the overall grades</th>
<th>Distraction</th>
<th>Privacy</th>
<th>Quality of information</th>
<th>Professionalism</th>
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<td>Saadeh, Saadeh and Torre (2020)</td>
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79
<table>
<thead>
<tr>
<th>Authors and year</th>
<th>Conclusions and recommendations</th>
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</thead>
<tbody>
<tr>
<td>Arnett, Loewen and Romito (2013)</td>
<td>The potential benefits of using social media in dental education, such as increased student interaction, must be balanced with the potential disadvantages such as the unprofessional usage of this technology.</td>
</tr>
<tr>
<td>Arnett, Christensen and Nelson (2014)</td>
<td>Before incorporation of social media in a course, training for faculty is crucial and should be focused on the most popular social networking sites.</td>
</tr>
<tr>
<td>Lee and Gould (2014)</td>
<td>Using Twitter in dental education provides an opportunity to reach students outside the classroom, in small and to promote recall and retention of course content.</td>
</tr>
<tr>
<td>Henry and Pieren (2014)</td>
<td>36% of dental hygiene programs have a policy for professional usage of social media. There are some reports about violations of professionalism policies by both students and teachers.</td>
</tr>
<tr>
<td>Alshiekhly et al. (2015)</td>
<td>Facebook allows students to discuss topics more openly in a flexible setting with less rigid time and place constraints.</td>
</tr>
<tr>
<td>Sen et al. (2016)</td>
<td>Social media are potentially useful for learning and communication among dental students and between them and their teachers.</td>
</tr>
<tr>
<td>Kenny and Johnson (2016)</td>
<td>Recommends that undergraduates receive training in the appropriate use of social media and managing risks online.</td>
</tr>
<tr>
<td>Author(s) and Year</td>
<td>Summary</td>
</tr>
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</tr>
<tr>
<td>Kazi, Saxena and Vineet Vinay (2016)</td>
<td>Facebook can become one of the teaching learning tools for better performance in dental students.</td>
</tr>
<tr>
<td>Gonzalez and Gadbury-Amyot (2016)</td>
<td>Twitter was useful for question-and-answer sessions in an oral and maxillofacial radiology course.</td>
</tr>
<tr>
<td>Seo et al. (2018)</td>
<td>YouTube is a suitable platform that facilitates self-directed learning of students, providing flexible and diverse learning forms for a flipped classroom.</td>
</tr>
<tr>
<td>Indu, Cherian and Kandoul (2018)</td>
<td>WhatsApp is an excellent supplementary educational tool if used appropriately.</td>
</tr>
<tr>
<td>Naguib et al. (2018)</td>
<td>Integrating learning through Facebook groups into the dental courses was generally well-perceived among the dental students.</td>
</tr>
<tr>
<td>Aldallal, Yates and Ajrash (2019)</td>
<td>YouTube is a useful tool for dental education but should not be used without validated instructional material.</td>
</tr>
<tr>
<td>Al-rabab et al. (2019)</td>
<td>Dental schools Facebook pages dedicated for enrolling students should be encouraged.</td>
</tr>
<tr>
<td>Souza et al. (2019)</td>
<td>This indicates that social networks can take active roles and became partners in teaching both didactic and clinical dentistry.</td>
</tr>
<tr>
<td>Saadeh, Saadeh and Torre (2020)</td>
<td>The limited usage of social media by medical and dental students to look for information indicated that caution should be taken before incorporating these tools in the curricula.</td>
</tr>
</tbody>
</table>
3.4.2 Quality appraisal results

Regarding this systematic review, eleven studies (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Lee and Gould, 2014; Alshiekhly et al., 2015; Kenny and Johnson, 2016; Sen et al., 2016; Naguib et al., 2018; Seo et al., 2018; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020) were assessed against quantitative deceptive criteria, two studies (Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018) against quantitative randomized control trials criteria and three studies (Henry and Pieren, 2014; Gonzalez and Gadbury-Amyot, 2016; Al-rabab et al., 2019) against mixed methods criteria (Appendix 2).

All the included studies have met the two screening questions. Four studies (Arnett, Loewen and Romito, 2013; Kenny and Johnson, 2016; Sen et al., 2016; Naguib et al., 2018) were found fulfilling all (100%) of the quality appraising criteria.

Seven studies (Arnett, Christensen and Nelson, 2014; Lee and Gould, 2014; Alshiekhly et al., 2015; 2018; Seo et al., 2018; Al-rabab et al., 2019; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019) did not clearly report indicators for appropriate measurements as testing the validity and reliability or pretesting the questionnaires before data collection. The risk of nonresponse bias was obtained in five studies (Arnett, Christensen and Nelson, 2014; Henry and Pieren, 2014; Lee and Gould, 2014; Al-rabab et al., 2019; Saadeh, Saadeh and Torre, 2020). Three studies (Henry and Pieren, 2014; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019) did not provide sufficient data about the participants or reasons for no participation, which made it hard to determine if the sample was representative to the targeted population or not. Three studies (Lee and Gould, 2014; Gonzalez and Gadbury-Amyot, 2016; Aldallal, Yates and Ajrash, 2019) did not provide sufficient data about the statistical analysis methods used, which prevented the thesis author determining the appropriateness of the statistical analysis to answer the research questions of those two studies. The method of data analysis of the qualitative part of the study conducted by Gonzalez and Gadbury-Amyot (2016) (mixed methods study) was not clearly reported, which made it hard to determine whether the findings were adequately derived from the data or not. Also, the coherence between qualitative data sources, collection, analysis, and interpretation were not clearly described in the same study (Appendix 2).

3.4.3 Aims of the included studies and social media that were assessed:

Two studies assessed the use of social media by dental or dental hygiene faculty members (Arnett, Loewen and Romito, 2013; Henry and Pieren, 2014). Five studies assessed the use of social media in general by undergraduate dental students (Arnett, Christensen and Nelson, 2014; Lee and Gould, 2014; Alshiekhly et al., 2015; Sen et al., 2016; Naguib et al., 2018).
2014; Kenny and Johnson, 2016; Sen et al., 2016; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020). Arnett, Christensen, and Nelson (2014) aimed to determine the social media platforms used by dental students and the degree of their interest to utilize social media for educational purposes. The results revealed that Facebook was the most popular social media platform among dental students (91%) followed by Google+ (32.5%) and 22% were registered with Twitter, 17.5% with LinkedIn, 2% used Foursquare and 3.5% reported using no social media platforms at all. Kenny and Johnson (2016) aimed to assess professional and unprofessional behaviour of dental students on social media. The authors found also that Facebook was the most commonly regularly used by undergraduate dental students (98.9%). Instagram was the second most commonly used platform (55%). This was followed by YouTube that was the third most commonly used platform (51%) and Twitter was the least popular platform with around one third of all students using it (31%). Sen et al. (2016) aimed to assess dental students’ use of social media in general for educational purposes. Facebook, Twitter, WhatsApp and YouTube were the most widely used platforms for educational purposes. The use by dental students of social media to learn about infection control in dentistry was assessed by Souza et al. (2019). Interestingly, 98.3% used Facebook, 100% for WhatsApp and 90% for Instagram. Another study conducted by Saadeh, Saadeh and Torre (2020) assessed the usage of social media by medical and dental students to obtain medical information. The results revealed that Facebook, Instagram, WhatsApp and Snapchat were the most commonly used social media among undergraduate dental students.

Four studies evaluated the use of Facebook as a learning tool by undergraduate dental students (Alshiekhly et al., 2015; Kazi, Saxena and VineetVinay, 2016; Naguib et al., 2018; Al-rabab et al., 2019). Alshiekhly et al. (2015) evaluated the effectiveness of Facebook as an educational tool for teaching emergencies in dental practice. Two-thirds of students agreed that Facebook was useful in dental education. Kazi, Saxena and VineetVinay (2016) assessed the acceptability and behaviour of dental students using Facebook as a teaching method for learning microbiology. Almost 80% agreed or strongly agreed to incorporate the idea of Facebook as a teaching method. Naguib et al. (2018) explored gender-based differences in students’ perceptions about using Facebook as an educational tool in learning a biomaterials course. Female students were significantly more satisfied than males. No significant differences between the two genders regarding the willingness for future use of Facebook as an educational tool were reported. Al-rabab et al. (2019) explored the perceptions and attitudes of undergraduate dental students towards using Facebook as an educational tool.

Two studies assessed YouTube as an educational tool in dental education (Seo et al., 2018; Aldallal, Yates and Ajrash, 2019). Seo et al. (2018) evaluated the applicability of YouTube
videos as a learning tool to deliver periodontology lecture videos and to assess students’ behaviour toward using this platform in a flipped classroom 82.6% of the participants stated that video lectures were easier to understand than face to face lectures. Aldallal, Yates and Ajrash (2019) assessed the use of YouTube as a learning source for oral surgery by undergraduate dental students. 67% of the participants used YouTube as a study resource.

The use of Twitter as an educational tool was assessed in two studies (Lee and Gould, 2014; Gonzalez and Gadbury-Amyot, 2016). Lee and Gould (2014) assessed Twitter as an educational tool in a basic anatomical science course. 96.6% felt comfortable with using Twitter as an educational tool and they reported that it helped them to recall course content. Gonzalez and Gadbury-Amyot (2016) evaluated dental students’ use of Twitter in an oral radiology course and assessed their perceptions about using this platform as an educational tool. Students mentioned three advantages with the use of Twitter: viewing posted radiographs, staying informed of the questions and answers, and improving communication with the tutor. One study evaluated the efficacy of WhatsApp as an educational tool for undergraduate dental students. The study also aimed to explore students’ perceptions of WhatsApp as an educational tool. 62% of participants agreed that using WhatsApp as a method of teaching helped them understand histopathology better.

3.4.4 Study participants:
Two studies involved dental and dental hygiene faculty members (Arnett, Loewen and Romito, 2013; Henry and Pieren, 2014). Twelve studies (Lee and Gould, 2014; Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kazi, Saxena and VineetVinay, 2016; Kenny and Johnson, 2016; Sen et al., 2016; Seo et al., 2018; Indu, Cherian and Kandoul, 2018; Naguib et al., 2018; Al-rabab et al., 2019; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019) involved undergraduate dental students only, whereas the other two studies were heterogenous as follows: Arnett, Christensen and Nelson (2014) involved undergraduate dental students (n=265) dental hygiene students (n=68) advanced dental education students or residents (n=32) while Saadeh, Saadeh and Torre (2020) involved undergraduate dental students (n=293) as well as medical students (n=563).

3.4.5 Study designs
Eleven studies were quantitative descriptive studies using either online or paper based close-ended questionnaires. Three studies were mixed methods: Henry and Pieren (2014) used a survey including 27 multiple choice and open-ended questions, Gonzalez and Gadbury-Amyot (2016) also used both closed- and open-ended questionnaires, while Al-rabab et al. (2019) used a paper-based questionnaire followed by a structured interview using open-ended
questions. Two studies were quantitative randomised control trials. Fourteen studies used cross-sectional designs including post-intervention surveys (n=12) to evaluate users’ satisfaction, attitudes and preferences and pre- and post-intervention surveys (n=2) to assess students’ knowledge, perceptions, and behaviours before and after the intervention.

Arnett, Christensen and Nelson (2014) used an online questionnaire including 18 multiple-choice questions through SurveyMonkey to assess dental students’ (n=351) perceptions to utilize social media for educational purposes. Lee and Gould (2014) tweeted multiple choice questions and answers after each lecture of anatomical science. The link was available for 1st and 2nd year dental students. 2nd year dental students were asked to take a pre tweet and 10 weeks post tweet quiz to assess their performance before and after the experiment. At the end, the students were asked to fill in a survey including closed-ended questions. Alshiekhly et al. (2015) invited participants (n=184) to join a closed Facebook group called “Medical emergencies in dental practice” during the second semester of the academic year 2013–2014. Administrators of the group published 61 posts during the course period, which extended for one month. Students’ progress in learning was evaluated using a self-assessment google form-based questionnaire administered to the students before and after the course and their perceptions about the new experience were also assessed.

Kenny and Johnson (2016) delivered a paper-based questionnaire (including closed questions) to the students (n=155) to assess professional and unprofessional behaviour of dental students on social media. Gonzalez and Gadbury-Amyot (2016) created a Twitter account and shared it with the students (n=40) before starting two radiology courses. The account was used to post radiographs and receive questions and answers from the students. At the end of the semester, a questionnaire was delivered to the students to explore their perceptions about using Twitter as an educational tool. The questionnaire contained both closed and open-ended questions. Sen et al. (2016) delivered a questionnaire consisting of 26 closed-ended questions to 500 dental students to explore their perceptions about the use of social media in dental education.

Seo et al. (2018) uploaded periodontology lecture videos to YouTube prior to each class. At the end of the second semester, the students (n=69) were surveyed using an online google form-based questionnaire. Naguib et al. (2018) created two Facebook groups (one for males and the other for females) before conducting a biomaterials course. Course related educational materials were posted on those groups after each lecture. At the end of the study, quantitative questionnaires were delivered to the students (n=210) to explore their perceptions. Aldallal, Yates and Ajrash (2019) delivered an online questionnaire including 16
closed ended questions to undergraduate dental students (n=169) to assess their use of YouTube as a learning source for oral surgery. Al-rabab et al. (2019) delivered a paper-based questionnaire to dental students (n=135) at the clinical sessions. This was followed by structured interviews using open questions to explore perceptions and attitudes of undergraduate dental students towards using Facebook as an educational tool. Souza et al. (2019) delivered a Google form questionnaire to dental students (n=298) via email to survey dental students` perceptions about using social media as educational tools for teaching infection control. The responses of the students were compared to those obtained from students who did not have access to social media for educational purposes. Saadeh, Saadeh and Torre (2020) administrated an online questionnaire including 14 closed ended questions to medical (n=563) and dental (N=293) students through Facebook groups to assess their usage of social media to obtain medical information.

Two studies (17.7%) were case control trials. Kazi, Saxena and VineetVinay (2016) divided the participants randomly into two groups (n=20 for each): Facebook and control group. After introducing a traditional microbiology lecture, the Facebook group received educational course materials through Facebook. Assessment through multiple choice questions was undertaken by both two groups at the end of the course. Also, feedback from the Facebook group was recorded to assess their experience. Indu, Cherian and Kandoul (2018) divided the participants randomly into two groups (A & B; 16 students for each). Histopathology slides were discussed in the classroom with the two groups. Then, labelled histopathological images were discussed only for Group A students, in a WhatsApp group named “GDC ALLEPPEY OPATH.” A set of questions about the slides were given to both groups and the results of the two groups were compared. In addition, group A students` perceptions were explored through a quantitative questionnaire.

3.4.6 Benefits of using social media in dental education

3.4.6.1 Online communication and interaction

The different ways in which dental students and their teachers communicated and interacted through social media appeared to influence their learning. Seven studies (44%) reported that social media provided an online method of communication and interaction either among the dental students themselves (Kenny and Johnson, 2016; Al-rabab et al., 2019) or between the students and their teachers (Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Sen et al., 2016; Indu, Cherian and Kandoul, 2018; Souza et al., 2019). Alshiekhly et al. (2015) created a Facebook group which served as an educational medium for the delivery of a “Medical emergencies in dental practice” course for undergraduate dental students at the
Faculty of Dentistry, Damascus University. At the end of the 2013/2014 semester, nearly all students (97.2%) reported that the Facebook group facilitated the interaction between the students and their administrators. Gonzalez and Gadbury-Amyot (2016) created a Twitter account and used it to supplement delivery of a radiology course for 40 second year dental students at the University of Nebraska Medical Centre College of Dentistry, USA. The account was used to post radiographs and receive questions and answers from the students. At the end of the course, 90% of the students mentioned that the question-and-answer sessions were helpful and reported that they improved accessibility to the instructor. Sen et al. (2016) reported that 91% of the participating dental students discussed their work with their colleagues through different social media platforms.

Indu, Cherian and Kandoul (2018) revealed that most of the dental students who participated in an oral pathology module at the Government Dental College, Alappuzha, India, appreciated the time they were getting with teachers in the WhatsApp group to learn oral pathology. The findings of a study conducted by Souza et al. (2019) also highlighted that many dental students (n=114, 38.1%) appreciated the value of social media for easing communication with dental teachers. Dental students reported that they became more comfortable to communicate with each other within closed Facebook groups (with security settings to limit access to discussions). When undergraduate dental students at the School of Dentistry, University of Jordon were asked whether they prefer the traditional classroom or Facebook pages, 30.4% reported that they prefer Facebook. The reasons that they mentioned varied but nearly half of participants preferred Facebook (46.6%) because it is more interactive and many participants reported that it allowed them to meet colleagues from all over the world (Al-rabab et al., 2019).

On the other hand, according to the findings of Kenny and Johnson (2016) half of the respondents believed that interaction with their tutors through social media was unprofessional and a small number of students reported that they had done this (N = 12, 8%).

3.4.6.2 Sharing educational materials:

Five studies (31%) highlighted the role of different social media platforms in sharing educational materials either among the students themselves or with their teachers. These educational materials included videos, handouts, clinical images, microscopic images, questions, and answers, etc. (Kazi, Saxena and VineetVinay, 2016; Sen et al., 2016; Indu, Cherian and Kandoul, 2018; Naguib et al., 2018; Al-rabab et al., 2019). According to a study conducted by Kazi, Saxena and VineetVinay (2016) the instructors shared information related to microbiology after each lecture with their students at a Facebook group, and active discussions were carried out through this group. At the end of the study, 80% agreed or strongly agreed to incorporate Facebook as a learning method. Sen et al. (2016) revealed that
most of the participating dental students used different social media platforms to share educational links, articles, their cases and their timetables with their colleagues and tutors. In another study, Facebook groups were used by the instructors after each lecture of a biomaterials course to share educational materials including presentations, handouts, videos, assignments, and some questions about the lecture contents (Naguib et al., 2018). At the end of the course, both male and female students had positive perceptions regarding the use of Facebook groups for sharing educational materials and showed a future willingness to use the same platform for other subjects. Al-rabab et al. (2019) highlighted the role of Facebook in sharing educational materials by undergraduate fourth- and fifth-year dental students. 50.4% of the participants reported posting dentistry related questions on Facebook and relying on answers they received. Also 19.3% of students reported posting clinical images of their cases on their Facebook accounts, however, this did not come with any consent from the patients.

In another study, a WhatsApp group was created by the instructors to discuss labelled and marked images for histopathology slides with third-year dental students to help them with the course. At the end of the study, 62% of the participants agreed that the WhatsApp group helped them to understand histopathology better (Indu, Cherian and Kandoul, 2018).

### 3.4.6.3 Ease of use and accessibility:

One study (Souza et al., 2019) highlighted the value dental students gained from being able to access a variety of social media platforms (Facebook, WhatsApp, and Instagram) in their own time and at their own pace that suited their educational needs. Most participants considered Facebook to be an advantageous tool in the subject (infection control) studied (n=295, 99%) with the greatest practical utility being access to didactic materials published in the online page of the discipline in an easy way. Some appreciated the ability to continue learning outside of normal classroom hours as they could tailor their education to fit their personal life.

### 3.4.6.4 Free to use:

Two studies highlighted the free use of social media as an advantage for students (Indu, Cherian and Kandoul, 2018; Seo et al., 2018). According to the findings of a study conducted by Seo et al. (2018), 89.9% of the participating undergraduate dental students appreciated the free use of YouTube as a learning tool. In the same way, the findings of another study reported that undergraduate dental students experienced no additional financial burden with social media-based methods of learning (Indu, Cherian and Kandoul, 2018).
3.4.6.5 Student centred learning:

It seemed that social media could create a student-centred learning environment in which a student can adopt a personal learning style and pace. This advantage was highlighted in two studies (Kazi, Saxena and VineetVinay, 2016; Aldallal, Yates and Ajrash, 2019). According to the findings of Kazi, Saxena and VineetVinay (2016) all students agreed or strongly agreed that they can learn independently through Facebook. However, 45% of students mentioned that they would prefer their teachers as moderators during the use of Facebook as a teaching medium. The results of another study conducted by Aldallal, Yates and Ajrash (2019) revealed that 97.5% of fourth and final year undergraduate dental students at Manchester University mentioned that they used YouTube as a self-directed learning method for an oral surgery subject.

3.4.6.6 Teaching methods:

Social media as a meaningful teaching tool for undergraduate dental students has been reported in seven studies (44%) (Lee and Gould, 2014; Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018; Seo et al., 2018; Souza et al., 2019). Facebook (n=2), Twitter (n=2), YouTube (n=1) and WhatsApp (n=2) were all platforms that were used in the seven studies. Those platforms were evaluated as teaching tools in courses such as comprehensive anatomical sciences (Lee and Gould, 2014), medical emergencies in dentistry (Alshiekhly et al., 2015), microbiology (Kazi, Saxena and VineetVinay, 2016), radiology (Gonzalez and Gadbury-Amyot, 2016), periodontology (Seo et al., 2018), histopathology (Indu, Cherian and Kandoul, 2018) and infection control (Souza et al., 2019).

Lee and Gould (2014) used a Twitter account to post multiple choice questions and answers after each lecture. At the end of the course, 96.6% of the students reported that they felt very comfortable using Twitter to enhance their learning. Alshiekhly et al. (2015) used a Facebook group to teach medical emergencies in dentistry for undergraduate dental students. At the end of the course, two-thirds of students agreed that the Facebook group was useful in studying the course contents. In the same way, Facebook was used as a teaching method for microbiology at a dental college in India (Kazi, Saxena and VineetVinay, 2016). At the end of the semester, almost 80% agreed or strongly agreed to incorporate Facebook as a teaching method in dental education and 85% agreed or strongly agreed that using Facebook for teaching was feasible.

Gonzalez and Gadbury-Amyot (2016) used Twitter as a teaching tool for a radiology course for undergraduate dental students. At the end of the study, 90% of students either agreed or
strongly agreed that question and answer sessions were helpful for learning radiology. Seo et al. (2018) used YouTube videos as a supplementary teaching tool in a flipped classroom to teach a course of periodontology for undergraduate dental students. At the end of the course, 92.7% of the students watched the YouTube videos before attending the classroom lectures. 97.1% reported engaging in the supplementary learning practices, such as going back to the previous stage after stopping the micro-lecture videos using the pause function of YouTube when they encountered difficulty in understanding while watching the lecture. In addition, 85.5% of the students reviewed the related lecture videos to prepare for the examinations.

Indu, Cherian and Kandoul (2018) evaluated WhatsApp as a supplementary teaching tool for histopathology for undergraduate dental students. At the end of the course, 62% of students agreed that inclusion of WhatsApp as a method of teaching helped them understand histopathology better. In addition, 94% expressed a desire to incorporate social media in future teaching alongside conventional methods. Also, the use of WhatsApp as a teaching aid in infection control was reported in another study conducted by Souza et al. (2019). All the participants reported that using WhatsApp as a teaching aid was advantageous. Most frequently reported educational advantages of WhatsApp by dental students were obtaining information about the discipline quickly, clarification of doubts and receiving answers from the instructors (64.3%).

3.4.6.7 Source of information:

Social media were evaluated as sources of information for undergraduate dental students in eight studies (50%) (Lee and Gould, 2014; Sen et al., 2016; Naguib et al., 2018; Seo et al., 2018; Al-rabab et al., 2019; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020). Platforms like YouTube (Seo et al., 2018; Aldallal, Yates and Ajrash, 2019), Facebook (Naguib et al., 2018; Al-rabab et al., 2019) and Twitter (Lee and Gould, 2014) were assessed as a source of information. Three studies assessed social media in general as a helpful source of information for dental students (Sen et al., 2016; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020).

Lee and Gould (2014) revealed that the questions and answers tweeted on a Twitter account helped most of the students with information retention and helped them to recall this information whenever they wanted. Sen et al. (2016) reported that 87.4% of the participants used different social media platforms to watch educational videos. According to the findings of Seo et al. (2018) 76.8% of the participating students reported that YouTube had the advantage of allowing them to watch an enormous amount of data. 82.6% of the students mentioned that micro-lecture videos were more helpful for understanding class topics than in-
class lectures. In addition, 86.9% of the students subscribed to YouTube channels related to their course, and 58% of the students additionally watched the related videos that YouTube recommended. 69.4% of the participants referred to other advantages of YouTube as “VR content, replay, feedback using comments, subtitles, and live streaming”. Aldallal, Yates and Ajrash (2019) revealed that 67% of the participants used YouTube to look at information related to oral surgery. 41% stated that the information they gained from YouTube had influenced their practice positively. Almost half of the participants rated the quality of videos uploaded on YouTube as excellent or very good. Administration of local anaesthesia and tooth extraction were searched the most.

One study (Naguib et al., 2018) aimed to discover any gender-based differences regarding the use of Facebook as a source of information about dental biomaterials. It was observed that female students were significantly more satisfied than the males to use Facebook in studying topics about the biomaterials course (p=0.009) and to study other subjects (p=0.012) and they thought that Facebook can be useful for didactic discussions (p=0.009). Although female students appreciated more the benefits of the questions, answers and videos posted on Facebook, compared to male students, the difference between them were not statistically significant. In a study conducted by Al-rabab et al. (2019), the authors reported that 80% of the participating undergraduate dental students reported using Facebook as a source of dental information related to their studies. 82% thought that having Facebook pages and post links presented during lectures would help improve the learning process. The most popular topics students looked for in Facebook were “cavity preparation”, tooth extraction, local anaesthesia injection, implant related procedures, and crowns and veneers”. 94.1% reported liking dentistry related posts or pages on Facebook. The most liked pages were “aesthetic and cosmetic dentistry pages (68.1%) endodontic pages (40.7%) oral medicine pages (23.7%) and implant dentistry pages (17.8%)”. Nearly half of the participants (50.4%) reported posting dentistry related questions on Facebook and relying on answers they get.

Souza et al. (2019) explored the role of three social media platforms (Facebook, WhatsApp, and Instagram) as sources of information for undergraduate dental students. The use of social media as virtual learning methods for infection control in dentistry was 98.3% for Facebook, 100% for WhatsApp, and 90% for Instagram. 18% believed that Facebook represented an easy way to access didactic materials quickly. 64.3% believed that WhatsApp allowed them to get quick responses from their teachers. 94% mentioned that subject related images on Instagram allowed them to assimilate the studied subject more effectively. According to the findings of a study conducted by Saadeh, Saadeh and Torre (2020) 49% of dental students used social media to look at dental information.
3.4.6.8 The overall grading score:

The influence of using social media in dental education on the overall grading score was assessed in six studies (Lee and Gould, 2014; Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018; Souza et al., 2019). Lee and Gould (2014) assessed the performance of second year dental students on an anatomical course through a “pre-quiz” and after 10 weeks from using Twitter in the course, the students were reassessed through a “post-quiz”. The students’ pre-quiz score average was 52.5%, while the post-quiz scores averaged 56.39%. The results of a study conducted by Alshiekhly et al. (2015) who used Facebook as an educational tool for teaching medical emergencies in dental practice, indicated that post-intervention assessment showed a significant improvement in students’ scores that were higher than the pre-intervention assessment scores. The reported improvement was highest for some basic life support procedures and the management of common medical emergencies. Another study conducted by Kazi, Saxena and VineetVinay (2016) also evaluated the performance of all students by conducting formative assessments with multiple choice question tests on topics taught in didactic classroom lectures and later shared with a Facebook group. The Facebook group had more correct answers compared to the control (classroom) group with a statistically significant difference (p<0.049).

Gonzalez and Gadbury-Amyot (2016) explored the perceptions of undergraduate dental students about whether Twitter had a positive impact on the learning environment. 43% of the participants perceived that using Twitter for question-and-answer sessions had improved their overall grades in oral radiology. Indu, Cherian and Kandoul (2018) assessed the level of performance of two groups (Group A who attended classroom lectures and used WhatsApp as a supplementary learning tool and group B who just attended the classroom lecture) who studied histopathology. The results found no significant differences between the two groups regarding identification of the disease, however, regarding identification of the histopathological features of a lesion, group A showed significantly higher scores than group B. One more study (Souza et al., 2019) compared the academic performance (scores) of undergraduate dental students who included social media in their studies and those of the previous semesters who did not use social media. The comparison of the test scores obtained by students enrolled in the course before and after inclusion of social media did not indicate a statistically significant difference between the two (p=0.141; Student’s t-test).
3.4.7 Concerns about using social media in dental education:

3.4.8 Distractive nature:
The distractive nature of social media was illustrated in two studies (Indu, Cherian and Kandoul, 2018; Al-rabab et al., 2019). Indu, Cherian and Kandoul (2018) who evaluated the use of WhatsApp in learning revealed that 60% of the participants completely agreed that they were getting distracted while they use social media by other online activities away from learning. Al-rabab et al. (2019) found that 25.2% of the participating undergraduate dental students perceived that Facebook was time consuming and distracting to look at dental information on Facebook.

3.4.8.1 Privacy concerns:
Privacy concerns were reported in three studies (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Kenny and Johnson, 2016). One of the main concerns for the students was the possible blurring of the line between their personal and professional lives. Arnett, Loewen and Romito (2013) reported that half of the participating dental and dental hygiene tutors indicated that the main barriers with using social media were privacy concerns. According to the findings of Arnett, Christensen and Nelson (2014) of the 16% of respondents who did not or who rarely participated in social media, 60% were concerned with privacy. Additionally, Kenny and Johnson (2016) revealed that most of the students used privacy settings for at least one platform. Facebook users reported having privacy settings to limit their audience. Twitter was the most common platform to be openly accessible to all (42% of Twitter users had open profiles). This was followed by YouTube and then Instagram. Most students (87%) did not feel their social media behaviour was separate from dental school. Most students intended to review (41.29%) or made minor changes (37.42%) to their social media profiles in order to protect their privacy. A small number of students (11%) intended to either delete their profiles or create separate professional online identities.

3.4.8.2 Quality of information:
One of the main challenges to incorporate social media in dental education was the quality of information available on social media and the evidence base for this information. This concern was highlighted in four studies (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Al-rabab et al., 2019; Saadeh, Saadeh and Torre, 2020). Arnett, Loewen and Romito (2013) found that 15.5% of participating dental and dental hygiene faculty members expressed their concerns about the “lack of relevant information on social media”. Also, Arnett, Christensen and Nelson (2014) revealed that 6.8% of the participants did not prefer to use social media in dental education as they believed that social media lacks relevant
information. According to another study conducted by Al-rabab et al. (2019) traditional teaching was preferred by 40.6% of participants because they believed that it provided evidence-based information (51.1%). Saadeh, Saadeh and Torre (2020) reported that most medical and dental students did not consider social media as trusted sources of information. However, medical students were less likely to use social media to look at medical information than dental students.

3.4.8.3 Professionalism:

Some concerns about the unprofessional usage of social media by dental students were raised in three studies (Henry and Pieren, 2014; Kenny and Johnson, 2016; Al-rabab et al., 2019). Some of the dental hygiene educators who participated in the study conducted by Henry and Pieren (2014) reported some violations from the students’ side to social media policies in form of unprofessional comments on the faculty, university, staff or other students. Kenny and Johnson (2016) highlighted the unprofessional usage of social media by undergraduate dental students. The findings of that study showed that respondents did not consider publishing photographs identifying their university as being unprofessional behaviour but 54% felt that publishing photographs of students within a clinical setting was unprofessional. 64% considered that publishing photos online of students drinking alcohol was unprofessional, this rose to 92% for images of intoxicated students. One third of students rated posting anonymised dental procedures as unprofessional (32%). Half of the respondents perceived that interacting with their tutors through social media was unprofessional. Most students perceived that using open and public groups to discuss patients, tutors/other students, interactions with patients via social media and making negative comments about individuals’ characteristics were unprofessional. Interestingly, female students were more likely to post photographs of students, interact with their tutors or patients through social media or post anonymised procedures than male students. In the same way, the findings of another study conducted by Al-rabab et al. (2019) indicated that nearly one fifth (19.3%) of undergraduate dental students reported posting clinical images of their cases on Facebook without obtaining consent from their patients.

3.4.9 Recommendations of the included studies:

Six studies delivered direct recommendations to undergraduate dental students, their tutors, and the faculties for appropriate usage of social media in dental education. Lee and Gould (2014) advised dental tutors to utilise social media to supplement classroom teachings as it was shown that this approach increased interactivity between the students and their teachers either inside or outside the classroom. Arnett, Christensen and Nelson (2014) recommended training for both the students and their tutors before incorporating social media in dental
education. In the same way, Kenny and Johnson (2016) recommended undergraduate dental students to receive training before using these new technologies in the learning process. This training should include awareness of the practical and professional use of social media, professional standards, and the appropriate behaviour. Indu, Cherian and Kandoul (2018) advised educators to make their students aware of the safe and professional usage of social media and to apply the institutional ethical guidelines for the social media behaviours. Also, the authors recommended to take care about patient privacy when students and teachers deal with the online platforms. In addition, they recommended to apply group discussions about certain subjects through appropriate social media platforms in order to encourage everyone to express their doubts without hesitation. Indu, Cherian and Kandoul (2018) suggested that WhatsApp could be an excellent supplementary educational tool, when used appropriately. Aldallal, Yates and Ajrash (2019) recommended using YouTube as a supplementary tool in dental education, but it should not be used without validated instructional material. To prevent a propagation of bad practice, universities were advised to provide recorded materials of their own and to teach students to review the videos critically. Al-rabab et al. (2019) advised dental schools to create their own Facebook pages dedicated to enrolling students.

3.5 Discussion

This systematic review represents the first synthesis of an English-language peer-reviewed literature evaluating the use of social media in dental education. Since the use of social media in dental education is relatively new and under regular change, the aim of this systematic review was to find out which social media tools have been integrated into dental education and how they have been used by dental students and their teachers for learning or teaching. In addition, this systematic review highlighted the positive and negative aspects of using these technologies in the dental education field.

The temporal distribution (2013-2020) of the sixteen reviewed studies confirms that research on the use of social media in dental education continues to increase and attracts scholarly interest. This was also clear in the diversity of geographical areas of the included studies that were conducted in USA, UK, India, Saudi Arabia, Syria, South Korea, Jordon, and Brazil. The included studies aimed to evaluate social media in general (n=7) and in particular Facebook (n=4), YouTube (n=2), WhatsApp (n=1) and Twitter (n=2). The prevalence of Facebook, YouTube, WhatsApp, and Twitter studies is probably linked to the worldwide popularity of these social networking sites.

In terms of research methods, it was found that all the included studies were observational including either descriptive cross-sectional studies (n=14) or randomised control trials (n=2).
The study designs incorporated surveys, post- or pre- and post-interventional surveys and only one structured interview study. However, using a single design method has limitations in exploring the myriad of variables involved in the learning process, such as implementation problems and the attitude of participants (Price, Jhangiani and Chiang, 2015). In addition, there were insufficient data about how and why social media were used by dental students and their teachers. Future studies should seek to use multiple data sources or conduct in-depth probing during data collection, as well as adopting triangulation methods to ensure research quality.

Descriptive research is “aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than was possible without employing this method” (Fox and Bayat, 2007). Descriptive studies often represent the first scientific “toe in the water” in new areas of investigations (Grimes and Schulz, 2002). Considering integrating social media in dental education as a recent phenomenon, being widely used for only the last decade, it is not surprising that at this stage research scholars are only using descriptive studies to answer questions such as “who, what, when and where” (Cheston, Flickinger and Chisolm, 2013; Guraya, 2016). However, descriptive studies are not suitable to answer “how and why” questions. In cross-sectional studies, the validity of the results is mainly dependent on whether the study sample is well representative of the population proposed to be studied, and whether all individual measurements were made using an accurate and identical tool, or not. If these criteria were not obtained, the results, then, are unlikely to be reliable. In addition, if the researcher has a potential bias towards the research, the observations then maybe considered as biased or untrue (Aggarwal and Ranganathan, 2019).

The findings of this review revealed that Facebook, Google+, Twitter, YouTube, WhatsApp, Instagram, Pinterest, and LinkedIn were the most used social media platforms by undergraduate dental students for educational purposes. This is not surprising, as by April 2020, Facebook was the first social networking website with almost 2.5 billion monthly active users followed by YouTube and WhatsApp with almost 2 billion monthly users for each (Statista, 2020). Additionally, Pinterest has been the fastest independently launched site to reach 10 million monthly visitors. By April 2020, Pinterest had 366 million users and is the 15th most popular social media in the world (Statista, 2020). The popularity of these social networking sites maybe because they are usually available in multiple languages and enable users to connect with peers across geographical, political, or economic borders, in addition to the variety of information and media content available at these platforms (Zhu et al., 2019). Moreover, three included studies highlighted the ease of use, the accessibility of social media
and their free of charge use as bonus advantages that have promoted the use of a range of social media platforms among university students (Indu, Cherian and Kandoul, 2018; Seo et al., 2018; Souza et al., 2019). The prevalence of social media is still expected to grow as smartphone device use and mobile social media platforms increasingly gain attraction especially among teenagers (Lee et al., 2016). It is also likely that the widespread use of social media reflects patterns of adoption of new technologies for educational purposes (Kenny and Johnson, 2016).

Considering the existing review, seven studies out of sixteen reported negative findings or highlighted students’ and tutors’ concerns about using social media in dental education. In contrast, all the included sixteen studies reported a number of positive aspects of social media as educational tools. This could indicate a publication bias with scholars only reporting positive outcomes (O’Connor et al., 2018).

3.5.1 Communication, interaction and sharing educational materials:
Undergraduate dental students highlighted the role of social media to facilitate the communication and interaction among them or between them and their teachers in seven studies (Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kenny and Johnson, 2016; Sen et al., 2016; Indu, Cherian and Kandoul, 2018; Al-rabab et al., 2019; Souza et al., 2019). The reason behind that could be the ability of social media to facilitate real-time communication among students outside the classroom which foster collaborative learning (Guraya, 2016). In addition, social media provide a forum to connect students with their teachers from wherever they are, offering the flexibility of extended learning hours and establish another online link between students and their faculty more openly and instantaneously (Wiberg, 2007). Moreover, Facebook has some privacy settings that allow students to create closed online groups enabling them to communicate with each other comfortably to discuss their own concerns, fears and doubts away from their tutors’ eyes (Kenny and Johnson, 2016). Twitter also seems to be a helpful way of interaction among students or between students and their tutors. The tweeting privilege may encourage class participation and allow the students to voice their opinion, and to share ideas (Fox and Varadarajan, 2011).

Ekarattanawong et al. (2015) suggested that social media enhanced communication with lecturers because students can speak directly to their tutors through the different social media platforms whereas before they had to go through a class representative. The speed of response has also increased. The authors argued that questions answered by means of social media were more valued by 2nd year medical students than in-class answers. However, the
authors found that communication among the students themselves was poor. This could be because the use of a Facebook page was not seen suitable to open discussions like other forms of social media. The authors suggested that a ‘closed group’ would yield better participation.

The speed of feedback was also highlighted by Hennessy et al. (2016) to be a strength of using Twitter. Several students reported that Twitter was helpful over the revision period to get rapid feedback and answers to their questions from their tutors. The rapid feedback maybe due to the 140-character limit in Twitter. In addition, the hashtag being used was public and therefore available to all students. This meant that students were able to look at each other’s questions and answers they received from their tutors. Hennessy et al. (2016) also noted that the face-to-face relationship between students and their tutors improved. Students felt that because they had spoken to their tutors via Twitter that they were then more approachable in the classroom. This shows that a relationship built online can be reflected to the classroom.

The ease of communication facilitated the sharing of online educational materials either among the students themselves or between them and their tutors. This privilege was highlighted in five studies (Kazi, Saxena and VineetVinay, 2016; Sen et al., 2016; Indu, Cherian and Kandoul, 2018; Naguib et al., 2018; Al-rabab et al., 2019). The value of social media in facilitating communication, interaction and the sharing of educational material among students and between them and their teachers has been illustrated in systematic reviews of other educational fields such as medical (Cheston, Flickinger and Chisolm, 2013; Smith and Lambert, 2014; Cordos, Bolboacâ and Drugan, 2016; Guraya, 2016; Whyte and Hennessy, 2017) and nursing (O’Connor et al., 2018) education. However, authors of these systematic reviews were concerned about some misunderstandings that could be associated with online communication. This could be because interaction over social media lacks facial expression. Additionally, students who answer questions for their colleagues in social media groups might give incorrect answers or information leading to confusion amongst the students. This concern can be addressed by correcting students’ answers, monitoring information quality by the tutors, or by limiting the ability of students to post to the whole group (Alshiekhly et al., 2015).

3.5.2 Teaching through social media

Facebook, Twitter, YouTube, and WhatsApp were found as meaningful ways for teaching many subjects in dental education. The acceptability of social media as a teaching-learning method by dental students might be due to the ease of use, being free of any cost and accessibility through many devices such as: smart phones, tablets, laptops, or personal computers (O’Connor et al., 2018). Additionally, some students might feel more comfortable to ask their tutors questions through social media instead of face to face (Kazi, Saxena and
VineetVinay, 2016). Gonzalez and Gadbury-Amyot (2016) suggested that Twitter could be used meaningfully as a teaching tool as it provided “near-immediate interaction, condensed posts, open interaction, and no requirement to join to view posts”. The near-immediate interaction privilege allowed students to ask questions and receive answers within minutes, ensuring they spent less wasted time on studying unrelated materials. Additionally, the limit of 140 characters forced both students and their tutors to post questions, answers, or comments in a direct and briefed way, making it easier for others to know exactly what was being asked and getting a direct answer. The open interaction of this platform allowed students to respond to others’ questions, creating an open collaborative learning environment in which the tutors would then guide their students to the correct answers. Another point worth mentioning about Twitter was that anyone with an internet connection could view all the posts, comments, questions, answers, photos, and radiographs that were posted (Gonzalez and Gadbury-Amyot, 2016).

YouTube was used as a supplementary teaching tool in a flipped classroom to teach a course of periodontology for undergraduate dental students (Seo et al., 2018). At the end of the study 97.1% reported engaging in the supplementary learning practices. Using YouTube in flipped classrooms gave the students the opportunity to study in their own pace. In addition, the settings supplied by YouTube enabled the students to pause, reply, adjust the speed and sound, comment and share with their peers or with their tutors. Furthermore, YouTube’s dashboard contains suggestions for relevant videos allowing the students to access and experience more meaningful learning materials and discover more about the subjects. It is noteworthy that supplying the students with educational videos allows them to reuse those materials in the future for continuing education or refreshing their minds. YouTube has also the privilege of “subscribe” which enables their users to get noted by any future relevant videos (Seo et al., 2018; Aldallal, Yates and Ajrash, 2019). In contrast, in a study conducted in five North American dental schools, only 21.4% of the participating dental and dental hygiene faculty members reported using YouTube videos in their lectures. One-third of the respondents indicated an uncertainty about the usefulness of social media applications, which suggests that there is room for improvement in faculty awareness about the educational applications of social media (Arnett, Loewen and Romito, 2013).

Introducing social media in the teaching process in dentistry rose from the need to utilize virtual tools that are easy to apply in an active learning approach. This is believed to transfer conventional classes into more dynamic and attractive environments for dental students who are actively involved in these technologies in their daily lives (Souza, Lopes and Lima, 2017). A systematic review (Cheston, Flickinger and Chisolm, 2013) about the use of social media in
medical education including 14 studies has revealed that students` engagement was the most prominent advantage in incorporating social media tools in teaching for undergraduate medical students.

### 3.5.3 Social media as sources of information

According to the findings of this review, Facebook, YouTube, WhatsApp, and Instagram have been used meaningfully as sources of information for undergraduate dental students in eight included papers (Lee and Gould, 2014; Sen et al., 2016; Naguib et al., 2018; Seo et al., 2018; Al-rabab et al., 2019; Aldallal, Yates and Ajrash, 2019; Souza et al., 2019; Saadeh, Saadeh and Torre, 2020). Souza et al. (2019) explored the reasons behind the prevalence of three social media tools (Facebook, WhatsApp, and Instagram) as sources of information. 18% of the participants highlighted the value of Facebook as an easy way to access didactic materials quickly. 64.3% believed that WhatsApp allowed them to get quick responses from their teachers. 94% mentioned that subject related images on Instagram allowed them to assimilate the studied subject more effectively. In contrast, four other studies highlighted concerns related to the quality of information published on social media (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Al-rabab et al., 2019; Saadeh, Saadeh and Torre, 2020). According to the findings of (Saadeh, Saadeh and Torre, 2020) 92% of medical and dental students reported using two or more social media. However, around 60% of medical and dental students did not consider social media as trusted sources of information. Over half of them reported rare use of social media to look for medical information and 96.5% did not rely on recommendations posted on social media to make their treatment decisions. Saadeh, Saadeh and Torre (2020) suggested that the high privilege of social media usage among dental students does not necessarily indicate high usage for educational purposes.

Arnett, Loewen and Romito (2013) highlighted the barriers behind the unwillingness of dental and dental hygiene tutors to incorporate social media in teaching process. Time and privacy concerns, uncertainty about the usefulness of social media, lack of relevant information and lack of expertise in how to use social media applications were the main barriers. These findings were substantiated by a systematic review conducted by Smith and Lambert (2014) who included 16 papers that highlighted the major concerns among medical faculty members towards using social media. The authors found that the impact of disclosure, professionalism and inappropriate content were the main barriers that avoid faculty members from using social media in medical education. This is likely due to the informal and personal nature of their use of these networks. However, the authors suggested that faculty members should receive training to improve their skills in using social media appropriately. As with any instructional
aide, such training should include information on evaluation and outcomes of the new employed technologies.

3.5.4 The influence of using social media upon the overall grades:
Six studies (Lee and Gould, 2014; Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018; Souza et al., 2019) highlighted the positive influence of utilizing social media in dental education upon the overall grades of the undergraduate dental students. According to the study conducted by Lee and Gould (2014) the questions and answers posted on the Twitter account led to an increase in the overall students’ score. The authors suggested that this approach aided knowledge retention and recall. Moreover, the exposure to 140-character tweets on a regular basis after the end of each lecture aided in information retrieval and subsequently long-term knowledge retention.

Souza et al. (2019) revealed an insignificant difference between before and after use of social media applications. This insignificance can be justified by the fact that they are only online educational resources to facilitate learning and access to educational materials. It is important to remember that social media are only tools, not a methodology. These tools, when properly used in a meaningful pedagogical context, can engage the students in an active learning environment where they can research, read, write, ask, discuss, or stay busy in problem-solving and developing projects. Such methodologies can encourage the development of students’ autonomy, increasing curiosity in the subjects, as well as stimulating decision making. Despite this similarity in the scores, it was possible to notice improvements in the development of knowledge for the students who experienced social media in the teaching of Dentistry. In contrast, Kirschner and Karpinski (2010) found a negative relationship between Facebook use and cumulative “Grade Point Average” (GPA) as the quantitative analysis of their study showed that there were mean differences between the GPAs of users (M = 3.06) and nonusers (M = 3.82). This has been agreed by, Paul, Baker and Cochran (2012) who showed that the time spent on social media by the medial students could negatively influence students’ academic performance. In their structural equation model, the authors reported a small, but significant, negative relationship (R = −0.119, P = 0.048) between time spent on social media and academic performance as measured by course grades and GPA.

3.5.5 Learning theories
Two learning theories (“connectivism” and “constructivism”) supported incorporating social media into the education system. “Connectivism” learning theory explained how internet technologies have created new opportunities for individuals to learn through communication
between peers and sharing information across online peer networks (Siemens, 2005; Whyte and Hennessy, 2017; Indu, Cherian and Kandoul, 2018). According to “constructivism” learning theory, students become able to subjectively construct knowledge themselves through interaction with their peers. Integrating social media into dental education offered an opportunity for learning to become more social because it is student-generated and collaborative (Kazi, Saxena and Vineet Vinay, 2016; Aldallal, Yates and Ajrash, 2019). Students can build their own knowledge from individuals with high level of expertise. Those individuals traditionally were their tutors, but they can also be their peers. It is thought that collaborative learning through interactions with others is vital for the students’ development and learning (Flynn, Jalali and Moreau, 2015; C. M. Hennessy et al., 2016).

In line with social constructivism, situated learning theory appears to support using social media for educational purposes (Hung and Yuen, 2010). The theory viewed learning as a participatory process in a social context. According to Lave and Wenger (1991), situated learning “extends the model of knowledge construction” by proposing that learning is situated in a specific context and embedded in a particular social and physical environment. In addition, using social media is believed to enhance the “community of practice” in the college classroom. Hung and Yuen (2010) argued that a sense of community was an essential element for successful e-learning.

3.5.6 Privacy and professionalism concerns

Although there were many positive aspects with using social media within a dental education context, this review has highlighted some concerns among undergraduate dental students and their teachers. Concerns related to professionalism (Henry and Pieren, 2014; Kenny and Johnson, 2016; Al-rabab et al., 2019), the distracting nature of social media (Indu, Cherian and Kandoul, 2018; Al-rabab et al., 2019) and privacy concerns (Arnett, Loewen and Romito, 2013; Arnett, Christensen and Nelson, 2014; Kenny and Johnson, 2016) have been reported.

One of the main concerns for dental tutors (Arnett, Loewen and Romito, 2013) and the students (Arnett, Christensen and Nelson, 2014) was the possible blurring of the line between their personal and professional lives. Many faculty members did not consider their students as friends and accepting a Facebook “friend request” from a student could blur these boundaries. On the other hand, students in a study conducted by Kenny and Johnson (2016) chose to use a range of privacy settings according to the social media platforms in order to limit access to their Facebook profiles and some limiting access to other platforms. In addition, students reported that they prefer to discuss their own thoughts and doubts in closed groups away from their teachers. However, using closed groups does not mean complete security
because information published in closed groups is susceptible to screenshots and sharing this information with others outside the closed groups is possible (Henry and Molnar, 2013).

Kenny and Johnson (2016) and Al-rabab et al. (2019) highlighted some unprofessional behaviour of undergraduate dental students regarding the way they use social media. This included publishing photographs of their clinical cases without consent from the patients, publishing photographs of their peers or tutors within the university campus without their permission, publishing photos online of students drinking alcohol, inappropriate interactions with tutors, interaction with patients and making negative comments about other individuals of social media by undergraduate dental students. These findings were supported by another systematic review conducted by Cordos, Bolboacă and Drugan (2016) who investigated the use of social media as a source of information for healthcare students. After reviewing 33 papers, the authors revealed that there were some profiles that showed unprofessional content, profiles had limited privacy but gave full access to photograph albums that contained personal images of the students’ children, spouse, and friends. Students understood the importance of maintaining professionalism on their social media sites. While the use of social media escalates, ethical policies and guidelines regarding the appropriate and professional conduct in dental schools need to be applied. The educators and administrators of dental schools are urged to develop ethical policies to define the balance between the appropriate and inappropriate social media behaviours that can help students navigate their online interactions (Wiberg, 2007; Cordos, Bolboacă and Drugan, 2016). Nevertheless, the application of a social media policy alone cannot prevent unprofessional networking behaviour by students and there is a strong urge to enforce the fundamental principles of ethics in dental schools (Guraya, London and Guraya, 2014). The UK General Dental Council (GDC) has set out guidance for the appropriate use of social media and digital professionalism applies to all dental professionals (General Dental Council, 2016).

3.6 Gaps in the included studies

3.6.1 Gaps in study designs

Considering the included studies, most were descriptive in nature, highlighting the attitudes of undergraduate dental students towards the use of social media in dental education. However, since incorporating social media in dental education is in its initial stages (Souza et al., 2019) more interventional studies are needed to assess the effectiveness of utilizing social media for teaching and learning purposes. In addition, the included studies lacked qualitative designs. There were only three mixed method studies. Two studies (Henry and Pieren, 2014; Gonzalez and Gadbury-Amyot, 2016) used questionnaires with open ended questions and one (Alshiekhly et al., 2015) used structured interviews after collating quantitative data. More
qualitative studies are needed to discover the in-depth perceptions of the undergraduate dental students and their teachers about the use of social media in dental education. Also, only two studies (Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018) employed comparative designs. More comparative studies are needed to find out the differences between using social media in dental education and any other pedagogical disciplines.

Only two studies (Arnett, Loewen and Romito, 2013; Henry and Pieren, 2014) included dental and dental therapy tutors in their design. Additionally, more studies are needed to explore the perceptions of dental hygiene, dental therapy, and dental nursing students. Also, more studies are needed to evaluate the perceptions of dental, dental therapy, dental hygiene, and dental nursing tutors about incorporating social media in dental education. Another gap worth mentioning was the quality of the included studies. Only four studies fulfilled all the quality appraising criteria. More high-quality studies are needed to minimise the risk of bias. Additionally, the number of social media that were assessed were limited and more studies are needed to explore the role of more social media tools in dental education. Also, most of the included studies were conducted in a single university. Comparisons between different universities are needed in order to explore a variety of learner populations and to find out any differences between different universities or any geographical influence on the results.

3.6.2 Gaps in study results

Although, the included studies reported some drawbacks related to the privacy, professionalism, quality of published information and the distractive nature of social media, none of the included studies suggested proper solutions, methods, guidelines, or policies to utilize social media in dental education more meaningfully. In addition, more unpacking is needed to explore attitudes and perceptions of undergraduate dental students and their teachers about the role of social media in dental education. No studies assessed the impact of social media on the clinical performance of dental students. Also, more studies are needed to explore the impact of social media on the educational performance of dental learners. Moreover, no study produced a clear definition of social media.

3.7 Limitations:

This systematic review has several limitations. Considering the recent rapid growth of literature about the use of social media in dental education, the most recent relevant articles that have been published since this search was conducted would have been missed. Moreover, some of the limitations of this systematic review were due to the inclusion and exclusion criteria. Inclusion of only English language studies might have excluded valuable non-English
language literature. In addition, exclusion of the grey literature could result in missing potentially valuable data leading to publication bias. Also, only peer-reviewed full text articles were included which allowed for the omission of potentially valuable data from non-peer reviewed articles. It is possible that the thesis author unintentionally excluded some relevant keywords and thereby relevant studies. Another limitation worth mentioning is that only three studies, out of sixteen, highlighted the negative aspects of incorporating social media in dental education. In contrast, ten studies illustrated the benefits of social media, and three studies discussed the pros and cons of utilizing social media in dental education. This could reflect a potential publication bias with authors favouring the benefits of social media rather than the negative aspects. Another limitation was that the included studies in this review were heterogeneous which did not allow for performing a meta-analysis. Social media are recent advancements in web technology and therefore the results are incredibly time-dependent, with new advancements and technologies becoming available with increasing frequency.

3.8 Conclusion
This systematic review included sixteen studies. Facebook, Google+, Twitter, YouTube, WhatsApp, Instagram, Pinterest, and LinkedIn are the most commonly used social media platforms by undergraduate dental students for educational purposes. Students used a variety of social media tools for communication, interaction and sharing of educational material (videos, photographs, radiographs, handouts, questions, answers, etc.) with each other or with their tutors and to look for information. The literature included some benefits of using social media in dental education. Social media were found to be online communication and interactivity tools, a way for sharing educational materials, a source of information, easy to use, accessible, and free of cost. In addition, they were able to encourage student-centred, active, and collaborative learning. Moreover, using social media in dental education was found to have a positive influence on the students’ overall assessment grades. However, some of the included studies reported some concerns regarding professionalism, privacy, the distractive nature of social media and the quality of information published on social media. Both undergraduate dental students and their teachers should be well trained in order to be able to use social media in the most pedagogically effective way. In addition, scholars have called to apply ethical guidelines and policies in order to protect the privacy of dental students, teachers, and patients.

The following chapter will explain the methodology that was adopted in this research to target the research objectives.
Methods
4 Methods

4.1 Introduction
In order to target the objectives of the research, a mixed methods sequential explanatory research design was adopted. This approach consisted of two phases. The first phase was a quantitative research approach using an online questionnaire that was delivered to undergraduate dental students and their teachers. The questionnaire aimed to find out: what social media are used by the participants; the prevalence of using social media for educational purposes; the perceptions of the participants regarding using social media for educational purposes; the prevalence of using social media for communication; the sharing of educational materials and to search for information and perceptions of the participants regarding the quality of information published on social media.

The second phase of the research adopted semi-structured interviews. The aim of this phase was to further investigate and justify some of the results of the quantitative research through finding out how social media were used by undergraduate dental students and their teachers for educational purposes. In addition, it aimed to explore participants’ perceptions regarding the strengths and weaknesses of using social media in dental education (Table 5.1).

Table 4.1 aims of the research designs used

<table>
<thead>
<tr>
<th>Research design</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative research</td>
<td>To find out what social media were used by the participants for educational purposes.</td>
</tr>
<tr>
<td></td>
<td>To explore perceptions of the participants regarding using social media for educational purposes</td>
</tr>
<tr>
<td>Qualitative research</td>
<td>To provide a novel definition of social media</td>
</tr>
<tr>
<td></td>
<td>To find how social media were used by undergraduate dental students and their teachers for educational purposes.</td>
</tr>
<tr>
<td></td>
<td>To find the positive and negative aspects regarding using social media in dental education.</td>
</tr>
<tr>
<td></td>
<td>To explore perceptions of the participants regarding using social media for educational purposes.</td>
</tr>
<tr>
<td>The two approaches together</td>
<td>To provide recommendations for the appropriate use of social media in dental education.</td>
</tr>
<tr>
<td></td>
<td>To develop a model for using social media in dental education.</td>
</tr>
</tbody>
</table>
4.2 Ethics approval:
Since, this research involved human participants, it was fundamentally crucial to get ethical approval from University of Portsmouth, as the host institution for this PhD study. Anonymity of the participants was guaranteed. The aim of the research was made clear to the participants and their right to withdraw at any time was explained. The contact details of the principal investigator and the supervisors were provided to the participants. The data collected were stored safely on a google drive, and only the principal investigator and the supervisors had access to the data. Information about how these data would be used were provided to the participants. A signed consent form was obtained from each participant before both the quantitative and the qualitative research aspects of the study.

Favourable ethical approval was obtained on the 10th of September 2019 from the Science and Health Faculty Ethics Committee at the University of Portsmouth, UK (Reference Number: SFEC 2019-081). Since then, two notifications for substantial amendments have been submitted to the same ethics committee. The first was on the 3rd of October 2019 to include a new university in the study (Beirut Arab University) (Reference number: SFEC 2019-081A). The second amendment agreement was obtained on the 18th of May 2020 (SFEC 2019-081B) to replace Beirut Arab University with Pharos University because the former university became unable to take part in the study. In addition, focus group discussions were replaced with online semi-structured interviews because face-to-face communication was suspended by the government in the UK due to the COVID-19 pandemic. (Appendix 4,5,6)

4.3 Insurance/indemnity Arrangements
This project has received confirmation of insurance by the University of Portsmouth’s Professional Indemnity Insurance (Appendix 7).

4.4 Study design:
This study utilized a mixed methods sequential explanatory research design. Mixed methods research was defined by Creswell and Clark (2011, p.123) as “The type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration”. Mixed methods research provides broader and more in-depth evidence for studying a research dilemma than either quantitative or qualitative research alone. It allows researchers to use all of the tools of data collection available rather than being restricted to those types associated with quantitative or qualitative research (Creswell and Clark, 2011).
A mixed methods sequential explanatory design (Creswell and Clark, 2011) consisting of two phases, was incorporated in this study. The first phase was quantitative (numeric) data collection using online questionnaires delivered for undergraduate dental students (including dental care professional students: dental therapy, dental hygiene, and dental nursing students) and their teachers. After analysis of the results of the quantitative data, a second phase including qualitative (text) data collection was carried out using semi-structured interviews for the same study population. The rationale for this approach was that the quantitative data and their subsequent analysis provided a general understanding of the research dilemma, while the qualitative data from the semi-structured interviews could help to explain the reasons behind and meaning of the quantitative questionnaire results for the purpose of complementarity (Ivankova, Creswell and Stick, 2006; Creswell and Clark, 2011; Mckim, 2017).

### 4.5 Study population:

Invitation letters were sent to the Deans of the participating dental schools to get approval for their students and dental teachers to participate in this study (Appendices: 8-15). The dental schools were:

1. The Faculty of Dentistry, Alexandria University (a state university in Egypt).
2. The Faculty of Dentistry, October University for Modern Science and Arts (MSA University) (a private university in Egypt).
3. The Faculty of Dentistry, Pharos University (a private university in Egypt).
4. University of Portsmouth Dental Academy (UPDA), UK.
5. The Faculty of Dentistry, Oral & Craniofacial Sciences at King’s College London, UK.

A convenience sample was selected. Convenience sampling is “a type of nonprobability or non-random sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time, or the willingness to participate are included for the purpose of the study” (Etikan, Musa and Rukayya, 2017, p.2). The convenience sampling was applied to both the participating universities as well as the participating students and teachers. This sampling technique was adopted because participation in this study was voluntary and only individuals who had the willingness to participate were included (Etikan, Musa and Rukayya, 2017; Jager, Putnick and Bornstein, 2017). This comprised undergraduate dental and dental care professional (dental hygiene, dental therapy, and dental nursing) students and their teachers from five dental schools (Table 5.2).
Inclusion Criteria:

- Undergraduate dental students (including dental care professional students: dental hygiene, dental hygiene and dental therapy and dental nursing students) from the five previously mentioned universities.
- Dental teachers from dental schools of the five previously mentioned universities.

Exclusion Criteria:

- Postgraduate dental students.
- Intern dental students.
- Students and/or their teachers outside of the previously mentioned universities.

4.6 Quantitative study:

4.6.1 Questionnaire for students

An online Google Form based questionnaire (Appendix 16) was developed to be sent to the dental (including dental care professional) students. The questionnaire was created based on similar studies related to the topic (Arnett, Loewen and Romito, 2013; Thalluri and Penman, 2015; Naguib et al., 2018; Al-rabab et al., 2019; Saadeh, Saadeh and Torre, 2020) and the questions were formatted according to the objectives of the study. At the beginning of the questionnaire, there was a brief introduction about the study, definition of social media with examples and objectives of the study. Participant consent was gained by ticking a box confirming the participant’s willingness to take part in this study by completing the questionnaire. The questionnaire consisted of 25 questions including multiple-choice (n=14) and Likert-scale (n=11) based questions. A 5-point Likert scale was used as it is simple to read and understand by the participant without being overwhelmed by many clarifications. Also, it gives the participant the option to be neutral in case he is not sure about his position (Dawes, 2008).

The questionnaire enquired about: demographic information (n=5) ii) use of social media (n=4) iii) use of social media for educational purposes (n=6) iv) use of social media to communicate with others for educational purposes (n=5) and v) perceptions of participating dental students about the value of social media as educational tools (n=5).
**Table 4.2 study population**

<table>
<thead>
<tr>
<th>Country</th>
<th>Dental school name</th>
<th>Students (total number of students)</th>
<th>Teachers (total number)</th>
<th>Program duration (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Egypt</td>
<td>Faculty of Dentistry, Alexandria University</td>
<td>Undergraduate dental students (n=2443)</td>
<td>Dental teachers (n=470)</td>
<td>5</td>
</tr>
<tr>
<td>2. Egypt</td>
<td>Faculty of Dentistry, October University for Modern Science and Arts (MSA university)</td>
<td>Undergraduate dental students (n=2107)</td>
<td>Dental teachers (n=182)</td>
<td>5</td>
</tr>
<tr>
<td>3. Egypt</td>
<td>Faculty of Dentistry, Pharos University</td>
<td>Undergraduate dental students (n=1990)</td>
<td>Dental teachers (n=173)</td>
<td>5</td>
</tr>
<tr>
<td>4. United Kingdom</td>
<td>University of Portsmouth Dental Academy</td>
<td>Dental care professionals: dental nursing, dental hygiene and dental therapy students (n=470)</td>
<td>Dental and dental care professional teachers (n=30)</td>
<td>3</td>
</tr>
<tr>
<td>5. United Kingdom</td>
<td>Faculty of Dentistry, Oral &amp; Craniofacial Sciences King`s College London</td>
<td>Year five undergraduate dental students who get training at University of Portsmouth Dental Academy (n=180)</td>
<td>Dental teachers: (n=20)</td>
<td>5</td>
</tr>
</tbody>
</table>
i) Demographic information (n=5): name of the university, year of study, gender, and age.

ii) Their use of social media (n=4): what social media platforms do they use in their personal lives? What did they use social media for? How did their university communicate with them?

iii) Use of social media for learning purposes (n=6): indicating their level of agreement for six statements using a 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. These questions aimed to explore participants’ perceptions about using social media as a supplementary learning tool, as a way for communication with their fellow students or with their teachers, the perceived need for social media to be used more by their universities, the usefulness of social media as a source of information and their confidence with information published on social media.

iv) The use of social media to communicate with others for educational purposes (n=5): the frequency of using social media to communicate with their fellow students, to share educational materials with their fellow students and their teachers, to get information from other dental schools or organizations and to interact with blogs, posts or wikis published on social media.

v) Perceptions of participating students about the use of social media as educational tools, communication methods, their ability to encourage students to participate more than in a traditional classroom (n=5). Participants indicated their level of agreement for using 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree. (Appendix 16)

4.6.1.1 Pilot study

The questionnaire was piloted with a small group (n=5). Five postgraduate dental care professional students from the University of Portsmouth Dental Academy received a preliminary paper-based draft of the questionnaire to complete. The participants of this pilot study were asked to write any comments, feedback and to highlight any questions that needed clarification. Based on feedback, no amendments were needed, and this draft was used as a final version of the questionnaire.

4.6.2 Questionnaire for dental teachers:

An online Google Form based questionnaire (Appendix 17) was developed, to be sent to the dental teachers by email (the questionnaire was almost identical to that which was developed
for dental students but with minor wording changes for the dental teachers. At the beginning of the questionnaire, there was a summarized introduction about the study, definition of social media with examples and objectives of the study. A consent was taken by each participant ticking a box confirming their consent to take part in this study and thereafter completing the questionnaire. The questionnaire consisted of 23 questions including multiple-choice (n=12) and Likert-scale (n=11) based questions. The questionnaire enquired about:

i) Demographic information (n=3): name of the university, gender, and age.

ii) Their use of social media (n=4): what were social media they used in their personal lives? What did they use social media for? How did their university communicate with them?

iii) Use of social media for teaching purposes (n=6): indicating their level of agreement for six statements using 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree. Those questions aimed to explore participants’ perceptions about using social media as supplement for classroom-teaching, as tool for communication with their fellow tutors or with their students, the need for social media to be used more by their universities, the usefulness of social media as source of information and their confidence of information published on social media.

iv) The use of social media to communicate with others for educational purposes (n=5): the frequency of using social media to communicate with their fellow teachers, to share educational materials with their fellow teachers and students, to get information from other dental schools or organizations and to interact with blogs, posts or wikis published on social media.

v) Perceptions of participating dental teachers about the use of social media as educational tools, communication methods, their ability to encourage students to participate more than traditional classroom (n=5). Participants indicated their level of agreement for using 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree. (Appendix 17)

4.6.2.1 Pilot study

The questionnaire was piloted with a small group (n=4). Four dental teachers from the University of Portsmouth Dental Academy received a preliminary paper-based draft of the questionnaire to complete. The participants of this pilot study were asked to write any
comments, feedback and to highlight any questions that needed clarification. Based on feedback, a few amendments were made to improve clarity and content to develop the final version of the questionnaire. The amendments made included addition of: (i) prefer not to say as a gender category (ii) over 60 years age category and (iii) examples of social media, to question number 4.

4.6.3 Validity and reliability tests
Content validity is “the extent to which a measure covers the construct of interest” (Price, Jhangiani and Chiang, 2015, p.100). The questionnaires were reviewed by the two supervisors to validate their content. Internal consistency is the degree to which scores on a scale correlate with each other. Cronbach’s alpha internal consistency indicator was used to test the reliability of both the students’ and teachers’ questionnaires. Cronbach’s alpha has been commonly used for educational research to demonstrate that tests and scales that have been constructed or adopted for research projects are fit for purpose (Heo, Kim and Faith, 2015; Taber, 2018; Sobaih and Hasanein, 2020). Cronbach’s alpha (α) was = 0.93 for the students’ form and 0.92 for the teachers’ form indicating excellent internal consistency.

4.6.4 Recruitment Strategy
The recruitment strategy differed for each university. This variation was because of the different routine methods of communication between the university and its dental students and teachers. (Table 5.3)

4.6.5 Data collection and storage
All completed questionnaires were stored on google drive. Data were only accessible by the principal investigator and supervisors.

4.6.6 Data analysis
Data were analysed using Statistical Package for the Social Sciences (SPSS) for windows version 23.0 (IBM Corp) and significance was set at a p value < 0.05. Frequencies and percentages were calculated for all variables and comparisons were done using chi square of Fisher exact tests. Monte Carlo corrected test was used whenever the data were sparse and unbalanced. Two binary logistic regression analyses were used to determine the association of different factors with social media use for education in both students and teachers, respectively. The dependent (outcome) variable was social media use, and the independent (exposure) variables were gender, age categories, and university (Alexandria, MSA, Pharos and UK universities). The students model included the university year as one of the independent variables. Unadjusted and adjusted regression estimates. Odds ratio (OR) and 95% confidence intervals (CI) were calculated.
<table>
<thead>
<tr>
<th>University</th>
<th>Recruitment strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Alexandria University</td>
<td>Research coordinator, who was assigned by the Dean of the Faculty of Dentistry Alexandria university, sent a link to the online questionnaire to dental teachers through WhatsApp groups that they used for communication with each other in December 2019. Another link for the online students’ questionnaire was sent to all undergraduate dental students through Facebook pages that were used by the students for communication in February 2020.</td>
</tr>
<tr>
<td>2 MSA University</td>
<td>A research coordinator, who was assigned by the Dean of the Faculty of Dentistry, MSA University, sent an email with a link to the online questionnaire to dental students and their teachers in February 2020. Two gentle email reminders were sent in March 2020.</td>
</tr>
<tr>
<td>3 Pharos University</td>
<td>A research coordinator, who was assigned by the Dean of the Faculty of Dentistry, Pharos university, sent a link to the online questionnaire to dental teachers through WhatsApp groups that were used for communication with each other in December 2019. Another link for the online students’ questionnaire was sent to all undergraduate dental students through Facebook pages that were used by the students for communication in February 2020. Two gentle reminders were sent to dental students and their teachers in March 2020.</td>
</tr>
<tr>
<td>4 University of Portsmouth Dental Academy</td>
<td>An administrator sent an email with a link to the online questionnaire to dental care professional students and their teachers in September 2019. Verbal announcements were also made in classrooms by the principal investigator in October 2019. Two gentle email reminders were sent in October and November 2019 for the students and their teachers, respectively. Students were allowed to submit a hard copy of their responses.</td>
</tr>
<tr>
<td>5 King’s College London</td>
<td>An administrator sent an email with a link to the online questionnaire to dental students and their teachers in September 2019. Two gentle email reminders were sent in November 2019. Students were also allowed to submit a hard copy of their responses in order to improve the response rate.</td>
</tr>
</tbody>
</table>
4.7 The qualitative study:

4.7.1 Overview:
This included an online semi-structured interview conducted over Zoom (Gray et al., 2020). Semi-structured interviews are argued by Holloway and Galvin (2016) as the most popular type of qualitative research that allow the researcher to use a predetermined list of questions and seek clarification when necessary (Owen and Noonan, 2013). The popularity of semi-structured interviews is related to its ability to allow the interviewees to talk freely and expressing their live in their own words without being shy of presence of other participants as in focus group discussions (Owen and Noonan, 2013). The interviews were conducted remotely over Zoom because face-to-face communication was prohibited during the time of the research due to the COVID-19 pandemic. Zoom is a cloud-based videoconferencing service offering features including online meetings, group messaging services, and secure recording of sessions (Zoom Video Communications Inc., 2016). Zoom offers the ability to communicate freely, easily and in real time with geographically distanced individuals through computers, tablets, or mobile smart phones. A key advantage of Zoom was its ability to securely record and store interviews without additional software. This feature was important in the research to protect highly sensitive data (Zoom Video Communications Inc., 2016; Archibald et al., 2019).

4.7.2 Semi-structured Interview guide:
The results of the quantitative data analysis were used to design a preliminary semi-structured interview guide, which included questions or topics which required clarification and deeper exploration. This guide was used to steer the interview, rather than act as a rigid set of standardised questions which might limit the obtained information. The questions aimed to explore the participants` own definition of social media, uses of social media for educational purposes, uses of social media for communication, uses of social media to search for dental information, perceptions regarding strengths, weaknesses and limitations of using social media in dental education, and finally, the role of social media in dental education during the COVID-19 pandemic. The interview guide was designed to ensure that relevant issues were covered systematically whilst allowing some flexibility to ensure participants` views were adequately reflected in the data (Ritchie, Spencer and O`Connel, 2003).

The interview guide was evaluated and piloted by the principal investigator using one of the supervisors as a participant, while the other supervisor was observing and writing notes for feedback. These mock interview sessions were repeated twice, and feedback was given by both supervisors, to ensure that the principal investigator was able to lead the interviews effectively and consistently. In additionally, the principal investigator received further training from the Graduate School at the University of Portsmouth. Based on the feedback and training,
the interview guide was modified to exclude any directing questions, and to allow for sufficient flexibility for the participants to clarify their points of views (Appendix 18).

4.7.3 Data collection

4.7.3.1 Before the interviews

A number of undergraduate dental (including dental care professional) students and their teachers were contacted to participate in the study. Some students and teachers were contacted through social media (Facebook, WhatsApp, and Instagram) groups, pages or accounts that were relevant to their universities. Candidates who agreed to participate, received an email including a standardised consent form to participate in the interviews and for them to be audio recorded (Appendix 19). Each participant was also given an information sheet through the email (Appendix 20) detailing information about the study. This included details of the research team, the research aims, the reason behind the invitation, what would happen during the interview, the rights of the interviewees, how their information will be analysed after the interview, where to go if the participant had a concern, and finally gratitude for participation in the study. Each participant was asked to read the participant information sheet before the interview, and to sign a copy of the consent form, and send it back through the email to the principal investigator. Thereafter, participants received invitation emails including a Zoom link, date and time of interview (Appendix 21). Interviews were conducted at a date and time most convenient to the participant.

4.7.3.2 During the interviews

All interviews were conducted on a one-to-one basis and lasted approximately half an hour. The principal investigator interviewer asked open ended questions using a neutral voice tone in order to minimise researcher bias. Data collection continued until saturation was achieved; that is until no further insights were elicited from the most recently collected data and thereafter data collection was halted (Bartlett et al., 2019). Ten interviews were conducted with students and seven with dental teachers. No new themes emerged after interview 8 for the students and interview 6 for the teachers. The interviews were conducted in the most convenient language, either Arabic or English, for the participants, as the principal investigator was bilingual, and was able to use both languages effectively. Participants from the Egyptian universities preferred to conduct the interviews in Arabic, whilst participants from UPDA preferred English.

4.7.3.3 After the interviews

Field notes and digital recordings of all the interviews were transcribed verbatim directly after the interview to allow the data to be analysed as they were collected. The interviews that were
conducted in Arabic were translated and transcribed verbatim in English by the same principal investigator. All digital recordings and transcripts were stored on a password protected laptop. The password was only known by the principal investigator. Participants were not identifiable from either the recordings or the transcriptions of the interviews and all data were fully anonymised before writing up (Gray et al., 2020).

4.7.4 Data analysis
The data transcripts were analysed using thematic Framework Analysis suggested by Ritchie, Spencer and O’Connell (2003). A preliminary framework was derived from pre-existing knowledge from the systematic review that was done at an early stage of the research. The preliminary framework analysis for both the student and teacher interviews had three main themes and eleven subthemes (Table 5.4):

Table 4.4 preliminary themes and subthemes

<table>
<thead>
<tr>
<th>Preliminary themes</th>
<th>Preliminary subthemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Uses of social media in dental education</td>
<td>1. Online communication and interaction</td>
</tr>
<tr>
<td></td>
<td>2. Sharing educational materials</td>
</tr>
<tr>
<td></td>
<td>3. Teaching methods</td>
</tr>
<tr>
<td></td>
<td>4. Source of information</td>
</tr>
<tr>
<td>II. Advantages of using social media in dental education</td>
<td>5. Ease of use</td>
</tr>
<tr>
<td></td>
<td>6. Accessibility</td>
</tr>
<tr>
<td></td>
<td>7. Quick way for communication</td>
</tr>
<tr>
<td>III. Concerns about using social media in dental education</td>
<td>8. Distractive tools</td>
</tr>
<tr>
<td></td>
<td>9. Privacy</td>
</tr>
<tr>
<td></td>
<td>10. Professionalism</td>
</tr>
<tr>
<td></td>
<td>11. Quality of information</td>
</tr>
</tbody>
</table>

Thematic Framework Analysis was conducted in five stages following the recommendations of Ritchie and Spencer (2002) (Srivastava and Thomson, 2009; Gale et al., 2013):

A. Familiarisation: the principal investigator became familiarised with the data by listening to the recordings and re-reading the field notes and transcripts. At the end of this stage, the researcher was able to identify key notes and recurrent themes.

B. Identify the thematic framework: the key notes and recurrent themes that were identified through the familiarization stage, in addition to the preliminary framework that was produced through the systematic review were used to produce a thematic framework. Despite the prior themes, the researcher allowed the data to dictate the
emerging themes, instead of adhering to the preliminary framework. To achieve that, the researcher maintained an open mind, and did not force the data to fit the prior issues.

C. Coding: through this stage, the researcher carefully read the transcript line by line, and applied a "code" that describes each statement. The "code" was in the form of a word or a short phrase that represents a theme or an idea. This process was applied to all the textual data (transcripts of the interviews). Manual coding was adopted using word documents. Each word document represented a certain theme and gathered materials that were relevant examples of this theme (Gale et al., 2013).

D. Charting: during this stage, the researcher rearranged the data that were coded in charts of themes according to the relevant parts of the thematic framework to produce distilled summaries of the views expressed in the data. These charts consisted of headings and subheadings.

E. Mapping and interpretation: This final stage used charts and emerging themes to define concepts, domains, and attributes within the context of using social media by dental students (including DCPs) and their teachers in dental education.

During analysis, the preliminary framework was modified where necessary. At the end of the framework analysis, the initial three themes with the eleven subthemes were expanded to be: four themes with seventeen subthemes for the students’ interviews, and six themes with seventeen subthemes for the teachers’ interviews. The analysis was carried out as a continuous process incorporating new data as they became available, thus enabling emergent themes to be chased in subsequent interviews and this ensured that no themes were missed (Gale et al., 2013). The data analysis was validated by triangulating it between principal investigator and the supervisors. The principal investigator continually checked both the transcripts and the analyses, whilst one of the supervisors checked the analysis to evaluate its consistency, and to compare findings with existing knowledge.

4.8 Conclusion
A mixed methods sequential explanatory study design approach was adopted in this thesis. This approach consisted of quantitative online questionnaires followed by qualitative semi-structured interviews. The results of the quantitative research were used to design the questions of the qualitative one. The data analysis of the two research approaches aimed to answer the research questions. The next chapter is showing the quantitative results followed by the qualitative thematic analysis. A correlation between the results of the two research designs will be provided also, at the end of the next chapter.
Results
5 Results

5.1 Introduction
This chapter consisted of three sections: quantitative results, qualitative results, and a correlation between them. The quantitative data of the participating cohorts were presented in this chapter firstly. Frequencies and percentages were calculated for all variables and comparisons were carried out using chi square of Fisher exact tests. Additionally, two binary logistic regression analyses were used to determine the association of gender, age, year of study and the university with social media use for education in both students and teachers.

The quantitative results explored the perceptions of the participants regarding the effectiveness of social media as supplementary learning and teaching tools, using social media for communication, and sharing educational materials amongst the students, teachers or between both of them. Moreover, the quantitative data explored the participants’ perceptions regarding using social media as an information resource and their trust in the accuracy of information published on social media. In addition, the data illustrated the prevalence of using social media for different learning and teaching activities.

The qualitative data explained how and why the participants used social media for educational purposes. Furthermore, they highlighted the perceptions of the participants regarding the positive and negative aspects of using social media in dental education.

The quantitative results had two separate sections:

a) Quantitative results of dental students.
b) Quantitative results of dental teachers.

Each of these sections revealed information about:

1. Demographic data about the participants.
2. The use of social media in general by the participants.
3. The use of social media for educational purposes.
4. The communication with others for educational purposes.
5. Participants’ perceptions regarding the use of social media for educational purposes.
6. Factors affecting using social media for educational purposes.
The quantitative results designed the questions of the qualitative results. That is why the qualitative thematic analysis was presented after the quantitative data analysis. The qualitative results consisted of two main separate sections:

a) Qualitative results of dental students.

b) Qualitative results of dental teachers.

The qualitative results justified some of the quantitative findings. The correlations between the quantitative and qualitative results were discussed at the end of this chapter.

5.2 Quantitative results of dental students (Appendix 22)

5.2.1 Demographic data:
A total of 923 dental and dental care professional students from the four cohorts (Alexandria, MSA, Pharos and UK universities) responded to the questionnaire. Of the survey respondents, 250 were from the Faculty of Dentistry, Alexandria University, Egypt; 422 were from the faculty of dentistry, Modern Science and Arts University (MSA University) Egypt; 80 were from the faculty of dentistry, Pharos University, Egypt and 171 were from UK universities (62 were from the University of Portsmouth Dental Academy (UPDA) UK and 109 from the Faculty of Dentistry, Oral & Craniofacial Sciences, King’s College London, UK). The majority of the participants from Alexandria (n=179, 71.6%), Pharos (n=68, 85%) and UK (n=105, 61.4%) universities were between 21-25 years old, while the majority from MSA universities (n=212, 50.2%) were between 16-20 years old. There is a significant difference in the age of the participants among the four groups (Monte Carlo corrected p value: $P_{MC} < 0.001$). Fifth year dental students dominated the response rate in Alexandria (n=79, 31.6%), Pharos (n=46, 57.5%) and UK (n=106, 62%), while second year dental students dominated the response rate in MSA university (n=164, 38.9). Most of the participants from the four groups were females (Alexandria University: n=178 (71.2%), MSA University: n=241 (57.1%), Pharos University: n=57 (71.3%) and UK universities: n=121 (70.8%). Table (5.1)

5.2.2 The use of social media:
All participating students (100%) indicated using social media in general and when they were asked to list which social media they use, Facebook, WhatsApp, YouTube, Instagram, and Twitter were the most frequently used platforms by the respondents. Facebook was found to be the most common platform used by the respondents of Alexandria, MSA and Pharos universities with 244 (97.6%), 375 (89.9%) and 69 (88.5%) respectively, followed by WhatsApp by 185 (74%), 352 (84.4%) and 61 (78.2%) respectively. On the other hand, WhatsApp was the most frequently used social media among the participants from UK universities with 136 (79.5%) followed by Facebook and Instagram with 126 (73.7%) for each.
Instagram was used by 141 (56.4%), 233 (55.9%) and 48 (61.5%) the participants from Alexandria, MSA and Pharos universities respectively. YouTube was used by 147 (58.8%) 186 (44.6%) 36 (46.2%) and 78 (45.6%) participants from Alexandria, MSA and Pharos and UK universities respectively. Twitter was used by 76 (30.4%), 128 (30.7%), 27 (34.6%) and 34 (19.9%) participants from Alexandria, MSA, Pharos and UK universities respectively. Interestingly, Snapchat was used by more than one quarter (n= 47, 27.5%) of the participating students from UK universities with a significant difference when compared to the very low usage rate by the participants from Alexandria (n=10, 4%), MSA (n= 25, 6%) and Pharos (n=4, 5.1%). Other platforms such as LinkedIn, Wikipedia, Ask.fm, zoom, Pinterest, Telegram and Gmail have been also reported by the respondents but at low percentages (Figure 5.1).

Table 5.1 Comparison between the studied universities according to demographic data in students

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=250)</th>
<th>MSA (n=422)</th>
<th>Pharos (n=80)</th>
<th>UK (n=171)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your age?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P&lt;MC &lt;0.001*</td>
</tr>
<tr>
<td>16-20</td>
<td>68(27.2%)</td>
<td>212(50.2%)</td>
<td>11(13.8%)</td>
<td>15(8.8%)</td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>179(71.6%)</td>
<td>202(47.9%)</td>
<td>68(85%)</td>
<td>105(61.4%)</td>
<td></td>
</tr>
<tr>
<td>26-30</td>
<td>3(1.2%)</td>
<td>7(1.7%)</td>
<td>0(0%)</td>
<td>40(23.4%)</td>
<td></td>
</tr>
<tr>
<td>31-35</td>
<td>0(0%)</td>
<td>1(0.2%)</td>
<td>1(1.3%)</td>
<td>7(4.1%)</td>
<td></td>
</tr>
<tr>
<td>More than 35</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4(2.3%)</td>
<td></td>
</tr>
<tr>
<td>What is your year of study?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P&lt;MC &lt;0.001*</td>
</tr>
<tr>
<td>First year</td>
<td>45(18%)</td>
<td>53(12.6%)</td>
<td>0(0%)</td>
<td>33(19.3%)</td>
<td></td>
</tr>
<tr>
<td>Second year</td>
<td>5(2%)</td>
<td>164(38.9%)</td>
<td>8(10%)</td>
<td>24(14%)</td>
<td></td>
</tr>
<tr>
<td>Third year</td>
<td>54(21.6%)</td>
<td>67(15.9%)</td>
<td>11(13.8%)</td>
<td>6(3.5%)</td>
<td></td>
</tr>
<tr>
<td>Fourth year</td>
<td>55(22%)</td>
<td>74(17.5%)</td>
<td>15(18.8%)</td>
<td>2(1.2%)</td>
<td></td>
</tr>
<tr>
<td>Fifth year</td>
<td>79(31.6%)</td>
<td>64(15.2%)</td>
<td>46(57.5%)</td>
<td>106(62%)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>12(4.8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
</tr>
<tr>
<td>What is your gender?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P&lt;MC 0.005*</td>
</tr>
<tr>
<td>Female</td>
<td>178(71.2%)</td>
<td>241(57.1%)</td>
<td>57(71.3%)</td>
<td>121(70.8%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>68(27.2%)</td>
<td>173(41%)</td>
<td>23(28.8%)</td>
<td>50(29.2%)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4 (1.6%)</td>
<td>8 (1.9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
</tbody>
</table>

p: p value for comparing between the studied groups
P<MC: Monte Carlo corrected p value
*: Statistically significant at p ≤ 0.05
When the participants were asked to mention what they used social media for, the majority of the four groups (Alexandria: n=213, 85.2%; MSA: n= 372, 89.2%; Pharos: n= 67, 84.4%; UK: n=171, 100%) mentioned personal communication as the main use of social media with a significant difference between the four groups (p<0.001). In addition, 195 (78%), 322 (77.2%), 56 (71.8%) and 120 (70.2%) from Alexandria, MSA, Pharos and UK universities respectively indicated that they use social media for educational purposes with no significant difference among the four groups. Other very common purposes for using social media such as professional communication, entertainment and work-related purposes were also reported by the participants. Email has been reported as the main method of communication in MSA (n= 40, 99.5%) and UK (n=168, 98.2%) universities. On the other hand, Facebook was reported as the main method of communication between dental students and the universities in Alexandria (n= 181, 72.4%) and Pharos (n=41, 51.3%) Table (5.2) and Figure (5.2)

5.2.3 The use of social media for educational purposes:

When the participating students were asked about their perceptions of using social media for educational purposes, most of the participants from Alexandria and Pharos universities responded by either “agree” or “strongly agree” with the believe that social media can successfully supplement classroom learning, while the participants from MSA and UK universities responded by either “agree” or “neutral” to the same believe (Figure 5.3).
Table 5.2 comparison between the studied universities according to the use of social media in students

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=250)</th>
<th>MSA (n=422)</th>
<th>Pharos (n=80)</th>
<th>UK (n=171)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Do you use social media?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>250(100%)</td>
<td>417(100%)</td>
<td>78(100%)</td>
<td>171(100%)</td>
<td>_</td>
</tr>
<tr>
<td>No</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>_</td>
</tr>
<tr>
<td>7</td>
<td>Please list the social media you use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook</td>
<td>244(97.6%)</td>
<td>375(89.9%)</td>
<td>69(88.5%)</td>
<td>126(73.7%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>WhatsApp</td>
<td>185(74%)</td>
<td>352(84.4%)</td>
<td>61(78.2%)</td>
<td>136(79.5%)</td>
<td>0.012*</td>
</tr>
<tr>
<td>Instagram</td>
<td>141(56.4%)</td>
<td>233(55.9%)</td>
<td>48(61.5%)</td>
<td>126(73.7%)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Twitter</td>
<td>76(30.4%)</td>
<td>128(30.7%)</td>
<td>27(34.6%)</td>
<td>34(19.9%)</td>
<td>0.030*</td>
</tr>
<tr>
<td>YouTube</td>
<td>147(58.8%)</td>
<td>186(44.6%)</td>
<td>36(46.2%)</td>
<td>78(45.6%)</td>
<td>0.003*</td>
</tr>
<tr>
<td>Telegram</td>
<td>22(8.8%)</td>
<td>38(9.1%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>_</td>
</tr>
<tr>
<td>8</td>
<td>What do you use social media for?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal communication</td>
<td>213(85.2%)</td>
<td>372(89.2%)</td>
<td>67(85.9%)</td>
<td>171(100%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Professional communication</td>
<td>66(26.4%)</td>
<td>123(29.5%)</td>
<td>26(33.3%)</td>
<td>87(50.9%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Education</td>
<td>195(78%)</td>
<td>322(77.2%)</td>
<td>56(71.8%)</td>
<td>120(70.2%)</td>
<td>0.194</td>
</tr>
<tr>
<td>Entertainment</td>
<td>210(84%)</td>
<td>329(78.9%)</td>
<td>63(80.8%)</td>
<td>154(90.1%)</td>
<td>0.007*</td>
</tr>
</tbody>
</table>

PFE: Fisher exact p value  
*: Statistically significant at p ≤ 0.05

Figure 5.2 the use of social media by dental students

![Diagram showing reasons for using social media for educational purposes, Facebook, Email, and Telegram between the university and students.](image-url)
The majority of the participants from the Alexandria, Pharos and UK universities responded by either “agree” or “strongly agree” with the belief that social media were useful for communicating with their tutors. Most of the participants from MSA university responded by either “neutral” or “agree”. On the other hand, the majority of the participants from Alexandria (n= 127, 50.8%), MSA (n= 137, 32.5%), Pharos (n= 51, 63.8%) and UK (n= 118, 69%) universities were “strongly agree” with the belief that social media were useful to help them for communication with their fellow colleagues (Figure 5.4). When the participants were asked if they believe that social media should be used more by the university to help with their learning, most of the respondents from the four groups were either “agree” or “strongly agree”. Also, when the participants were asked if they believe that social media were helpful to search for information, the majority of them responded by “agree” or “strongly agree (Figure 5.5). On the other hand, most of the respondents from the four groups answered with “neutral” when they were asked if they feel confident with the accuracy of information found from social media (Figure 5.6).
Figure 5.5 using social media to search for information
5.2.4 The communication with others for educational purposes

When the participating students were asked about the frequency of using social media to communicate with others for educational purposes, a significant difference was found regarding the frequency of using social media by the participants from the four groups to communicate with their fellow students \( (P_{MC} = 0.008) \). Most of the participants from Alexandria (n=96, 38.4%) and Pharos (n=34, 42.5%) universities used social media to communicate with their fellow students at least once a day, while 42.7% and 51.5% of participants from MSA and UK universities respectively used social media to communicate with their colleagues more than three times per day. A significant difference was found regarding the frequency of sharing educational materials among the participating students from the four groups \( (P_{MC} < 0.001) \). Most of the participants from Alexandria (n=88, 35.2%), Pharos (n=22, 27.5%) and UK (n=75, 43.9%) universities shared educational materials with their fellow students “once a week”, while most of the participants from MSA university (n=130, 30.8%) did it “once a day”. When the participants were asked how often they used social media to get information from other dental schools or international associations, a significant difference was found among the responses of the four groups \( (P_{MC} < 0.001) \). Most of the participants from Alexandria (n=66, 26.4%) and Pharos (n=24, 30.0%) universities responded with “once a month”. Around one quarter of the participants from MSA university (n=114, 27.0%) responded with “once a week” while, 43.3% of the participants from UK universities responded with “never”. When the participants were asked how often they read or interacted with blogs, posts or Wikis for
education-related information, the majority of the participants from the four groups responded with “once a week”. **Table (5.3)**

Table 5.3 comparison between the studied universities according to the communication with others for educational purposes by the students

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=250)</th>
<th>MSA (n=422)</th>
<th>Pharos (n=80)</th>
<th>UK (n=171)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you use social media to communicate with fellow students in your dental school or university?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>14(5.6%)</td>
<td>10(2.4%)</td>
<td>6(7.5%)</td>
<td>3(1.8%)</td>
<td></td>
</tr>
<tr>
<td>Once a month</td>
<td>15(6.0%)</td>
<td>24(5.7%)</td>
<td>3(3.8%)</td>
<td>4(2.3%)</td>
<td>(p^{MC}=0.008^*)</td>
</tr>
<tr>
<td>Once a week</td>
<td>42(16.8%)</td>
<td>63(14.9%)</td>
<td>10(12.5%)</td>
<td>25(14.6%)</td>
<td></td>
</tr>
<tr>
<td>Once a day</td>
<td>96(38.4%)</td>
<td>145(34.4%)</td>
<td>34(42.5%)</td>
<td>51(29.8%)</td>
<td></td>
</tr>
<tr>
<td>More than 3 times per day</td>
<td>83(33.2%)</td>
<td>180(42.7%)</td>
<td>27(33.8%)</td>
<td>88(51.5%)</td>
<td></td>
</tr>
</tbody>
</table>

p: p value for comparing between the studied groups  
\(p^{MC}\): Monte Carlo corrected p value

5.2.5 Students` perceptions regarding the use of social media for educational purposes

When the participating students were asked if they believe that learning through social media was effective, a significant difference was found among the four groups. Most respondents from Alexandria (n=84, 33.6%) and UK (n=80, 46.8%) universities answered with “agree”, while most respondents from MSA (n=121, 28.7%) and Pharos (n=24, 30%) universities answered with “neutral”. The majority of the participants from the four groups responded with either “agree” or “strongly agree” when they were asked if they believe interaction with fellow students from their universities or other universities through social media was effective. When the participants were asked if they believe that interaction with their dental teachers through social media was effective, most of the participants from Alexandria and Pharos university responded with either “agree” or "strongly agree", while most respondents from MSA and UK universities answered with either “agree” or “neutral”. When the participants were asked if they believe that utilising social media in the educational process was more effective for learning than traditional teaching, the majority of Alexandria (n=67, 26.8%), MSA (n=107, 25.4%) and UK (n=48, 28.1%) universities answered with “neutral”, while around one third of respondents from Pharos university (n= 27, 33.8%) answered by “strongly agree”. When the participants were asked if they felt comfortable to participate in the learning process through social media more than inside a classroom setting, a significant difference was obtained among the responses from the four groups (p<0.001). Most of the respondents from Alexandria (n=68, 27.2%) and UK (n=60, 35.1%) universities answered with “neutral”. Almost one third of the respondents from MSA (n=126, 29.9%) university were “strongly disagree”, while the majority of the participants from Pharos university were either “agree” or “strongly agree”. **Table (5.4)**

129
Table 5.4 comparison between the studied universities according to perceptions regarding the use of social media for educational purposes by students

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=250)</th>
<th>MSA (n=422)</th>
<th>Pharos (n=80)</th>
<th>UK (n=171)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>I believe that learning through social media is effective.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>19(7.6%)</td>
<td>81(19.2%)</td>
<td>5(6.3%)</td>
<td>14(8.2%)</td>
<td></td>
</tr>
<tr>
<td>Disagree</td>
<td>23(9.2%)</td>
<td>94(22.3%)</td>
<td>5(6.3%)</td>
<td>18(10.5%)</td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td>66(26.4%)</td>
<td>121(28.7%)</td>
<td>24(30%)</td>
<td>33(19.3%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Agree</td>
<td>84(33.6%)</td>
<td>80(19%)</td>
<td>23(28.8%)</td>
<td>80(46.8%)</td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>58(23.2%)</td>
<td>46(10.9%)</td>
<td>23(28.8%)</td>
<td>26(15.2%)</td>
<td></td>
</tr>
</tbody>
</table>

p: p value for comparing between the studied groups
*: Statistically significant at p ≤ 0.05

5.2.6 Factors affecting using social media by the students for educational purposes

In order to get further insight into the effect of demographic and geographic variables on the use of social media in education, a regression analysis was performed. Table 5.5 shows the unadjusted and adjusted odds ratio (OR) which have been obtained from the regression coefficients, and describe how gender, age, university, and study year affect the use of social media in dental education. Because these variables are categorical, a reference category was chosen for each variable. “Female” was the reference category for the gender variable, “> 35” the reference category for the age variable, “UK universities” for the university variable, and finally the “fifth year” for the study year variable.

The “other” gender showed a significant lower use of social media than females in both the adjusted and unadjusted models (OR=0.66 for the unadjusted model and 0.26 for the adjusted model). No significant differences were found between males and females in both adjusted and unadjusted models. No significant association was found between age categories and the use of social media in dental education in both the unadjusted and adjusted models. The adjusted model showed that the use of social media for educational purposes was significantly higher for undergraduate dental students at Alexandria (OR=1.72) and MSA (OR=1.70) universities than the participating UK universities (the reference category). Also, the adjusted model showed that students from the first (OR=0.53), second (OR=0.56) third, (0.55) and fourth years (OR=0.61) used social media for educational purposes significantly less than the fifth year (the reference category).

In conclusion, there was no association between the age nor the gender of the participants and their use of social media for educational purposes. Alexandria and MSA university used social media for educational purpose more than UK universities. Fifth year dental students used social media for educational purpose more than the students of the other studying years.
Table 5.5 factors affecting use of social media in Education (students)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unadjusted model</th>
<th>Adjusted model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P value</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.93 (0.68, 1.28)</td>
<td>0.67</td>
</tr>
<tr>
<td>Other</td>
<td>0.66 (0.68, 1.28)</td>
<td>0.01*</td>
</tr>
<tr>
<td>Female</td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>0.77 (0.09, 7.02)</td>
<td>0.82</td>
</tr>
<tr>
<td>21-25</td>
<td>0.81 (0.09, 7.35)</td>
<td>0.86</td>
</tr>
<tr>
<td>26-30</td>
<td>0.62 (0.07, 5.90)</td>
<td>0.68</td>
</tr>
<tr>
<td>31-35</td>
<td>0.50 (0.04, 5.74)</td>
<td>0.58</td>
</tr>
<tr>
<td>&gt; 35</td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alexandria University</td>
<td>1.52 (0.97, 2.36)</td>
<td>0.07</td>
</tr>
<tr>
<td>MSA</td>
<td>1.39 (0.94, 2.05)</td>
<td>0.10</td>
</tr>
<tr>
<td>Pharos</td>
<td>1.19 (0.66, 2.12)</td>
<td>0.57</td>
</tr>
<tr>
<td>UK universities</td>
<td>Reference category</td>
<td></td>
</tr>
<tr>
<td>Study year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First year</td>
<td>0.67 (0.42, 1.07)</td>
<td>0.09</td>
</tr>
<tr>
<td>Second year</td>
<td>0.72 (0.47, 1.08)</td>
<td>0.11</td>
</tr>
<tr>
<td>Third year</td>
<td>0.70 (0.44, 1.12)</td>
<td>0.14</td>
</tr>
<tr>
<td>Fourth year</td>
<td>0.74 (0.46, 1.17)</td>
<td>0.20</td>
</tr>
<tr>
<td>Fifth year</td>
<td>Reference category</td>
<td></td>
</tr>
</tbody>
</table>

Model Chi-square = 19.67, p value = 0.10, OR= Odds ratio, CI= Confidence interval
*Statistically significant at p value <0.05
5.3 Quantitative results of dental teachers (Appendix 23)

5.3.1 Demographic data
A total number of 192 dental and dental care professional teachers from the four cohorts responded to the questionnaire. These included 39 from Alexandria University, Egypt; 109 from Modern Science and Arts University (MSA University) Egypt; 19 from Pharos University, Egypt; and 25 from UK universities (17 from the University of Portsmouth Dental Academy (UPDA) and 8 from King’s College London). A chi-square test showed a significant difference in the age of the participants among the four groups (Monte Carlo corrected p value: $P_{MC}<0.001$). The majority of the participants from Alexandria ($n=28, 71.8\%$), MSA ($n=63, 57.8\%$) and Pharos ($n=13, 68.4\%$) universities were between 21-30 years old, while the majority of the participants from UK universities ($n=10, 40\%$) were between 31-40 years old. The majority of all participants were females (Alexandria University: $n=28 (71.8\%)$, MSA University: $n=76 (69.7\%)$, Pharos University: $n=12 (63.2\%)$ and UK universities: $n=15 (60\%)$. Table (5.6)

Table 5.6 Comparison between the studied universities according to demographic data in teachers

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=39)</th>
<th>MSA (n=109)</th>
<th>Pharos (n=19)</th>
<th>UK (n=25)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>What is your age?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21- 30</td>
<td>28 (71.8%)</td>
<td>63 (57.8%)</td>
<td>13 (68.4%)</td>
<td>2 (8%)</td>
</tr>
<tr>
<td></td>
<td>31- 40</td>
<td>10 (25.6%)</td>
<td>31 (28.4%)</td>
<td>3 (15.8%)</td>
<td>10 (40%)</td>
</tr>
<tr>
<td></td>
<td>41- 50</td>
<td>1 (2.6%)</td>
<td>9 (8.3%)</td>
<td>1 (5.3%)</td>
<td>2 (8%)</td>
</tr>
<tr>
<td></td>
<td>51-60</td>
<td>0 (0 %)</td>
<td>2 (1.8%)</td>
<td>2 (10.5%)</td>
<td>8 (32%)</td>
</tr>
<tr>
<td></td>
<td>Over 60</td>
<td>0 (0 %)</td>
<td>4 (3.7%)</td>
<td>0 (0 %)</td>
<td>3 (12%)</td>
</tr>
<tr>
<td>2</td>
<td>What is your gender?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>28 (71.8%)</td>
<td>76 (69.7%)</td>
<td>12 (63.2%)</td>
<td>15 (60%)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>11 (28.2%)</td>
<td>33 (30.3%)</td>
<td>7 (36.8%)</td>
<td>10 (40%)</td>
</tr>
</tbody>
</table>

$p$: p value for comparing between the studied groups  
$p_{MC}$: Monte Carlo corrected p value  
*: Statistically significant at p ≤ 0.05

5.3.2 The use of social media
All participants (100\%) indicated using social media at some level. When they were asked to list which social media they use, Facebook, WhatsApp, Instagram, YouTube, and Twitter turned out to be the most frequently used platforms by the respondents. Other platforms such as LinkedIn, Wikipedia, Google Scholar, Pinterest, Telegram and eLearning have been also reported by the respondents but at lower percentages (Figure 5.7).
When the participants were asked to mention what they use social media for, the majority of the four groups (Alexandria: n=38, 97.4%; MSA: n=98, 89.9%; Pharos: n= 18, 94.7%; UK: n=24, 96%) mentioned personal communication as the main reason for using social media with no significant difference between the groups. On the other hand, a significant difference was found among the groups regarding the use of social media for educational purposes. 29 (74.4%), 92 (84.4%), 18 (94.7%) and 16 (64%) from Alexandria, MSA, Pharos and UK universities respectively, indicated using social media for educational purposes. Other aims for using social media such as professional communication, entertainment, shopping and looking for news were also reported by the participants.

When the participants were asked about the main method of communication between themselves and the university, Email was reported as the most common means of communication by 18 (46.2%), 109 (100 %), 18 (94.7%) and 25 (100%) from Alexandria, MSA, Pharos and UK universities respectively, with a significant difference among the four groups (P<0.001). Interestingly, Facebook was used for communication with the university by 8 (20.5%) and 30 (27.5%) of the respondents from Alexandria and MSA respectively, while it was used by only 3 (15.8%) and 1 (4%) of the respondents from Pharos and UK universities respectively. However, no significant difference was observed among the four cohorts. WhatsApp was reported by 9 (47.4%) of Pharos University respondents as the main means of communication between themselves and the university, while mobile SMSs were reported
by 55 (50.5%) as the main means of communication between dental teachers and the university in MSA. **Table (5.7)** and **Figure (5.8)**

**Table 5.7** comparison between the studied universities according to the use of social media in teachers

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandria (n=39)</th>
<th>MSA (n=109)</th>
<th>Pharos (n=19)</th>
<th>UK (n=25)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Do you use social media?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Yes</td>
<td>39 (100%)</td>
<td>109 (100%)</td>
<td>19 (100%)</td>
<td>25 (100%)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Please list the social media you use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook</td>
<td>37(94.9%)</td>
<td>100 (91.7%)</td>
<td>19(100%)</td>
<td>15(60.0%)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>WhatsApp</td>
<td>28(71.8%)</td>
<td>95 (87.2%)</td>
<td>15(79.0%)</td>
<td>17(68.0%)</td>
<td>0.049*</td>
</tr>
<tr>
<td>YouTube</td>
<td>19(48.7%)</td>
<td>54 (49.5%)</td>
<td>7(36.8%)</td>
<td>14(56.0%)</td>
<td>0.653</td>
</tr>
<tr>
<td>Instagram</td>
<td>21(53.8%)</td>
<td>47 (43.1%)</td>
<td>9(47.4%)</td>
<td>14(56.0%)</td>
<td>0.533</td>
</tr>
<tr>
<td>Twitter</td>
<td>6(15.4%)</td>
<td>14 (12.8%)</td>
<td>0 (0%)</td>
<td>7(28.0%)</td>
<td>PFE= 0.057</td>
</tr>
<tr>
<td>Telegram</td>
<td>2(5.1%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>PFE= 0.135</td>
</tr>
<tr>
<td><strong>What do you use social media for?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal communication</td>
<td>38 (97.4%)</td>
<td>98 (89.9%)</td>
<td>18 (94.7%)</td>
<td>24 (96%)</td>
<td>0.503</td>
</tr>
<tr>
<td>Professional communication</td>
<td>24 (61.5%)</td>
<td>86 (78.9%)</td>
<td>15 (78.9%)</td>
<td>23 (92%)</td>
<td>0.033*</td>
</tr>
<tr>
<td>Education</td>
<td>29 (74.4%)</td>
<td>92 (84.4%)</td>
<td>18 (94.7%)</td>
<td>16 (64%)</td>
<td>0.030*</td>
</tr>
<tr>
<td>Entertainment</td>
<td>32 (82.1%)</td>
<td>92 (84.4%)</td>
<td>17 (89.5%)</td>
<td>21 (84%)</td>
<td>0.936</td>
</tr>
</tbody>
</table>

p: p value for comparing between the studied groups
PFE: Fisher exact p value
*: Statistically significant at p ≤ 0.05

**Figure 5.8** the use of social media by dental teachers
5.3.3 The use of social media for teaching purposes

When the participants were asked about their perceptions of using social media for educational purposes, most of them would either agree or strongly agree with the believe that social media can successfully supplement classroom teaching (Figure 5.9). Also, the majority of the participants either agreed or strongly agreed with the believe that social media were useful for communicating with their students (Figure 5.10). Most of the participants from Egyptian universities agreed or strongly agreed that social media should be used more by their universities. However, almost half of the UK participants (n=12, 48%) showed a neutral perception towards the idea. More than 50% of the participants from Alexandria (n=21, 53.8%), MSA (n= 76, 69.7%) and Pharos (n= 13, 68.4%) universities strongly agreed with the idea of using social media to search for information (Figure 5.11). On the other hand, only seven (28%) from the UK participants strongly agreed with the same idea and around one third (n=8, 32%) showed a neutral attitude. Interestingly, a significant difference was found between the perceptions of the participants from the four groups (P<0.002) regarding their trust in the accuracy of information found on social media. Around half of the participants at Alexandria (n= 17, 43.6%), MSA (n=49, 45%) and Pharos (n=10, 52.6%) universities showed neutral feelings, while most of the UK participants either disagreed or strongly disagreed with the accuracy of information they find on social media. (Figure 5.12)
Figure 5.10 social media for communication between dental teachers and their students

The participating universities

Percentage of the participants (%)

Alexandria MSA Pharos UK

strongly disagree disagree neutral agree strongly agree

Figure 5.11 using social media to search for information

The participating universities

Percentage of the participants (%)

Alexandria MSA Pharos UK

strongly disagree disagree neutral agree strongly agree
5.3.4 Communication with others for educational purposes:
A significant difference was found regarding the frequency of using social media by the participants from the four groups to communicate with their fellow teacher colleagues $^{\text{PMC}} < 0.001$. Most of the participants from Alexandria (n=16, 41%) and Pharos (n=11, 57.9%) universities used social media to communicate with their fellow teacher colleagues at least once a day, while 44% and 28% of the participants from MSA and UK universities respectively used social media for the same purpose more than three times per day.

When the participants were asked about the frequency of using social media to share educational material with their students, there was a significant difference among the responses of the four groups. Around half (n=19, 48.7%) of the participants from Alexandria university answered with “never”, while most of the participants from MSA university (n=43, 39.4%) answered with “once a week” and 42.1% of respondents from Pharos university answered with “once a month”. In the UK universities almost one third of the participants answered with “never”, while another third answered with “more than three times per day”.

When the participants were asked about the frequency of using social media to get information from other dental schools or international associations, UK respondents were the ones that most frequently used social media for that purpose, with 44% used social media more than 3 times per day. The majority of respondents from Alexandria university answered with either
“once a week” (n= 13, 33.3%) or “once a month” (n= 12, 30.8%). About two thirds of the participants from MSA university answered with either “once a day” (n= 33, 30.3%) or “once a week” (n=32, 29.4%). Most of the respondents from Pharos university answered either with “once a month” (n=7, 36.8%) or “once a week” (n=5, 26.3%). When the participants were asked about their frequency of reading or interacting with blogs, posts or Wikis for education-related information, almost one third of the participants from Alexandria, MSA and Pharos universities answered with “once a week”, while 40% of the respondents from UK universities answered with “more than three times per day” Table (5.8).

5.3.1 Teachers’ perceptions regarding the use of social media for educational purposes

When the participants were asked whether they believe that teaching through social media is effective, most of the participants from Alexandria (n= 15, 38.5%) and the UK (n= 9, 36%) universities answered with “neutral”. About one third of the participants from MSA university (n=38, 34.9%) answered with “agree” and the majority of the participants from Pharos university (n=7, 36.8%) answered with “strongly agree”. The majority of the participants from Alexandria, MSA and Pharos universities agreed with the belief that interaction with teacher colleagues from their universities or other universities through social media is effective. On the other hand, 7 (28%) of the UK participants showed a “neutral” belief toward the same idea, and the same number of participants agreed/disagreed with that belief.

Table 5.8 Comparison between the studied universities relating to teacher communication with others for educational purposes

| Q |  | Alexandria (n=39) | MSA (n=109) | Pharos (n=19) | UK (n=25) | p
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>16</td>
<td>How often do you use social media to share educational materials with your students</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>19 (48.7%)</td>
<td>8(7.3%)</td>
<td>2 (10.5%)</td>
<td>9 (36%)</td>
</tr>
<tr>
<td></td>
<td>Once a month</td>
<td>8 (20.5%)</td>
<td>19(17.4%)</td>
<td>8 (42.1%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>9 (23.1%)</td>
<td>43(39.4%)</td>
<td>4 (21.1%)</td>
<td>2 (8%)</td>
</tr>
<tr>
<td></td>
<td>Once a day</td>
<td>2 (5.1%)</td>
<td>29(26.6%)</td>
<td>3 (15.8%)</td>
<td>5 (20%)</td>
</tr>
<tr>
<td></td>
<td>More than 3 times per day</td>
<td>1 (2.6%)</td>
<td>10(9.2%)</td>
<td>2 (10.5%)</td>
<td>9 (36%)</td>
</tr>
</tbody>
</table>

p: p value for comparing between the studied groups

pMC: Monte Carlo corrected p value

*: Statistically significant at p ≤ 0.05

A significant difference was found among the participating groups regarding the use of social media to interact with students (P<0.001). The majority (n=16, 41%) of Alexandria university’s participants responded with “strongly agree”, 39.4% of MSA university’s participants responded with “agree”, around two thirds of the participants from Pharos university responded either with “agree” or “strongly agree”, and only 28% of UK respondents
answered with “agree”. When the participants were asked whether they believe that utilising social media in the teaching process is more effective than traditional teaching, the majority of them showed “neutral” perceptions. When the participants were asked if they believe that utilising social media in the teaching process could encourage students to participate better than in the traditional classroom setting, most of those from Alexandria and Pharos universities did either “agree” or “strongly agree”, while the majority of the participants from MSA and UK universities were either “neutral” or did “agree” Table (5.9).

5.3.2 Factors affecting using social media by teachers in education

The same regression analysis run for the students was performed on the teachers’ responses, to understand the relationship between demographic and geographic variables and the use of social media. In particular, unadjuste...
<table>
<thead>
<tr>
<th>Variables</th>
<th>Unadjusted model</th>
<th></th>
<th></th>
<th>Adjusted model</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P value</td>
<td>OR (95% CI)</td>
<td>P value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males vs females</td>
<td>0.72 (0.34, 1.51)</td>
<td>0.38</td>
<td>0.70 (0.32, 1.57)</td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>1.83 (0.33, 10.16)</td>
<td>0.49</td>
<td>0.88 (0.13, 6.17)</td>
<td>0.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-40</td>
<td>1.26 (0.22, 7.29)</td>
<td>0.80</td>
<td>0.88 (0.13, 5.84)</td>
<td>0.89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td>4.80 (0.35, 65.76)</td>
<td>0.24</td>
<td>3.28 (0.21, 5.47)</td>
<td>0.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60</td>
<td>2.00 (0.21, 18.69)</td>
<td>0.54</td>
<td>0.41 (0.25, 28.50)</td>
<td>0.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 60</td>
<td>Reference category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alexandria</td>
<td>1.80 (0.61, 5.31)</td>
<td>0.29</td>
<td>2.48 (0.68, 9.06)</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSA</td>
<td>3.04 (1.16, 8.00)</td>
<td>0.02*</td>
<td>4.16 (1.30, 13.35)</td>
<td>0.02*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pharos</td>
<td>8.44 (0.95, 74.85)</td>
<td>0.06</td>
<td>12.70 (1.23, 13.87)</td>
<td>0.03*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UK universities</td>
<td>Reference category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Model Chi-square = 11.69, p value = 0.17, OR= Odds ratio, CI= Confidence interval
*Statistically significant at p value <0.05
5.4 Qualitative Results of students’ semi-structured interviews

A total of 10 semi-structured interviews were conducted in 4 different dental schools: Alexandria university (n=3), MSA university (n=3), UPDA (n=3) and Pharos university (n=1). The one participant from Pharos university was included to confirm whether any different themes might arise relative to the previous participants. *(Table 5.11)*

Table 5.11 the participating students at the semi structured interviews

<table>
<thead>
<tr>
<th>Participant</th>
<th>University</th>
<th>Year</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MSA</td>
<td>4</td>
<td>Female</td>
</tr>
<tr>
<td>2</td>
<td>Alexandria</td>
<td>3</td>
<td>Female</td>
</tr>
<tr>
<td>3</td>
<td>Alexandria</td>
<td>4</td>
<td>Male</td>
</tr>
<tr>
<td>4</td>
<td>MSA</td>
<td>5</td>
<td>Male</td>
</tr>
<tr>
<td>5</td>
<td>MSA</td>
<td>3</td>
<td>Female</td>
</tr>
<tr>
<td>6</td>
<td>Alexandria</td>
<td>3</td>
<td>Male</td>
</tr>
<tr>
<td>7</td>
<td>UPDA</td>
<td>2</td>
<td>Female</td>
</tr>
<tr>
<td>8</td>
<td>UPDA</td>
<td>2</td>
<td>Female</td>
</tr>
<tr>
<td>9</td>
<td>UPDA</td>
<td>2</td>
<td>Female</td>
</tr>
<tr>
<td>10</td>
<td>Pharos</td>
<td>5</td>
<td>Male</td>
</tr>
</tbody>
</table>

The analysed data resulted in a number of main emerging themes and subthemes:

I. Definition of social media

II. Uses of social media in dental education

a) Students’ collaboration and communication.

b) Communication with dental teachers.

c) Networking with other dental professionals.

d) Source of information.
III. Advantages of using social media in dental education

a) Ease of use and accessibility.
b) Quick way of communication.
c) Learning in your own space and time.
d) Source of information.
e) Save time.

IV. Concerns about using social media in dental education

a) Need technical facilities.
b) The quality of information.
c) Distracting tools.
d) Negative effect on learning.
e) Professionalism.
f) Privacy concerns.
g) Negative effect on real social life.
h) Concerns about building relations through social media.

I. Definition of social media

Social media were found by all the participants to be those platforms used for online communication amongst individuals. Some examples were mentioned like Facebook, WhatsApp, Twitter, Instagram, Telegram, Messenger, YouTube, Switch, Discord, and gaming platforms. Participants have mentioned some devices that were needed to use social media like smart phones, laptops, or tablets:

“I would say they are the different technological ways of communication, whether that via using mobile applications, computer or tablet form for going onto a web browser and using your name to log in Facebook, WhatsApp, Twitter for example. They are different way for communication with different people around the world.”8

* The number beside the quoting refers to the participant’s number present in table 5.13
Two participants mentioned that social media were those platforms that were used specifically, in an informal and unofficial way:

“I would say that social media are those platforms that are used in friendly way and unofficial, maybe because we used to use them previously in a friendly or entertaining way only, before using them for other purposes”

What social media is not:

When the participants were asked whether they consider Email to be social media, the answers varied. Some participants agreed that Email was a kind of social media as it allowed for online communication between individuals:

“now it is very rare to use email. It is an old fashion, but previously when it was used, yes it was a kind of social media”

“I would consider it, because it is very common to use email for a very long time. It has a two way of conversation. And it makes life quicker and easier to get information from someone.”

On the other hand, other participants disagreed with considering Email as social media as it is a formal tool:

“Mmm, I am not sure, but I think it is hard to consider the Email as social media. There are many other alternative ways for communication that are more modern and faster than the Email, like WhatsApp and Telegram. Also, there is a certain way of writing at the email. Through social media you don’t need to write in a certain way, you just send the necessary information”

“I don’t really see Email as social media as it is more formal”

The definition of social media was unclear. Platforms like Email, Zoom, Moodle, Microsoft teams and blackboard were considered by many participants to be social media, as they allowed for online communication among individuals. The definition of social media was linked mainly with online communication and networking.

II. Uses of social media in dental education

The participants mentioned many uses of social media in the context of dental education.

a) Students’ collaboration and communication

Social media platforms, specifically: Facebook, WhatsApp, and Telegram, were used by undergraduate dental students for collaborative purposes, including sharing educational
materials like PowerPoint presentations, lecture summaries, PDF handouts, or shared announcements, university updates or information. All participants mentioned using WhatsApp for communication and collaboration among undergraduate dental students. Students created WhatsApp groups for communication mainly and for sharing updates and news. Each year cohort has its own WhatsApp group, and sometimes, especially at UPDA, students were further divided into smaller cohorts and each group created their own WhatsApp group to arrange group projects or to share cohort announcements. These groups allowed students to be up to date with university and course module updates, and they allowed students to make their own enquires about examination dates, deadlines, or any information that is missed through the email:

“we, as year 4, have created a WhatsApp group that is used to share recommendations, announcements, instructions and advice of the tutors”1

“Particularly on WhatsApp, if I need to ask about something that I am not familiar with or did not try before, it has usually been discussed at the WhatsApp group. If someone find a subject particularly difficult or a part of a module that is difficult, we usually have a chat about this. And when I come to this part, I remember that we discussed it, and I go back to the discussion and write my notes about that.”8

The role of WhatsApp seemed to be limited to only communication and the sharing of news or getting quick answers. That is why other platforms were used for more collaborative purposes:

“we have a WhatsApp group for communication between the students. however, WhatsApp has a lot of limitations. It allows only for sending quick messages or updates. So, we depend more on the Facebook group”.5

Besides WhatsApp groups, Facebook was used by undergraduate dental students for larger collaborative purposes among undergraduate dental students in Alexandria and MSA universities. Students of each year created Facebook groups where they shared PowerPoint presentations, PDF handouts, educational YouTube videos, question lists, in addition to the university announcements, updates and examination timetables. Additionally, students used these Facebook groups to share clinical enquiries and to receive answers, help and recommendations either from their fellow colleagues or from their teachers who are engaged in these groups:

“through Facebook and WhatsApp groups, we as students, share educational materials, educational YouTube videos, news, any updates, needed assignments, quizzes details,
exams’ timetables, or examples of questions from past years’ exams. Also, if someone needs further knowledge about anything that he does not understand, he can find assistance through this group’s 4

Undergraduate dental students from each of Alexandria, MSA and Pharos created their own Facebook group for patients’ enquiries. If any student needed a specific clinical case to fulfil his/her clinical requirements, he/she would be able to ask his/her colleagues at these groups and find if someone had the required clinical case. Also, if someone needed help with their clinical case, they would be able to ask within those Facebook groups. Many dental teachers were engaged with students within these groups to deliver advice, help or suggest recommendations when needed:

“there is a Facebook group called sharing patients. If someone is looking for a specific clinical case, he will find it through that group. If someone has a case that he wants someone else to do it, he also can share it through this group. Or, if anyone needs any clinical assistance, he can seek the assistance at that groups as well” 4

Telegram was another social media platform that was used by undergraduate dental students from Alexandria university for student collaboration and communication. What is unique about Telegram was that it allowed users to share a variety of media and save them to be revised when needed:

“there is an advantage in Telegram as there is no option of (seen). This raise the embarrassment of me when I see a message and decide not to respond or maybe decide to respond later” 6

“another advantage in Telegram is that you can save any materials and in a very high quality” 6

Students created many “Telegram channels” for different purposes:

“… for exams, channels for updates and news, channels for discussions and questions and channel for sharing educational materials like PowerPoints, PDF, exams…”

“we have a channel called (Study together) including students from all levels. Any student can ask any question and the higher levels answer questions of students from the lower levels” 6

Telegram has helped undergraduate dental students during the COVID-19 pandemic. Students used this platform to create summaries of lectures and shared these paper handouts
with fellow students. Because face to face communication was restricted during the COVID-19 pandemic, Telegram offered an effective alternative solution:

“nowadays, we do not get educational handouts from the college, so, me and others write summaries and handouts and share them with the others through different ways of social media, like WhatsApp, Facebook groups or Telegram channels”3

“Previously, we used to share papers including educational materials and share photocopies of that. Because of the Pandemic and the restrictions over the face-to-face communication, now we share the same materials but online through the Telegram channels”6

b) Communication with dental teachers

Communication between undergraduate dental students and their teachers occurred via Email mainly in UPDA and MSA universities. However, some dental teachers, from the Egyptian dental schools only, accepted communication via other social media platforms such as Facebook and WhatsApp instead of Email. Some dental teachers were engaged with students’ Facebook and WhatsApp groups to answer student questions or enquiries. The participating students argued that acceptance of their teachers to communicate with them through social media could be related to their teachers’ preferences or the fast nature of social media as a way of communication. In addition, social media were seen by the participants as an effective way of communicating with their teachers during the COVID-19 pandemic, when face to face communication was limited:

“some tutors are engaged in some Facebook groups to interact with the students, while other tutors do not prefer to do so”1

“Platforms like Facebook and Microsoft teams have become the only ways of communication between the students and their tutors, especially during the pandemic, when face to face communication has become very limited”2

“our tutors sometimes send us the updates through the email, however, not everyone checks his/her email regularly, so, they send that updates through the Facebook as well because it is faster method for communication and everyone check his/her Facebook many times during the day”5

Participating dental students explained why not all their dental teachers were engaged with students over social media. Older age, a high number of students and concerns with professionalism were the main reasons behind the rejection by some dental teachers to be engaged with their students over social media:
“old lecturers are not engaged regularly with social media”5

“I think it is hard for the teachers to communicate with that large number of students through the social media”6

“I think it is to keep it professional, it is related to the professional standards. I am not sure if lecturers would be happy with that, and it depends on the social media policies at the university. I think people should be careful about who you are talking to, what you upload on that, but I think it is to keep everything professional”8

On the other hand, students at UPDA communicated with dental teachers through Email, Moodle and Zoom only.

Communication between students and their teachers changed during the COVID-19 pandemic. Because of the pandemic, face to face communication was limited. So, dental schools looked for alternative ways of communication. Platforms like Zoom, Microsoft Teams and Google Meets offered an effective way of communication between students and their teachers:

“we have weekly meeting with dental teachers in each subject through Microsoft teams. At that meetings, we discuss any enquiries, questions, or any concerns. There is an icon which is (Raise hand) when you press it, the teacher allows you to ask your own questions”3

“at the beginning of the pandemic, range of social media platforms like Zoom, eLearning and Facebook were the only ways for communication between us and the teachers, to know the curriculum, updates, exams, how would we continue the academic year, how would we get our lectures, what should I do if I do not understand something, the assignments needed, asking ourselves, collaborating together and how would the educational process be”4

“we, especially now during the pandemic, use Zoom for communication quite a lot. It allows for sharing screen and communicate with audio and video as well as chatting. We never used it before the pandemic”9

**c) Networking with other dental professionals**

Social media offered a good chance to communicate with other dental professionals from elsewhere. Students highlighted the value of learning from the posts and discussions conducted at Facebook pages and groups. These discussions included general dental information, answers to questions asked by other dentists or DCPs, recommendations for new infection control measures to combat the COVID-19 pandemic or any news related to the
pandemic. The participating students, also, highlighted the value of social media as a forum that connected them with different dental professionals from elsewhere:

“for example, at the hygiene and therapy network, people were discussing questions like if someone has any information about another lockdown, any new recommended PPE to combat the Corona virus. It is like a forum discussion which is educationally helpful, especially to know what other people are think about.”8

“…networking with everyone. It links you to different people around the country. Some people that you can recognise their names or you are familiar with, some of them are university students, and some are those who work at the dental hygiene therapy or periodontology, and you have any discussions with those people.”8

“some people post clinical questions, if they are not sure about something, and get any suggestions or recommendations. And also, you can find some questions about how dentistry now compared to before the pandemic. There are a lot of work discussions.”8

**d) Source of information:**

Several social media platforms were used as sources of dental information for undergraduate dental students. YouTube, Facebook and Instagram were used by many students to look for dental information in various ways;

“Instead of looking through large textboxes, we are able to find any piece of information through various social media platforms”1

YouTube, for example, was found as the main source of dental information to illustrate practical and clinical dental work step by step. Because of the high number of students in Egyptian dental schools that could reach 500 in each year, students mentioned that they were not able to watch all the live demonstrations at the dental school. YouTube videos were found to be an effective alternative to watch what they missed during the on-campus demonstrations. Additionally, YouTube was believed by the participants to be a helpful educational platform, not merely during university time, but also after graduation, as they believed that it could aid them in keeping up to date new technologies in dentistry.

“Because of the high number of students watching practical demonstrations at the college, I depend on YouTube videos to watch demonstrations that I missed at the university”10

“after we attend demonstrations at the college, we need YouTube videos to remind us with what we have seen in the clinics or the laboratories. For example: tooth reduction and how the finish line looks like in Zircon crowns”1
“I do use YouTube video to explain some topics that I am not aware of or I cannot understand”

Because YouTube is connected to other social media platforms such as Facebook, WhatsApp and Instagram, students were able to share educational materials through their Facebook and WhatsApp groups.

Examples of dental topics that are searched for through YouTube by undergraduate dental students were cavity preparation, impression techniques, root canal treatments, removable prosthesis, dental morphology, radiology, and physics.

Joining dental-related Facebook groups and following Facebook pages were seen as useful sources of dental information and effective ways to engage with dental professionals from everywhere. Facebook offered a good opportunity for undergraduate dental students to learn about new techniques, materials, innovations, and recommendations, through engagement with the posts and discussions found on Facebook pages and groups. These posts included questions, opinions, videos, photos, or x-rays illustrating clinical procedures, new dental materials, clinical cases for differential diagnosis and management. After each post, there were comments including discussions about the posts by many dental practitioners or experts:

“because of dental related Facebook pages, we are exposed to many cases, x-rays, photos of dental cases, treatment plans”

“Facebook is the main source of information. There are many Facebook dental pages including many posts for clinical cases for other dentists and many group discussions that are considered informative and useful”

“I do. I follow a couple of dental groups on Facebook and Instagram. One for dental hygiene – therapy network. And I find them useful as they put many posts every day. Some maybe for fun, some maybe like refresher. And they are so helpful for networking, and discussing different things like the currently used PPE, and I like this aspect.”

Instagram was also seen as a useful source of dental information. Following dentistry related accounts allowed the students to find many short videos and photos for clinical cases, dental procedures, questions and answers:

“Instagram is a useful platform where dentists share their cases and new treatment techniques”
“social media allow us to be updated with the most recent dental innovations and techniques that we may miss to learn at the university, especially when you follow dental related Facebook pages or Instagram accounts.”

What is unique about Instagram, as a source of dental information, was that it delivered information in a very summarised, bold and “eye-catching” way. Even the educational videos posted on Instagram didn’t exceed one minute:

“unintentionally, when you scroll down in applications like Instagram, your eye would catch some dental information published by dental pages that I follow. So, I get many dental or dental hygiene information with no previous intention.”

“Instagram has also some quite useful educational pages that deliver dental information. They are bold and catchy. It is not like learning through PowerPoint presentation, it delivers information in from of one picture or one small video like a one-minute video, and it is catchy”

It is worth mentioning that some participants expressed their comfort to ask their peers over social media groups instead of asking their teachers. They explained saying:

“sometimes I feel shy to ask my teachers. I feel that they may consider my questions as stupid. So, I feel more comfortable to ask my colleagues or share my questions with my group through our Facebook groups”

“students feel more comfortable to ask their fellow students instead of asking their teachers. I think some students do not like to interact with others in person and prefer to do it behind their screens”

III. Advantages of utilising social media in dental education

Learning through social media has been described as a “mixed blessing tool”.

a) Ease of use and accessibility

Participants highlighted the ease of use and accessibility as key advantages of social media. A range of devices such as personal computers, laptops and tablets were available to allow individuals to access their social media accounts seamlessly. In addition, the ubiquitous access to smartphones amongst undergraduate dental students aided in using social media anywhere and at any time;

“social media are easy to use and accessible through many devices like laptops, tablets and smart phones”
“I prefer communication through social media. They are more accessible that we check every day not like the eLearning that I don’t open regularly so I may miss some information or updates.”

b) Fast way of communication:

Eight participants reported that social media formed fast methods for communication among dental students and between the students and their teachers. Social media platforms like Facebook, WhatsApp and Telegram allowed undergraduate dental students to send and receive information and get quick answers from their teachers instead of waiting until the next day to meet them in person. Additionally, social media allowed for group discussions, collaboration and sharing educational materials like PDF documents, PowerPoint presentations, educational videos, photos and x-rays in an easy and rapid way;

“they ease the communication and interaction either among the students themselves or between the students and their teachers. In addition, they offer a fast way to deliver the educational materials like PowerPoint presentations, news, updates, information, questions and answers.”

“Accessibility, ease of use, fast way for communication instead of waiting for the next day to meet him/her in person.”

“I would say definitely, communication with your colleagues. They are a quick and easy way to give and receive information, to help someone to understand what is going on, especially if you are stuck at home so they help you in order not to feel that you are left on your own. It is nice way to interact instead of the physical interaction at the uni. They give you the chance to chat about the normal life, Uni life and work life. Also using Facebook groups is fun and educational. And it is nice to have different discussions with different clinicians and professionals to see how to deal with different clinical situations.”

Another point worth mentioning is that social media were considered as the main method of communication among dental students and between the students and their teachers during the COVID-19 pandemic when face-to-face communication was limited, and students were having to work from home;

“learning through social media increased during the Pandemic because face to face communication has been limited. So, we try to keep in touch virtually as much as we can through social media.”
"ease of communication especially during the COVID-19 pandemic. We would never be able to complete the academic year without the social media"5

"they allowed for communication when face to face communication become limited during the pandemic"9

c) Learning in your own space

Three participants pointed to the privilege of "learning in your own space" that was provided by social media. Many dental students working days are often busy and exhausting. Dental students spend all day moving between classrooms to clinics or laboratories. Social media offered them an opportunity to learn in their own space outside the campus through the different social media platforms;

"Classroom learning is exhausting and stressful. We feel exhausted when we learn from 8 am to 5 pm everyday moving from clinics to lectures. So, learning through social media gave me the chance to learn in my own space. I definitely would say it is more comfortable"3

"Previously, I used to spend all my day between lectures and clinics, but now, we can get the lectures at any suitable or convenient time and inside the campus, we can focus on the clinical work"6

"you can learn around you own schedule which is helpful if you have commitment like having children or things like that."8

However, some other participants considered “learning in your own space” as a disadvantage, as it was dependent on self-motivation. They explained saying:

“learning through social media depends on the student himself (self-learning). So, if the student is motivated to learn, he will do, If not he will not “5

d) Save time

Three students mentioned that using social media in dental education saved their learning time. Students’ social media groups facilitated collaboration. They were able to: access information any time, arrange group meetings, discuss university updates, share educational materials quickly; instead of partaking in these activities in person on campus. Some students that live away from the campus also highlighted the value of social media to save time and money required for travelling.

“previously, it was hard to arrange meetings between large number of students, but now we can do any discussions through our social media groups”1
“you don’t have to go to the university for lectures and this saves a lot of time and money”3

“save time to find an answer for your questions”6

4. Concerns about using social media in dental education

a) Technical issues

Some technical issues such as the quality of the internet connection, cuts in electricity service and problems with equipment including personal computers, laptops and smartphones, were reported as barriers, resulting in some students at the Egyptian universities not utilising social media in dental education. This concern was not mentioned by students of UPDA;

“If we improve some technical issues like the internet connections and electricity interruptions, I will be happy with online learning and will consider learning through social media the same as classroom learning”1

“also, using social media needs technical facilities and equipment like rapid internet connections, Laptop or tablets, which are not available for everyone and definitely not everywhere. That is why lecturers record the lectures instead of doing them live, so you are able to watch them when you get facilities to connect with internet at your own place”2

b) The quality of information:

Most of the participants (n=7) were concerned about the accuracy of the information published on social media. One of the main concerns of social media was that it allows anyone to publish any post regardless of its accuracy. Although there is a benefit of having access to a large amount of varied information, not all of this information was considered to be accurate or evidence based. Moreover, some of the posts found on social media were based on personal opinions that could be biased or incorrect. But this did not mean that individuals stopped using social media to search for dental information. Instead, they still used this technology, but they tried to make sure that the published information is correct by asking their teachers or looking for more information evidence-based resources;

“sometimes you can find incorrect information with no evidence base, wrong or biased opinions”2

“I do not trust the information published on social media. Except educational videos published by a university”3
“if I find any information that are different than what I already know, or completely new to my knowledge, I try to ask my tutors or look at another trustable resources to confirm whether this information are right or wrong” 4

c) Distracting tools

Social media were described as distracting tools. Social media has the potential to distract individuals using a variety of approaches such as entertainment videos, games or online shopping. Also, when some students used social media like Facebook or YouTube for educational purposes, not all of them could avoid scrolling down and looking at some irrelevant videos or posts.

“Sometimes, when I go to search for a certain topic, I find myself scrolling and moving between video to video and go out of the topic” 5

“also, sometimes when you go to look for information on social media, you get distracted with the other irrelevant media that appears in front of you, and you start to scroll down and go from topic to another which are away from the topic that you were looking at” 9

Social media can distract users by showing them entertaining posts, games or news. Social media can use the personal information and data of its users to target them with posts related to their interests. For example:

“if you do online shopping, advertisements of what you looked for will keep appearing in front of you through any social media you use like Facebook, Instagram and YouTube” 9

“platforms like Facebook, Instagram and YouTube gather data about you and your interests, and use these data to suggest materials that you are interested in. This approach allows for spending more and more time on social media.” 9

d) Negative effect on learning

One potential negative impact of social media on learning is the risk it will discourage students to look for information themselves through textbooks or educational journals.

“it reduces students` willing to look for dental information. If someone has a question, he will ask his/her peers instead of looking at the textbooks, scientific papers or the literature himself/herself. My concern is that everyone should know how to look for dental information themselves” 6
The variety of information found on social media also had a negative effect on learning, as it could lead to information overload. Some students became confused when they found a topic that was illustrated in a variety of ways, and they become unable to decide which way was correct right. This observation was made with dental practical techniques or dental materials related topics;

“sometimes I find different clinical techniques and I become confused which one is the right, or which techniques should I adopt, and this is applied too on the dental materials. Sometimes I find someone using a material that is different than what I learned. Also, sometimes I find different information that what I have been taught inside the dental school”7

“sometimes you get quite overwhelmed with all the different information that are discussed every day, because everything is changing in dentistry. Sometimes you can feel that you can't keep on the top of things. “8

Face to face teaching was still preferable by the students when compared to teaching through social media. The face to face interaction was considered to be superior to interactions through social media groups. You can easily ask questions, follow up with clarification questions and illustrate any point using pen and paper, instead of sending educational materials or voice messages through social media groups;

“there is an advantage regarding face to face teaching even among the students themselves. It is easier to teach any point face to face, using a pen and paper, instead of sending a voice message or upload a paper”6

e) Professionalism

Participants referred to some unprofessional uses of social media by undergraduate dental students, for example, posting clinical photos of their patients;

“some students post clinical photos for their patients. I have some doubts if this is ethically accepted or not”3

In addition, negative comments and unprofessional discussions might arise and this discouraged some students from participating in such discussions;

“there was a WhatsApp group for all the level 5 dental therapy, but I, very quickly, came off that, because it is catty. It was very cliquey. If you disagree with some opinions, or trying to give different perspectives, some of the reactions are really uncalled for, so, I took myself out of that.”7
f) Privacy concerns

Some students preferred to keep their social media accounts private and separate from the educational process. They were concerned about their privacy and their right to post whatever they want on their personal social media accounts. So, engagement in the student groups through their personal accounts would make these accounts, with their private contents, open to others. That is why many students still prefer to communicate with their colleagues or their dental teachers professionally through Email, and keep their personal social media accounts private.

“I do have only two fellow students at my Facebook. Because you need to be very careful and watch what you say as long you are a medical profession. It is regulated so you have got to be careful what you say, as anything can be misconstrued, and my future career could be in jeopardy if it is taken the wrong way by somebody even if it is not to offend or whatever watching that if they take offence then there is no lecturers on my Facebook so I end up having my university email for to keep it professional and keep my social media separate from my education.”

Participants were also concerned about the security of social media. They reported many cases of hacking of personal accounts and the inappropriate use of personal data and information;

“someone may hack your account and talk on your behalf or use your photos, security stuff like that may do harm you”5

g) Negative effect on real social life

Although the main aim of social media is to facilitate communication and socialisation between individuals, it also appears to have had a negative effect on the real social lives of some individuals. Some users have become addicted to the different social media platforms. They spend a lot of time in front of their screen talking to others. Even if, they were staying with their families or friends in person, they become distracted by scrolling or chatting with others over the different social media platforms using their smartphones or tablets;

“they made people sticking to their phones and devices and spending most of their time looking at screens and communication with others through that platforms instead of spending a real time in person with friends or families. They made people addict to spend their time on social media instead of meeting each other in person. And by the time, they
lose the sense of humanity, and individuals become preferring staying alone with their phones. It is very addictive”

h) Concerns about building relations through social media

Under normal circumstances, it can be difficult for students in their first year to build social relations with their colleagues through social media. As a result of various lockdown measures during the COVID-19 pandemic, students have been unable to meet each other as before. Many social media platforms, such as WhatsApp, Facebook, and Telegram, have offered alternative effective ways of communication among students. However, some students, especially the older ones, have struggled to build social relations with their colleagues through social media groups.

“I think it’s the me being the granny of the group, because I’m the oldest in the whole year. I’m used to meeting people on Facebook, you know, and I do not find it easy to approach a stranger on social media and not only stranger, but also if someone that I don’t know very well, I don’t find that as easy as I do when I am in a room and speaking to them. For me it is not easy, and I didn’t do new friends over social media.”

5.5 Qualitative results of teachers’ semi-structured interviews

A total of 7 semi-structured interviews were conducted in 4 different dental schools: Alexandria university (n=2), MSA university (n=1), UPDA (n=3) and Pharos university (n=1). (Table 5.12)

Table 5.12 the participating dental teachers at the semi-structured interviews

<table>
<thead>
<tr>
<th>Participant</th>
<th>University</th>
<th>Gender</th>
</tr>
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<tbody>
<tr>
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<td>male</td>
</tr>
<tr>
<td>2</td>
<td>Alexandria</td>
<td>female</td>
</tr>
<tr>
<td>3</td>
<td>UPDA</td>
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<td>4</td>
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<td>5</td>
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<td>6</td>
<td>UPDA</td>
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<tr>
<td>7</td>
<td>Pharos</td>
<td>Female</td>
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</tbody>
</table>
The analysed data resulted in several emerging main themes and subthemes:

I. **Definition of social media.**

II. **Uses of social media in dental education.**
   a) Using social media for communication with students.
   b) Using social media for communication with fellow teachers.
   c) Using social media to network with others.
   d) Using social media to search for dental information.
   e) Using social media for teaching purposes.
   f) Using social media by the university for news and promotions.

III. **Advantages of using social media in dental education.**
   a) Communication.
   b) Accessibility.

IV. **Concerns about using social media in dental education.**
   a) Confusion
   b) Accuracy of information.
   c) Limited interaction.
   d) Need for technical facilities.
   e) Need for training.
   f) Need for motivation.
   g) Privacy concerns.
   h) Negative learning effects.
   i) Distractive tools.

V. **Limitations.**
VI. Recommendations.

I. Definition of social media

The participants stated that they previously regarded social media as platforms that were used for socialising, informal communication among individuals that were known or unknown to each other and for the sharing of content such as photographs and videos; and they gave examples such as Facebook, Twitter, WhatsApp, Telegram, Instagram, LinkedIn, Snapchat and YouTube. However more recently, social media were considered by the participants to be used for other purposes such as education, marketing, entertaining, texting, online conferences, and professional communication. This is why some participants considered that online conferencing applications like Zoom and Google Meet could also be regarded as examples of social media, as they allowed for online communication and the sharing of content amongst users. However, for the purposes of this study, online conferencing applications were not included in the rest of the questions.

“applications or websites through which one is allowed to communicate with others and share media like photos, videos or information, Etc”

“they are something that you would use technologies to interact with other people, family and friends, I used to believe that social media should not be used for professional reasons, however, my opinion has changed during the COVID pandemic and maybe even before the COVID time as we use these technologies to interact with students. Now I think that social media include emails, video conferencing apps, messaging apps, but you can’t educate students through Twitter and Instagram. So, I think using social media for educational purposes is blur. That is why I am not confident how social media can be used in dental education and I am interested to see how others do that”

II. Uses of social media in dental education

a) Using social media for communication with students

Although universities have created official avenues for online communication between dental teachers and their students, including Email, Blackboard, eLearning, and Microsoft Teams, participating dental teachers noticed that students were still looking for unofficial ways for communication with their teachers. This included direct or indirect approaches. The direct approaches at the Egyptian universities included creating Facebook or WhatsApp groups by the students themselves and inviting dental teachers to be engaged with the students through

* The number beside the quoting refers to the participant’s number present in table 5.14
these groups. This allowed dental students to ask questions whenever they want or to get consultations and advice from their teachers.

“students usually communicate with me, unofficially, through WhatsApp or Facebook to get an assistance or consultation for emergency cases and how to deal with that”

“we communicate with the students officially through eLearning. But they don’t check the eLearning website like they do with Facebook that they check every 10 minutes”

The indirect approaches in both the Egyptian and UK universities, included creating WhatsApp groups by the students themselves, and dental teachers communicated with the students’ representatives, and those representatives transferred information and announcements from the teachers to the students through these WhatsApp groups. In these situations, the dental teachers were not engaged directly with the students, and this way was found to be comfortable for both the dental students and their teachers;

“we used WhatsApp groups to communicate with students. Each cohort of students create a WhatsApp group, students’ representatives do that, that is used to exchange information, updates, assessments, or any changes. If there is any important news, I contact the students’ representatives and they disseminate that messages through the WhatsApp group. For example, this happened when the pandemic started, I told the rep that no clinics next week so far students should not travel. Although we sent emails including that updates, some students may miss that. So, I believe that WhatsApp groups are quicker to disseminate news”

“I asked the undergraduate dental students who I am a personal tutor for if they want to contact me through WhatsApp, but they preferred to do that either in person or through video conferences. So, I am led by the students by that. They may not feel the need to do that and like to keep their private lives separate. Also, sometimes students feel shy to participate in social media groups and prefer to do it privately. But I have no concern personally”

When participating dental teachers were asked about the reason behind the need for unofficial ways to communicate with their students, they noticed that many students did not prefer the official ways of communication, and they did not check them regularly as they did with social media platforms such as WhatsApp and Facebook that were described as “Friendly tools”. In addition, sending a message or announcement to a group of students over social media would allow the students to discuss the sent message or announcement through their own groups.
Besides, participants thought that students would prefer communication over social media groups that were created and directed themselves.

“I think because WhatsApp groups are created by the students themselves, they find it more friendly, and news as well as information are more likely to be seen by the students through their own WhatsApp groups” 3

“because the email is a formal way of communication and they don’t prefer formal ways. For example, in Pharos university, the formal way of communication is through the Blackboard platform and the academic email. However, students still prefer to communicate with us through the WhatsApp.”7

It is worth mentioning that many participating dental teachers, especially from UPDA, rejected direct unofficial communication with their students over social media for many reasons. They considered these approaches to be unprofessional for communication, and they preferred to keep a professional distance between themselves and their students;

“for me, I do not find that appropriate. I think it is appropriate to have professional distance, I think a lot of social media blur the line between personal and professional life”4

Additionally, they highlighted their privacy concerns about sharing their own telephone numbers with their students, as:

“some students do not respect the personal time and can give me a call any time”5

b) Using social media for communication with fellow teachers

Social media platforms such as Facebook and WhatsApp were used by many dental teachers to communicate with each other. Some departments created WhatsApp groups to arrange for meetings, inform about timetables, discuss departmental or student needs, and generally share enquiries. Other departments created Facebook groups to arrange for seminars and to share photographs and x-rays for clinical cases. Three of the seven participants, stated that many dental professors preferred to be contacted by telephone as they found it “disrespectful” to be contacted through social media messaging;

“there is a WhatsApp group for the postgraduate students and fellow tutors at the academy to communicate”4

“yes, but with the fellows at the same age. Old people find it disrespectful to contact them through social media and they prefer phone calls”5
“yes, we as an orthodontics department, have a WhatsApp group, where we discuss all the course relevant information, clinical cases or announcements. Only excel sheets or PDF attachments are shared through the email.”7

c) Using social media to network with others

Participating dental teachers highlighted the value of social media as a tool for networking with other dental professionals outside their institutions. Social media platforms such as Facebook, Instagram and LinkedIn offered a great opportunity to meet dentists, dental hygienists, dental therapists and dental nurses from around the world through Facebook groups or pages, Instagram accounts or LinkedIn;

“there is a big private Facebook group, and you have to be dental hygienist of therapist who is registered in the UK to be able to join that group. They talk about everything; problems of work, how to deal with things, information, if someone is looking for help, or conducting surveys. So definitely I would say that Facebook is one of the most ways I use social media in education”

d) Using social media to search for dental information

YouTube was mentioned by many participating dental teachers as a good and simple platform to deliver educational videos. Also, Facebook contained a variety of educational videos that were useful to learn about new dental materials, instruments, or techniques. Besides, many scientific discussions were conducted over Facebook groups and pages. Examples include posts about clinical cases, and from the comments, it is possible to learn a lot about these cases, including differential diagnoses and treatment plans. Participants mentioned particular dental topics that they usually search for through social media, such as new impression materials or techniques, gingival retraction materials, dental implants, radiography, maxillofacial surgery, obturators, removable prostheses, wire bending, dental morphology, and wax carving.

“I do look at videos on YouTube for examples on dental implants to refresh my knowledge”1

“I definitely would mention Facebook, I have a notification set, so anyone when he posts on dental groups I will be notified. Otherwise, I can use the search bar on the actual group to type keyword of topics that I am looking for and results would come up including any videos, discussion or posts by someone”4

“sometimes yes. When I find some people posting educational posts on Facebook or videos at Instagram including new techniques or steps of clinical procedures”5
e) Using social media for teaching purposes

Some participating dental teachers (n=4) mentioned that they shared some educational videos with their students to help them understand a technique or a certain topic in a simple way;

“absolutely, I use a lot of YouTube clips to demonstrate, especially with things like radiography, physics elements and things like that”6

“I share some educational videos related to orthodontics with the students. sometimes when they find a technique, that we adopt, and is found difficult, I send them some YouTube videos that illustrate the same techniques but in a simpler way. Also, they prefer to watch videos beside the live demonstration. This helps them to memorize techniques of orthodontics”7

Also, social media groups were used to send google form quizzes or entertaining educational games for cohorts of students that they could complete either inside or outside the classroom. These were believed to be effective supplementary teaching tools to aid the educational process;

“they aid to help learning by giving them games on entertaining interaction that will help understanding of what you tell them.”6

“Google forms quizzes, cohort quizzes, fun elements, something that they can join in, And can type in any name which can be seen on the main screen which causes interaction and communication with the group and there is a little bit of elements, if you going to win and excitement”6

On the other hand, other participating dental teachers refused to share YouTube videos with their students. They were concerned about the copyrights of the videos published on YouTube. Also, they had some concerns regarding the accuracy or appropriateness of information published on social media;

“I do not share that with the students as I am quite conscious about the copyrights. In addition, not all the information published on social media are right”3

“I don’t recommend YouTube videos for the students as some videos use different techniques and I don’t want the students to get confused.”4

f) Using social media by the university for news and promotions

The University of Portsmouth Dental Academy had Facebook, Twitter, and Instagram accounts, through which general news, announcements and updates of the academy were posted. Scientific papers, dental awards and participation in conferences were also announced through these three platforms;
“we have dental academy Facebook and Twitter accounts and we use them to publish general messages for promotion or when someone of the students or the staff published a new paper or got awards, we promote that through those accounts to increase the awareness”3

“the university of Portsmouth the dental academy has Facebook, Instagram and Twitter for posting any general news or updates. The three platforms are linked to each other, so you don’t have to have accounts at all of them.”4

Also, there were Facebook and Instagram accounts for the student dental society. These accounts were created by the students themselves, and were used to help dental care professional students to be better connected with each other and with the dental academy. The students used these social media to conduct social and scientific events organized either by the students themselves or delivered by external speakers including awareness campaigns such as the “oral cancer awareness campaign”;

“there is a Facebook group for the dental society. It is used for awareness and to make students feeling connected and deliver advice especially for first year’s students. Also, they adopt some awareness campaigns about topics like oral cancers, including videos and photographs”4

III. Advantages of using social media in dental education

a) Communication

All the participating dental teachers highlighted the value of social media as informal, fast and easy ways of communication either amongst the teachers themselves or with their students. Social media allowed dental teachers to communicate with large groups of students and to create cohort discussions through WhatsApp or Facebook groups. Additionally, these groups played an important role to encourage shy students who felt more comfortable to participate in discussions behind their screens, instead of through face to face communication. Also, the interaction between dental students and their teachers through social media helped to break the ice between them, and thus, allowed for more flexible communication;

“It is easy and quicker to disseminate information for the students through their WhatsApp groups than doing that through the email”3

“it is useful for breaking the ice between the student and the tutors. Also, it enhanced the fast and flexible communication”1
“Some students become too shy to talk in person. Also, it is useful to send information to a group of people at the same time.”

“They are more comfortable for students that are shy to communicate in person.”

One teacher who did not previously communicate with their students showed their intention to do so in the future, and stated:

“I think younger generation spend a lot of time on social media, therefore, it makes sense for tutors to be engaged with that, and it will be much easier for sharing educational materials with them in this way.”

During the COVID-19 pandemic, group gatherings were prohibited to combat the spread of the virus. At that time, group discussions through social media platforms were considered as reliable alternatives to face to face meetings. Social media groups gave the students a sense of community and the feeling of belongingness and connectivity to their universities during the pandemic, instead of feeling isolated.

“They allow for group communication especially through this pandemic time when, group gatherings are prohibited.”

“Social media, like WhatsApp groups, gave the chance for the students to support each other and feel a sense of community and engagement during the pandemic.”

“Social media helped people to be connected either with each other or with the university news and updates through the pandemic.”

b) Accessibility

One of the main advantages of social media was their accessibility. Dental teachers could access their social media accounts through their smartphones, laptops, personal computers, or tablets. Also, they could access their accounts whenever and wherever they wanted as long they had internet facilities. This allowed them to send fast answers for their students’ enquiries that were sent over social media. Consequently, social media were seen as fast tools that saved time, as they allowed students to send their questions immediately without waiting to get appointments for in-person meetings.

“I would say that one of the main advantages of social media is the accessibility through their smart phones, laptops or tablets.”

“Platforms like Facebook and WhatsApp are easier to use and more accessible by students who can access that platforms anywhere through their mobiles.”
IV. Concerns about using social media in dental education

a) Confusion

Learning from different social media sources was thought to possibly cause confusion for undergraduate dental students. Participating dental teachers expressed their concerns regarding information overload that might be caused by immersing the students into multiple sources of information, such as delivering different practical techniques and exposing them to different dental materials. It was also considered that information should be delivered at an appropriate time in the curriculum, so as to avoid confusion for the dental students.

“Although of that, I do not recommend those YouTube videos for everyone as I do not want to make students confused or distracted. I aim to give them the necessary knowledge at the appropriate time”1

“Some students become confused when they watch different techniques than what they learn at the university. Also, we as dental teachers aim to standardise the educational materials that are received by dental students to avoid any confusion.”1

“Information overload, they may become hesitated when they have a lot of resources and links. Then they may feel confused”3

b) Accuracy of information

The majority of the participants (n=5) were concerned about the accuracy of the information published on social media. Much of this information is based on personal opinions without an evidence base, and dental teachers had no control over the information delivered to the students. In addition, social media were used excessively for marketing purposes by many dental professionals and the dental industry, and this has negatively influenced the way they use social media in dentistry. Exposing dental students to these inappropriate and unprofessional approaches might mislead them, leading to the acquisition of incorrect knowledge. Participating dental teachers suggested some sort of quality control of the scientific content published on social media to make it more evidence-based.

“I have a concern about YouTube videos, because sometimes they mislead the students by giving him faulty information or techniques”1
“some Facebook groups and Instagram accounts publish wrong information with no evidence base that may mislead dental students and professionals” 1

“not definitely. Social media contents should be filtered. That is why I prefer to send the selected video and content to make sure that the information they receive are correct. Some of the published information are done by people who are not experts. That is why I say that the content has to be filtered.”7

c) Limited interaction

Communication through social media was described by most of the participating dental teachers (n=5) as “emotionless ways of communication”. Tutors were not able to look at the facial expressions of their students. Face to face interaction was believed important to allow teachers to know whether their students understood the information they received or not. This emotionless communication might lead to misunderstandings. Some students might feel that their teachers talked to them in a rude or harsh way through social media texting. But this was because text messaging is often an emotionless method of communication. Participants also perceived that it was much easier to conduct group discussions inside the classroom than through social media groups.

“in person interaction inside the classroom is much better as it allow me as a teacher to look at the facial expression and know if the student understand what I am saying or not, is he concentrating at the lecture or distracted, and allow me to ask the students questions to make sure that they understand what I am saying”2

“it could create a misunderstanding, for example the way I write an email could be misunderstood as a tough language or unfriendly one because emotions cannot be reflected on what I write. And the way I use the language is not very diplomatic”3

“It is much easier to generate discussions inside classrooms than online”6

d) Need for technical facilities

Participants highlighted the need for good technical facilities to use social media. High speed internet connections, uninterrupted electricity supplies and good learning equipment such as a Laptop, PC, smartphone, or tablet were needed to use social media. These technical facilities were seen as barriers preventing some students from using social media in dental education, especially in Egypt, because of the big variations in the socioeconomic level of the students, some of whom could not afford these facilities.
e) **Need for training**

Some participating dental teachers raised concerns regarding the need for regular training to get the best use of social media for educational purposes. Social media settings change regularly, and new social media platforms arise frequently. Additionally, how to use social media continuously changes. This resulted in the dental teachers wanting to be regularly updated about new useful social media platforms, as well as changes in the existing platforms. Participants argued that many of the dental teachers, particularly the older ones, did not previously use many social media platforms before. These were amongst the neediest individuals for training if the university decided to adopt using social media for educational purposes.

“the need for training to use social media platforms in the right way”

“most of old aged dental teachers did not used to use social media. I think they are in bad need to get well trained if the university decided to adopt social media in dental education”

f) **The need for motivation**

Many participating dental teachers argued that the success of utilising social media in dental education depends mainly on their motivation and their willingness to use these platforms. Some dental teachers were motivated more than others. Most of the older teachers, for example, were less motivated than the younger dental teachers to use social media for educational purposes. They were also less familiar with the different platforms and the new technology in general.

“if teachers were not motivated to be engaged with social media, they wouldn`t”

“I don’t communicate with dental students over social media. That maybe because I am quite old fashioned possibly and probably, I have never thought about that”

“I think old aged professors did not use social media for educational purposes. That is why they look less motivated than the younger dental teachers to do”

g) **Privacy concerns**

Most of the participants (n=5) expressed privacy concerns whilst engaging with their students through social media. They preferred to keep their private lives away from their students.
Engagement with dental students through social media meant that teachers’ social media accounts would be exposed to the students, who would then be able to access their teachers’ personal activities, photographs, opinions, beliefs and phone numbers through their social media accounts. Participants were concerned about the misuse of this data by some students. Additionally, some participants preferred to keep some professional limits between themselves and their students.

“privacy concerns. I don’t want to feel that I am exposed to the rest of the world and everyone can see what I am doing”³

“No, I don’t use social media for educational purposes. I do outside the work, but I don’t within work. Because I just wonder whether they would be data protected and that information, I am probably getting nervous of getting Facebook groups for students that it could be handled in wrong way possibly outside the university environment. Now we have things like zoom where we do group tutorials online, google meets, but I never thought about using Facebook or Instagram. “⁶

h) **Negative learning effects**

Two participants referred to the negative effects of engaging dental students with social media. One participant argued that some students could be adversely influenced by bad or negative impressions or thoughts stated by others. For example,

“when I find someone saying (I hate this subject or dislike that module or topic) I would ask why I should study that”⁴

Also, students could be adversely impacted by posts published by some high profile dentists. This could make them focus on the advertising or marketing aspects of dentistry without thinking about whether this is right or wrong. Any inappropriate or unprofessional posts on social media could result in sanctions from the dental councils, with the risk of suspension from work or other penalties. Both students and their teachers need to be cautious when using social media for dental purposes.

“when students find a dentist with many followers and doing a lot of posts, they should be care about how to use social media appropriately. Because if you do any inappropriate post and someone reported to the GDC, you will be in a problem”⁵

i) **Distractive tools**

Participants highlighted the distractive nature of social media. They argued that many students spend much time on social media, and they wasted their time moving between videos and
posts published on these platforms. Participating dental teachers advised students to control their time spent using social media, and to know exactly how to use it appropriately and not to waste their time.

“Some students may abuse social media by accessing them many times during the working hours, maybe”6

“The distracting nature of social media. they should be controlled, and students should be guided to get only the correct and relevant information”7

V. Limitations

Participating dental teachers referred to several limitations regarding the use of social media for educational purposes. They argued that social media were not suitable for practical training. Although they are useful for the students to watch practical demonstrations, they needed to apply what they watched, and this was not possible through social media. Also, clinical training with patients is not applicable through social media. Participants argued that using social media for practical training was very limited. Additionally, assessing the level of understanding of the students was not possible over social media. The dental teachers argued that the lack of face to face interaction prevented them from making sure that students understood their teaching.

“the practical trainings and the in-person interaction. Also, it disables the teacher to assess the educational level of his/her students and knowing the weak and strong points”1

“the practical training is so limited through social media like wire bending, how to do intraoral photography”2

VI. Recommendations

All participants recommended using social media as supplementary teaching tools, to fill in the gaps of the traditional classroom. Although social media are fast communication tools and accessible sources of information, participating dental teachers still preferred traditional classroom teaching. The dental teachers recommended a blend of both traditional face to face teaching and social media as a supplementary educational tool. They believed that social media could be the future of university education if they were used appropriately. Additionally, the participants highlighted the value of social media in supporting student-centred learning, as it allowed students to collaborate and learn in their own space. Some participants trusted the ability social media to support blended learning and the flipped classroom approach, however, they reported the need to train dental teachers to effectively achieve this goal.
“I think if they are used properly and cleverly, they will be good tools for education”

“I think we still need to use blend of both classroom and online learning. Together they are very powerful”

“I think combination of both would be the best. Definitely social media will not be an alternative to the face-to-face interaction. Face to face interaction is still necessary in order to be able to evaluate the students in person, and to know strengths and weakness points in each student, and how to help them with the weaknesses. In addition, some students understand better with the face-to-face teaching. All of this need human interaction. Social media will enhance the ways of teaching and will give me more space for interaction, but they should be used as a supplementary to the face-to-face teaching and interaction, not as an alternative.”

5.6 A link between the quantitative and qualitative data

According to the results of the students’ questionnaire, the participating groups reported using social media for educational purposes. The uses of social media in dental education were explored in more detail during the semi-structured interviews that were conducted with 10 undergraduate dental and dental care professional students from the four groups. The students used social media to communicate and collaborate with each other. They asked questions of their peers and networked with other dental professionals from elsewhere. They searched for dental information and shared educational materials (PDF documents, lectures’ summaries, PowerPoint presentations, educational videos and drawings). Sharing educational materials amongst students was found in the questionnaire results to be mostly “once a week” in Alexandria, Pharos, and UK universities, and “once per day” in MSA university.

The quantitative results of the students’ survey revealed that the majority of participants strongly believed that social media were useful for communicating with their colleagues. The results showed the high incidence of using social media for communication among students on a daily basis. WhatsApp was found to be the most popular platform used by the students from all four participating groups, for sending quick messages, during one-to-one conversations or within cohort WhatsApp groups. Facebook was used by the participants from the Egyptian universities for more expanded collaboration through closed Facebook groups. Telegram was used effectively by undergraduate dental students from Alexandria and Pharos universities. Telegram channels allowed for more student collaboration. It allowed students to share large volume files, and to save these files for future access when required.
On the other hand, interaction between the students and their teachers through social media was limited. The students from Alexandria and Pharos universities either agreed or strongly agreed with the effectiveness of social media as a means of communication with their teachers. While most of the participants from MSA and UK universities showed neutral perceptions. Privacy and professionalism concerns were reported as some of the reasons for some students and teachers to reject communicating through social media. They preferred to keep their private life away from their professional life. The interaction through social media was defined by many interviewee students as "limited" because it lacked face-to-face communication, facial expressions, and emotions. This might allow for misunderstandings to occur between the students and their teachers.

Most of the responding students either agreed or strongly agreed with the usefulness of social media to search for information. YouTube was most frequently used by the students to search for dental information, especially for practical techniques and new dental materials. However, some concerns regarding the quality of information published on social media and the biased opinions were found to be the barriers behind some students rejecting the use of social media as a source of information. That is why most of the participants showed neutral perceptions when they were asked about their confidence with the accuracy of information published on social media. Additionally, information overload was highlighted as a source of confusion that may affect the students due to looking at multiple information resources, and in some cases those resources adopted different techniques or opinions to what the students received at their university.

“Neutral” perceptions dominated the responses from the participating students when they were asked if they prefer learning through social media more than traditional classroom learning. These “neutral” perceptions were clearly explained in the semi-structured interviews. All the interviewee students agreed that social media were a “mixed blessing”. Although they had a lot of advantages such as accessibility, ease of use, rapid communication, timesaving, allowing students to learn in their own space, and a big source of information, students could not ignore the drawbacks. Several concerns were expressed by the students including privacy, professionalism, distractive nature, quality of information, negative effects on one’s social life, learning and on building social relations and the need for technical facilities.

Most of the participating dental teachers reported using social media for educational purposes. These purposes were explained in the semi-structured interviews. Social media were used by dental teachers mainly to communicate with each other, to interact with their students, to network with other dental professionals, and to search for dental information. Universities also
used posted general announcements, promotions and advertisements through their own social media accounts.

The majority of dental teachers from the Egyptian universities either agreed or strongly agreed with using social media to interact with their students. The agreement percentage was much lower (only 28%) at UK universities. Teachers from UPDA preferred using the official ways, such as email and Moodle, to communicate with their students. They wanted to keep their personal social media accounts away from their students. Additionally, they believed that social media are not appropriate for communication between the students and their teachers. They expressed some concerns regarding privacy and professionalism. On the other hand, dental teachers at the Egyptian universities showed more flexibility toward interaction with their students through social media. They believed that it would be useful for the students to engage with their dental teachers using their own social media groups. This would allow dental teachers to respond to questions and to offer advice and recommendations when required. Also, they believed that they could disseminate announcements faster through social media that are checked by the students almost daily.

Agreeing with the students, the majority of dental teachers from the four groups showed “neutral” perceptions, when they were asked if they prefer teaching through social media more than the traditional classroom. The interviewed dental teachers pointed to many drawbacks of using social media in dental education, and the concerns far exceeded the advantages. They agreed with the students regarding privacy, professionalism, the accuracy of information, limited interaction, and the need for technical facilities. Besides, they reported the need for training and motivation effectively utilise social media in dental education. Also, they worried about the confusion that might be caused to dental students when they find information in social media different to that taught to them inside the classroom.

5.7 Conclusion

Most of the participating dental students and their teachers used different social media platforms for educational purposes. Facebook, WhatsApp, Instagram, YouTube, and Telegram were the most used social media by the participants. Undergraduate dental students used social media (Facebook, WhatsApp, and Telegram) groups for communication, collaboration and for sharing educational materials amongst each other or between them and their teachers. YouTube was used to search for educational videos especially some clinical procedures about operative dentistry, removable prostheses, oral surgery, and orthodontics. The participants highlighted some advantages regarding using social media in dental education. These advantages were: the ease of use, accessibility, being free of any costs,
being a fast way for communication. However, the participants expressed some concerns related to the quality of information published on social media, privacy, professionalism, distractive nature of social media, the need for motivation, training, and some technical facilities to adopt using social media in dental education.

The next chapter (discussion) aimed to discuss all the quantitative and qualitative results combined with the findings of the systematic and narrative reviews that were conducted at the beginning of this research. Also, it aimed to justify all the findings presented in this research and connected them to the current literature to find out whether it supports the research findings or disagrees with them and why.
Discussion
6 Discussion

A narrative review was conducted at the beginning of this research to represent the gateway of the research. It aimed to introduce some information about the influence of social media on active, collaborative, student-centred, blended and problem-based learning approaches. Moreover, it discussed the correlation between social media and some existing learning theories such as social constructivist, social learning, community of practice, situated learning, connectivism, and the theory of weak ties. Finally, it introduced previous uses of social media in secondary school, higher, medical, and dental education. After that, a systematic review of the literature was conducted. The systematic review was a synthesis of the relevant literature on the use of social media in dental education by undergraduate dental students (including dental care professionals) and their teachers. The systematic review helped to identify the previous uses and drawbacks of using social media for educational purposes. Additionally, it highlighted the knowledge gaps regarding assessing the use of social media in dental education. The systematic review revealed that the literature lacked qualitative studies. Only three previous studies adopted a mixed methods research approach to understand the uses of Facebook (Alshiekhly et al., 2015; Al-rabab et al., 2019) and Twitter (Gonzalez and Gadbury-Amyot, 2016) in dental education. However, they used questionnaires with closed- and open-ended questions. None of these studies used semi-structured interviews as a research tool. Moreover, each of those studies was restricted to a single dental school meaning no comparisons were possible across different educational establishments.

The study in this thesis utilised a mixed methods sequential explanatory research design. This approach consisted of two stages. Firstly, the quantitative study, in the form of an online questionnaire, reported about the social media platforms used by dental students and their teachers. Additionally, it illustrated the perceptions of the participants and their frequency of use of social media for educational purposes. The quantitative study also compared the perceptions and uses of social media in dental education amongst dental students and their teachers from four participating university cohorts from the UK and Egypt. The quantitative study identified the significant differences between the participant cohorts using the chi square of Fisher exact tests and binary regression analysis reported the influence of age, gender, or the university, on the use of social media by the participants for educational purposes.

Secondly, the results of the quantitative study were used to inform the design and construction of the qualitative study, which was executed through semi-structured interviews. In general, the qualitative study aimed to further investigate, justify and clarify the quantitative results. Because the quantitative results revealed uncertainty regarding what the social media were,
the first question during the semi-structured interviews enquired about the participants’ own definition of social media. The qualitative study aimed to answer questions including how and why dental students and their teachers used social media in dental education. In addition, it highlighted the participants’ motivations and concerns regarding utilising social media in dental education. Also, the interviews explored the role of social media in dental education during the COVID-19 pandemic.

The quantitative data analysis revealed that all the participating dental and dental care professional students and their respective teachers confirmed using social media. When the participants were asked to mention what social media platforms they used frequently, the responses varied between the different dental schools. However, in general, Facebook, WhatsApp, Instagram, and YouTube were reported as the most frequently used platforms by the participants. These results were comparable with other studies which explored using social media among medical professional students (El Bialy and Ayoub, 2017; Masood et al., 2017; Souza et al., 2019) and their tutors (Arnett, Loewen and Romito, 2013; Rajeh et al., 2020).

6.1 Definition of social media

A general consensus of how to define social media was not clear among the participants. For example, very few participating students reported email as a social media platform that they used. Whilst a significantly higher percentage reported, within the same survey, using email as a means of communication between themselves and their university. This reflected the participants’ uncertainty about whether they considered email to be categorised as social media, and more generally, the uncertainty about what social media means. This is why the first question at the semi-structured interviews was “how do you define social media?” It was clear from the semi-structured interviews that most of the participants did not previously think about what social media means, and they gave examples based on their own experiences. Many participants were not sure whether some platforms such as Zoom, Email, Blackboard or Microsoft Teams could be described as social media. Follow up questions were asked to encourage the participants to express their own definitions of social media. Most of the participants believed that social media are internet-based platforms that allowed for online informal communication, interaction and the sharing of online materials such as photos, videos, and documents. This definition was analogous to those reported by other authors (Russo et al., 2008; Lewis, 2010; Carr et al., 2015). Russo et al. (2008, p.22) defined social media as “those that facilitate online communication, networking, and/or collaboration”. Lewis (2010) described social media as a “label for digital technologies that allow people to connect, interact, produce and share content” (p. 2). More recently, Carr et al. (2015, p.49) defined social media as “Internet-based and persistent channels of mass personal
communication facilitating perceptions of interactions among users, deriving value primarily from user-generated content”.

The challenge of defining social media could be due to the rapid development of the technology, the increasing number of uses and the increasing knowledge resource as new websites and online content appear each day. Hence, the definition of social media was obviously rolled up, as it showed a general consensus of what tools might be considered social media but without a consensus on what defined these tools as social media. So, the dynamic rapid growth and change in social media technologies, content, aims, settings, and uses could be the reason behind the failure to produce exact definition of social media (Carr et al., 2015). Scott and Jacka (2011, p.5) further argued that: “there is no single recognized definition of social media”.

6.2 Adoption and rejection of social media

No significant differences were found between the participating dental students from the different universities regarding using social media for educational purposes. On the other hand, a significant difference was found among the participating dental teachers from the four universities regarding the use of social media for educational purposes. Dental teachers from the UK universities were the cohort that used social media the least for educational purposes, followed by Alexandria University, Egypt. Dental teachers from Pharos and MSA universities (both in Egypt) were found to be the cohorts that used social media the most for educational purposes.

The intention for the participants to adopt social media in dental education could be explained by the diffusion of innovation theory (Rogers, 2003; Folorunso et al., 2009; Archibald and Clark, 2013; Koçak, Kaya and Erol, 2020). The theory aims to explain how, why, and at what rate new ideas and technologies spread. Diffusion was defined by Rogers (2003, P.21) as “the process by which an innovation is communicated over time among the participants in a social system”. Considering social media as the innovation and according to this definition, adoption of social media in dental education depends on four main elements. These elements include the social media themselves, how information about the social media is spread among individuals through communication channels, the time spent to introduce social media for learners and educators, and the social system into which social media are introduced (Rogers, 2003; Koçak, Kaya and Erol, 2020).

Rogers (2003, P.29-30) determined five main features for the successful dissemination of innovations. These features are “relative advantage, compatibility, complexity, trialability and observability”. According to Rogers`s theory, “the perceived efficiencies by the innovation
should be relative to current tools or procedures”. Social media offered an opportunity for conducting online discussions, and communication in a more seamless, and easier way than some other online platforms such as email. This relative advantage was clearly reflected upon through the semi structured interviews with the dental students who preferred using social media for communication than using email. The ease of use, accessibility, and being free of any costs, were additional advantages of social media that encouraged a range of participants to adopt the use of social media in dental education. Compatibility is “the degree to which an innovation is perceived as consistent with the existing value, past experiences, and needs of potential adopters”. The more compatible the innovation, the higher the rate of adoption (Rogers, 2003; Koçak, Kaya and Erol, 2020). Social media were seen by the participants as tools that fulfilled their needs for communication and finding information in an easy way. Complexity is “the degree to which an innovation is perceived as relatively difficult to understand and use”. The complexity of an innovation is adversely related to its rate of adoption (Folorunso et al., 2009; Koçak, Kaya and Erol, 2020). One of the main advantages that were mentioned by the participants was the ease of use of social media. Some social media platforms such as YouTube, do not even need users to create an account on these platforms. Additionally, using most of the social media platforms, especially the popular ones, were free of any costs. This encouraged individuals to try to use new and different social media platforms with almost no cost implications. Trialability or testability is “the degree to which an innovation may be experimented with in a limited basis”. Trial of innovations is a way for removing the uncertainty (Rogers, 2003). Observability is “the degree to which the results of innovation are visible to others” (Rogers, 2003). The results of a study conducted by Lee and Gould (2014) reported that 96.6% of the participating dental students (n= 29) perceived comfort and familiarity with using Twitter for educational purpose.

6.3 Age
The results of the binary regression analysis showed no influence of age on the use of social media by students and teachers for educational purposes. This could be because most of the participating students were below 25 years old and most of the participating teachers were under 40 years old. Some of the interviewed dental students reported engaging with younger aged dental teachers within the student groups on social media. Additionally, one dental teacher from Alexandria university said that some older dental teachers found it inappropriate to communicate with them through social media, and they preferred direct contact over the telephone. This could be because of the greater prevalence of using social media amongst younger individuals compared to older persons. Rajeh et al. (2020) reported that younger aged dental teachers used Twitter, Snapchat, and Instagram more than older teachers. Young
adults were found to be among the earliest adaptors of social media in the USA. In 2021, 84% of adults in the USA were found using at least one social media platform. On the other hand, in the same year, 45% of individuals over 65 years were found to be using at least one social media (Pew Research Centre, 2021). In 2021, 31.1% of Facebook users in Egypt were aged between 25–34-years, while only 2.3% were above 65 years (Hankovska, 2021a). In the UK, 25.2% of Facebook users were aged between 25–34years in 2021, while only 8.4% were above 65 years old (Hankovska, 2021b). A study conducted by Rajeh et al. (2020) found that dental demonstrators, lecturers, and assistant professors were more likely to use Twitter, Instagram, and Snapchat compared to associate and full professors in three Saudi universities. Because most of the students fell into the same age range, there were no differences in their use of social media based on their age. On the other hand, younger dental teachers engaged with social media more than older dental teachers.

6.4 Gender
The binary regression analysis showed no significant difference between males and females regarding the use of social media for educational purposes amongst both the students and their teachers. These results correspond with those of Rajeh et al. (2020) who found no significant association between gender regarding using social media by dental teachers. In contrast, Saadeh, Saadeh and Torre (2020) found that gender had a significant association with the number of applications used and the time spent on social media. The authors found that female medical and dental students (Total number was 856) used more social media applications than males (95.9% vs. 89.5%) and spent more time on social media (70.3% vs. 56.7%).

6.5 The university
Undergraduate dental students from Alexandria and MSA universities were seen to use social media for educational purposes significantly more than UK universities. This could be because of the high number of dental students at the Egyptian universities (Alexandria: n=2443 and MSA: n=2107) compared to UK universities (UPDA: n=470 and Kings` College London: n=180). The interviewed students from the Egyptian universities reported that the high number of dental students in each level had a direct association with their need to use social media platforms to supplement classroom learning. For example, some students struggled with practical demonstrations being unclear at the universities because of the high number of students watching these demonstrations at the same time. This motivated the students to look at practical demonstrations published on YouTube as an alternative to the on-campus demonstrations. Some of these educational videos were published by some dental teachers from the same university or other universities, and dental students shared these videos
amongst themselves through social media platforms such as Facebook, WhatsApp, or Telegram. Also, the high number of dental students attending classroom lectures pushed some dental students to not attend these lectures and depended more on lecture summaries produced by their colleagues who then shared these through the social media groups. In addition, dental students at Alexandria university did not have university email. So, they used social media platforms as an alternative to the university email for communication.

Participating dental teachers from MSA and Pharos universities used social media for educational purposes significantly more than teachers in the UK universities. The semi-structured interviews with dental teachers in the UK universities revealed that they preferred to keep communication between them formal in order to preserve the professional boundaries between them and their students. Additionally, they wanted to keep their social media use private and separate from their professional work. They believed that Emails were the best method for formal communication either between them and their fellow teachers or between them and their students. On the other hand, the Egyptian dental teachers did not mind engaging with their students through the different social media groups and pages. This could be because all of the interviewed Egyptian dental teachers were relatively younger than the UK teachers.

6.6 Motivations behind using social media in dental education

6.6.1 Flexible accessibility

Some students and teachers reported the value they gained from being able to access their social media platforms at a time and place that suited their needs. This flexibility gave students and teachers more choice and control over when and where they accessed information. Some participants appreciated the ability to carry on learning outside of the traditional classroom hours as they could tailor the educational process to fit their personal life. This allowed students to learn in their own space and time. Additionally, it gave the students the opportunity to ask questions at any time and gave the teachers the chance to respond to these questions whenever they wanted without adhering to the official working hours. A systematic review (O’Connor et al., 2018) about the use of social media in nursing education also highlighted the value of accessibility of social media as a motivation for engagement of nursing students with social media for educational purposes.

The ubiquitous ownership of smartphones allowed dental students and teachers to access their social media accounts from anywhere whenever they have internet access. Sen et al. (2016) reported that 93.2% of undergraduate dental students (n=500) owned smartphones, and they used them for discussing their work with their colleagues (n= 455, 91%), listening to
instructional audios on the Internet (n=440, 88%), reading or sharing educational articles with their colleagues (n=440, 88%), discussing cases on social media groups (n=391, 87.2%) or sharing videos of their work on social media groups (n=304, 60.8%). A study investigated the use of smartphones for learning purposes by Australian dental students revealed that 73.6% of participants accessed social media using their smartphones (Rung, Warnke and Mattheos, 2014). The same study showed that dental students used social media applications on their smartphones to look for course timetables, course announcements, sharing educational materials, taking photographs of their work, communicating with their staff and colleagues. These findings were supported by another study (Villanti et al., 2017) that was conducted in the USA between 2014-2016 to assess how young adults (18-24 years) access their social media platforms. The results of that study revealed that, 87% of the participating young adults (n=2248) reported using smart phones with Internet access, 74% a PC or laptop computer with Internet access, 41% a tablet with Internet access, 29% a smart TV or video game console with Internet access. In a flipped classroom experience (Seo et al., 2018), around 70% of the participating dental students at a dental school in Korea used their smartphones to watch micro lectures on YouTube before the classroom lectures.

Similar findings were found by Jabali et al. (2019) who explored medical faculty members about using smartphones as an educational tool. Most of the participating medical faculty staff agreed that smartphones allowed for easier access of information anywhere and anytime through webpages and social media. However, the ubiquitous nature of smartphones could be a disruption. Rung, Warnke and Mattheos (2014,) found that around half of the dental students used their smartphones inside the lecture room regularly and often for non-educational reasons. In the same way, Jabali et al. (2019) found that some medical teachers believed that using smart phones inside classrooms could be a source of distraction to their students, and few teachers completely banned using smartphones by medical students inside lecture rooms.

6.6.2 Supplement classroom learning

Social media were described by the participating dental students and their teachers as supplementary learning and teaching tools as they eased communication, collaboration, and the sharing of educational materials among the participants. Also, they were used as sources of information, and for interaction with other dental professionals. Most of the participating students from Alexandria and Pharos universities either agreed or strongly agreed that social media can successfully supplement classroom learning, whilst the participants from MSA and UK universities showed either agreement or neutral perceptions toward the same belief. This could be because UK universities used “Moodle” and MSA used “Elearning” as supplementary
platforms, where teachers add and share educational materials with their students. Additionally, most of the participating dental teachers either agreed or strongly agreed with the belief that social media can successfully supplement classroom teaching.

These results correspond with those of Arnett, Christensen and Nelson (2014) who assessed the use of social media by dental students in Loma University, USA. The authors suggested that posting educational articles, questions, quizzes, and clinical pictures might enhance the classroom experience. Additionally, course-related information and announcements posted on social media websites were found to be more likely read by the students than those posted on the university email (Arnett, Christensen and Nelson, 2014). Another study conducted by Lee and Gould (2014) who used Twitter as a supplementary tool for the delivery of an anatomical course, revealed that 67% of second year dental students reported that they felt that the course related tweets helped them to prepare for the final examination. Additionally, the overall grades were enhanced after integrating Twitter in the teaching of the anatomical course.

The results of this study were supported by another study conducted by Souza et al. (2019) who evaluated dental student (n=371) perceptions about the inclusion of three social media platforms (Facebook, WhatsApp, and Instagram) as learning tools for teaching infection control. Adoption of social media as virtual learning platforms for infection control in dentistry were 98.3% (n=294) for Facebook, 100% (n=298) for WhatsApp, and 90% (n=269) for Instagram. 99% of the participants considered Facebook to be a helpful tool in the subject studied with the greatest practical utility being easy access to didactic material published in the virtual page of the discipline. The use of WhatsApp as a teaching aid was reported by the participants to be useful for all interviewees and the most frequently reported practical use was for obtaining information about the discipline quickly (clarification of doubts, receiving messages) (n=181, 64.3%). Other positive aspects were the ease of communication with teachers (n=114, 38.1%).

6.6.3 Collaborative learning

Social media were reported by the dental students as tools that aided their collaboration and communication either between themselves or with their teachers. Most of the participating students from the five universities strongly agreed with the belief that social media were useful to help them with communication with their fellow colleagues. The interviews revealed that dental students used platforms like WhatsApp, Facebook, and Telegram for communication and collaborative academic purposes. They created WhatsApp groups, Facebook groups or pages or Telegram channels for informal communication purposes. Through these platforms,
the students were able to share educational materials (PDF documents, educational videos, lists of questions and answers, or educational diagrams), conduct discussions, sharing patients’ enquiries, or express their doubts, with each other.

According to a study conducted by Sen et al. (2016) most of the dental students (n=500) used various social media platforms to conduct discussions with their colleagues (91%) or shared announcements (83.8%), educational links (78.2%), educational articles (88%), instructional videos (87.4%), work videos (60.8%) or uploaded photographs of their work (75%). The value of social media as communication tools among dental students were also highlighted by Masood et al. (2017) who assessed the efficacy of social media as tools of learning by medical students in the University of the Punjab, Lahore. The results of this study revealed that 87.5% (n=350) of the participants believed that social media helped them to communicate with their colleagues for academic tasks, 77.5% (n=310) believed that social media offered an open forum for academic sharing, and 80.25% (n=321) believed that sharing educational materials were easier through social media platforms.

Social media provided an opportunity for interaction among the learners. This interaction creates a chance for the evolution of knowledge (Schrader, 2018). According to the theory of social constructivism, knowledge is constructed through social interactions with others (Vygotsky, 1962). The cognitive budgeting process that adds new experiences into an individual’s knowledge system, or the social and cultural allocation of new skills, develops through opportunities of interaction in social media via the Internet or via computer and / or mobile technologies (Gehlbach, 2010). Knowledge construction occurs through group activities, community engagement, discussions, and communication in a community of shared activity. All of these activities were reported by undergraduate dental students to be applied through many social media platforms. Students’ groups on social media offered a helpful forum to allow for active, collaborative, and student-centred learning. Students learn to both think and explore within and outside of their own perspective or mindset (Schrader, 2018).

Integrating social media into dental education allowed learning to become a more social process, because it has become user-generated and collaborative (Whyte and Hennessy, 2017). Through social media (WhatsApp, Facebook, Twitter, Telegram, etc.) groups and pages, students become able to build their own knowledge from people with more expertise than themselves. Those people could be teachers, peers, or other experts from anywhere (Hennessy et al., 2016; Whyte and Hennessy, 2017). Flynn, Jalali and Moreau (2015) argued that this active process of understanding through interactions with others was vital for the
students’ development and learning. Many studies found a positive relationship between integrating social media in dental education and examination results (Alshiekhly et al., 2015; Gonzalez and Gadbury-Amyot, 2016; Kazi, Saxena and VineetVinay, 2016; Indu, Cherian and Kandoul, 2018; Souza et al., 2019).

The quantitative results of this study have shown that some students felt the comfort to participate in the learning process through social media more than inside classroom settings. These findings agreed with those of Kazi, Saxena and VineetVinay (2016) who used Facebook as a teaching method for microbiology for second year dental students. They found that the dental students felt comfortable when Facebook was used for the course teaching. Additionally, 95% were satisfied with using Facebook as a didactic tool.

In traditional classrooms, attention must be paid to those who are less outspoken, who may be bullied, shy, less popular, or less socially active, those who are not involved and others who are excluded. Interpersonal skills are important components for learning as are social and cultural adjustments and can be allocated through the use of social media. These skills include social compliance, cooperation, and the development of positive and effective relationships (Gehlbach, 2010). Students with less developed social skills or who possess socially unacceptable or embarrassing interpersonal skills and are less socially included face challenges inside the classroom, may view colleges more negatively, have lower achievement goals, and may frustrate their teachers and friends (Raver, Garner and Smith-Donald, 2007; Shin and Ryan, 2014; Schrader, 2018). Thus, through the technology of social media, classrooms become wider, and participation becomes more equal. Everyone has equal opportunities (if they have the technology) to participate (Schrader, 2018). The stunning display of social media connects with transcending the boundaries of the classroom and the social components of new media use. Additionally, having a level of anonymity online meant that some students might be more comfortable to engage with their peers and faculty, as it removed a level of anxiety felt in traditional classrooms (O’Connor et al., 2018). The use of social media has created new and larger communities of learners, reaching a wide spectrum and more diverse collaborators in the learning process. This may include those with physical and cognitive disabilities and a large number of personalities and interaction patterns (Schrader, 2018).

Utilising social media, engages all participants in the educational process to share activities in synchronous or asynchronous virtual time and space. Social interaction processes and products that appear in digital shapes and spaces can be grouped together
to create confluence. This confluence of learning promotes more creative, accurate, inclusive learning than would otherwise have happened, without the ability of social media to bring together a variety of mental mindsets into group activities, thus providing ample opportunities for learning as well as shifts in the cognitive perspective about the nature of knowledge creation itself. It is this type of learning that is characterized by both pedagogical interaction and paradigm changes at the same time - both for individuals and in the field of education (Schrader, 2018). On the other hand, a study conducted by Ebrahimpour et al. (2016) found that most of undergraduate medical students (n=1000) in 7 universities in Tehran believed that social media had no significant effect on the educational process. Ebrahimpour et al. (2016, p,136) argued that the reason behind that was that "the universities and educational institutes did not take the application of the social networks serious affairs in education”.

6.6.4 Sense of community
Social media facilitated bringing groups of students and teachers together leading to a strong sense of community, which, accordingly, increased interactivity of the students (Jaffar, 2014; Hennessy et al., 2016; Whyte and Hennessy, 2017). Hennessy et al. (2016) elucidated how Twitter helped medical students to express their emotions and to receive encouragement from each other and from their teachers during a neuroanatomy course. Expressing students’ anxiety and stress was done by posting photos on Twitter that represented their emotions. The emotions shared between students seemed to act as a coping mechanism that they used for motivation to continue their learning activities (Hennessy et al., 2016).

6.6.5 Community of practice
The traditional community of practice (CoP) was based on face-to-face communication amongst groups who have the same interest and profession, providing a social context for learning (Lave and Wenger, 1991). Learning in a CoP is a collaborative, active, and a social process (Farnsworth, Kleanthous and Wenger-Trainner, 2016; Pyrko, Dörfler and Eden, 2017). As groups interact, they develop a social identity where common ideas, knowledge, concepts, language, and other social tools become communal properties and end results of the members of that community (Barton and Tusting, 2005; Machles, Bonkemeyer and Mcmichael, 2010; Thoma et al., 2018). The results of this study found that social media allowed for learning through a virtual community of practice (vCOP) (Thoma et al., 2018). A virtual CoP shares the same characteristics as the traditional CoP, but their members interact mainly in a virtual environment using online communication technologies (Dubé, Bourhis and Jacob, 2005). As social media becomes popular, online vCoP started to expand in various fields, including dental education. Social media tools offered an opportunity for the learners and professionals
to conduct debates, discussions of clinical issues, share opinions and get recommendations and advice among the community members (Thoma et al., 2018).

Duncan et al. (2013) explored the impact of using Facebook in higher education courses on developing a community of practice and how it affects students’ sense of classroom community. The authors revealed that incorporating Facebook into a course’s instructional design enhanced students’ collaboration and interaction. This most likely is due to the nature of Web 2.0 technology. It was found that students were able to engage in group discussions and communicate with classmates in their Facebook group. They were also able to find and share educational materials and to promote the sharing of knowledge. The authors concluded that Facebook improved a CoP that was supplementing to both teaching and learning.

6.6.6 The role of social media to support students during the COVID-19 pandemic

Due to the COVID-19 pandemic, dental educators in many dental institutions around the world started to utilise an online learning approach instead of the in-classroom approach. This was to eliminate the spread of the pandemic. This approach led to some limitations in the in-person communication among the students themselves and between the students and their teachers (Cao et al., 2020; Rajeh et al., 2020).

The qualitative results of this study revealed that social media helped the students to stay connected and to support each other emotionally during the COVID-19 pandemic. Through social media groups, the students were able to express their doubts and fears regarding continuing the educational process at their universities after lockdown was applied by the different governments. Social media helped the students not to feel alone during these hard times. The dental teachers also valued social media as a means for connection with their students, to send information and to assure them at the beginning of and throughout the pandemic. Medicine (2020, p.1) argued that “digital technologies can overcome the social distancing constraints during mass quarantine and provide mental health support resources and solidarity with those persons in a lock-down situation”. However, these results did not agree with those of other studies (Ahmad and Murad, 2020; Id et al., 2020) that found a direct relation between the feeling of anxiety and the use of social media by adults aged between 18-30 years old. This could be because social media were used to spread news and information about the pandemic and the subsequent lockdown. This led to the spread of panic and fear amongst individuals with the continuous news which were not all correct. This is one of the drawbacks of social media as they allow anyone to publish any news regardless of their accuracy (Whyte and Hennessy, 2017; Medicine, 2020).
6.6.7 Student centred learning

Positive students’ learning experiences displayed in the findings of this study confirmed the possible incorporation of social media to facilitate effective teaching and learning through interactions (Cheng et al., 2016). Many studies (Tangney, 2014; Cheng et al., 2016; Kazi, Saxena and VineetVinay, 2016; O’Connor et al., 2018; Aldallal, Yates and Ajrash, 2019) highlighted the value of learning through social media in supporting a student-centred learning approach. In a study conducted by Kazi, Saxena and VineetVinay (2016) all the participating dental students reported their ability to use Facebook to learn on their own. Another study conducted by Aldallal, Yates and Ajrash (2019) revealed that 90% of the dental students used YouTube videos to learn practical oral surgery procedures themselves.

6.6.8 Communication between dental teachers and their students

Most of the participating dental teachers in this study believed that social media were useful for communication with their students. Some teachers reported their engagement with students in their social media groups, to answer their questions or to clarify any unclear issues. This is because of the fast way of communication and feedback from the lecturers to their students. Additionally, social media allows teachers to send information to many of the students instead of sending individual emails to each of them (Whyte and Hennessy, 2017). Ekarattanawong and Thuppia (2015) found that questions that were answered by the lecturer over social media were more valued by medical students than those they receive inside the classroom. These results were supported by another study conducted by Rajeh et al. (2020) who found that more than 75% of dental teachers (n=380) in three Saudi universities, either strongly agreed or agreed that social media facilitated communication with their students, speeded up feedback and the delivery of results and were useful to update their students with the new resources.

Although the value of social media to facilitate communication between the teachers and their students is clear, not all the participating dental teachers in this study adopted this approach for communication. Some of the interviewed dental teachers in this study have highlighted some concerns related to privacy and professionalism which act as barriers that prevented them from using social media for communication with their students. Also, they were concerned regarding the misunderstanding that might happen when they send a message over social media. This misunderstanding could be because communication over social media holds no emotions, and communicators are not able to read the facial
expressions of their audience (El Bialy and Ayoub, 2017; Murumba and Micheni, 2017).

### 6.6.9 Source of information

Most of the students` questionnaire responses from the five dental schools either agreed or strongly agreed that social media were useful to search for information. A number of participating dental students explained how they used social media to search for information during the semi-structured interviews. The participants referred to some platforms like YouTube, Facebook, and Instagram that they used to search for information. These results were supported by another study conducted by Saadeh, Saadeh and Torre (2020) that explored medical and dental students’ perceptions at Jordon university, revealed that around 44% of the participating students (n=856) reported using social media to search for medical information.

YouTube was found to be a helpful educational tool that illustrates clinical and practical techniques in a step-by-step way. Moreover, when the number of students attending a practical demonstration was high, other students would be deprived of clear vision of the demonstration. Under these circumstances YouTube videos could be useful supplementary tools that could help the students to watch what they missed inside the classroom. These findings were supported by another study conducted by Barry et al. (2016) who investigated using social media by undergraduate medical students (n=73) in a medical school in Ireland. The results of this study reported that 78% of the participants used YouTube as their primary source of anatomy-related video clips and the same percentage found them either useful or extremely useful for anatomy learning. Also, Aldallal, Yates and Ajrash (2019) explored the perceptions of fourth and fifth year undergraduate dental students regarding the effectiveness of YouTube as a learning resource for oral surgery. The findings of this study revealed that 90% (n=110) reported that YouTube videos about oral surgery were beneficial. However, the same study revealed that Most students (n = 83, 68%) had not been given any videos on oral surgery by the faculty, and almost a similar proportion studied oral surgery procedures through YouTube.

The interviewed dental students gave some examples of dental topics that were searched through YouTube. These examples were cavity preparation, impression techniques, root canal treatments, removable prostheses, dental morphology, radiology, and physics. Another study (Al-rabab et al., 2019) reported that the most searched dental topics on Facebook by undergraduate dental students (n=135) were cavity preparation, tooth extraction, local anaesthesia injection, implant-related procedures, and crowns and veneers. Most of these topics were practical or clinical topics that need clarification in a step-by-step approach. The
interviewed dental students at this study reported the usefulness of these videos not merely before graduation, but also after graduation. Additionally, they highlighted the advantage of pausing the videos, saving them on their devices and repeating them when necessary. Also, YouTube has a feature that can suggest videos that are relevant to the topic that the users have searched for (Seitz, Orsini and Gringle, 2011; Aldallal, Yates and Ajrash, 2019).

Engagement of dental students with some educational Facebook pages and groups might offer a good opportunity for active learning. These pages or groups allow for scientific negotiations in the form of posts and comments or questions and answers. Moreover, discussions about clinical cases, dental materials, new techniques, x-rays, or differential diagnoses might be conducted through these groups. Also, following Instagram accounts was seen by the participating dental interviewee students as an opportunity for them to get exposed to the recent techniques and dental innovations in the form of one-minute videos or photos with short comments. This was supported by another study conducted by Souza et al. (2019) who evaluated dental students’ perceptions regarding the use of social media in teaching infection control. The study revealed that using Instagram as a didactic resource was considered useful for studying infection control by 94% (n=280) of the participants. The main use of Instagram was having images that helped dental students to assimilate the subject more effectively. However, although popular among students, Instagram has shown little insertion into academic life. According to student perceptions, in a previous study (Smith, 2017), only 22.6% of the interviewed students attributed an important role for their learning in higher education to Instagram. The reasons for using Instagram could be its popularity and student interest, as well as the convenience of using camera phones and the high social aspect of the application (Bell, 2013). Saadeh, Saadeh and Torre (2020) argued that the ease of use and the availability of information could be possible explanations for the preference of the undergraduate medical students to use social media to enquire about information because they were less experienced with informative sources other than social media. Additionally, using social media was habitual and comfortable to many of them.

The majority of participating dental teachers from Alexandria (n=21, 53.8%), MSA (n=76, 69.7%) and Pharos (n=13, 68.4%) universities strongly agreed with the view that social media were useful to search for information. While only 7 (28%) of participating dental teachers from UK universities “strongly agreed” with the same perception. However, using social media by dental teachers to search for information did not mean that they shared this information with their students. This could be because of their concerns regarding the copyright, appropriateness, and the accuracy of this information. Additionally, dental teachers were concerned about the confusion that could be caused to their students when they receive too
much information from different resources, and some of this information could be different from what they received at the university. A study of 221 dental teachers from five North American dental schools found that only 21.4% of the teachers utilised YouTube videos in their lectures, and that around one-third did not think that social media platforms had any educational benefit (Arnett, Loewen and Romito, 2013). Additionally, in the study conducted by Aldallal, Yates and Ajrash (2019) around 40% of the dental students referred to the inconsistency between the YouTube educational content and their lessons. The proportions were higher in another study conducted by Rajeh et al. (2020) who found that 82.17% (n=212) of dental teachers in three Saudi universities used social media to search for information. However, the same study revealed that demonstrators/lecturers (96.97%) used social media more than assistant professors (84.62%) or full professors (76.87%). The authors argued that the COVID-19 pandemic motivated dental teachers to utilize social media to reach out to their students who were using online home-based learning because of the pandemic.

6.7 Concerns regarding using social media in dental education

6.7.1 Quality of information:
Although most of the participants believed in the value of social media as a useful source of information, a few of them expressed their trust in the accuracy of information published on social media. The quantitative findings of this study revealed that most of the participating students and their teachers from the four groups showed either neutral or disagreement perceptions regarding their confidence about the accuracy of information published on social media. These concerns were emphasized at the semi-structured interviews. These results agreed with the study conducted by Arnett, Loewen and Romito (2013) who assessed using social media for educational purposes by faculty members from five dental schools in the United States of America. The authors found that although most of the faculty members watched educational YouTube videos, very few of them previously shared these videos with their students. A systematic review about the role of social media in medical education (Whyte and Hennessy, 2017) highlighted some concerns about the accuracy of information published on social media, because this information was not peer reviewed as in traditional medical journals. Also, Saadeh, Saadeh and Torre (2020) found that 59.3% (n=504) of the participating dental and medical students didn’t believe that social media were trusted sources of information, and only 3.4% (n=29) considered recommendations on social media as a main source for treatment decisions.

A previous study (Jung and Bleckmann, 2010) that evaluated the educational dental videos published on YouTube, described YouTube as “underdeveloped and underestimated” regarding its potential use in dental education. A recent study that was conducted by Al-rabab
et al. (2019) showed that 40.6% of the participating dental students preferred traditional teaching over teaching through Facebook and 51.1% believed that traditional teaching provided evidence-based information. These doubts regarding the accuracy of social media content could be because of the fact that most of the educational content published on social media are personal opinions that could be biased and have no evidence base (Saadeh, Saadeh and Torre, 2020). This means that a lot of social media content could have no scientific background and might include false or unreliable information (Chretien and Kind, 2013).

6.7.2 Privacy

Most of the interviewed dental teachers and a smaller number of the dental students expressed their concerns regarding their privacy when they used social media for academic purposes. Dental teachers did not want their private social media accounts to be exposed to their students. They thought that students might leak their personal information, or misuse information and posts published on their own social media accounts. Also, some of the dental students wanted to keep their private social media accounts separate from their academic life. That is why some of the dental students and their teachers preferred to keep the communication between them through email as they found it more “formal” and more “professional”. Privacy concerns were found in many other studies as the main barriers for not using social media for educational purposes by dental teachers (Arnett, Loewen and Romito, 2013) and undergraduate dental (Arnett, Christensen and Nelson, 2014; Alshiekhly et al., 2015) and medical (Masood et al., 2017) students. Arnett, Christensen and Nelson (2014) found in their study that 12.8% of the participating dental students (n=351) were concerned about blurring the line between their personal and professional lives. Attendees at the American Dental Education Association annual session workshop (year 2012) “Using social media in dental education”, expressed concern about having students as “friends” on Facebook (Arnett, Christensen and Nelson, 2014). Cain and Fink (2010) argued that some ethical issues require a crucial consideration, including who is able to view the information published on social media accounts, how the information could be accessed; the purpose for this information, the criteria that are used to judge the social media information/accounts and the appropriateness of the relationships within social media.

Content privacy control has become a critical issue for users on social media, Fiesler et al. (2017). A range of privacy settings are available in many social media platforms, and these settings can be adjusted to limit information accessibility by others (Kenny and Johnson, 2016). However, previous studies (Madejski, Johnson and Steven, 2012; Sleeper et al., 2013; Hoofnagle and Urban, 2014) have found that privacy setting options were often difficult to understand and apply, by many users. Nevertheless, selective sharing is one strategy for
users searching for ways to better control their online content and identities (Madden, 2012; Vitak and Kim, 2014). The content of many social media platforms has become a mixture of public content and non-public content (selectively shared). This is especially true for sites like Facebook with multi-level privacy settings, allowing the public (which can be seen by anyone) and non-public (can only be viewed by specific people, for example, friends) to cut across the content of users. In addition, accepting a Facebook ‘friend request’ from students to their teachers may blur the boundaries between them. Both teachers and students might have a misunderstanding of how Facebook pages operate and believe, wrongly, that teachers would have to be a Facebook ‘friend’ for an educational process to work, and thus have access to their private information (Arnett, Christensen and Nelson, 2014). For example, when a private group is created on Facebook, users of the group do not automatically have access to the creator’s or colleagues’ personal account information. Students can adjust privacy settings to limit the amount of personal information accessed by their classmates and teachers (Arnett, Christensen and Nelson, 2014).

Kenny and Johnson (2016) found that many undergraduate dental students might feel more secure if they can conduct discussions in closed groups (with security settings to limit access to discussions) and a small number felt this to be acceptable in open groups. This feeling of safety in closed groups may increase the amount of information disclosed and shared. However, there are also risks to privacy from information storage locations and the ability to screenshot any information posted online. This means that online content is available and can still be shared despite security settings. Other platforms like Instagram or Twitter, users have a single privacy setting. So, users have to set their settings for their accounts to be either public or non-public, accessible. A better understanding of the privacy settings on each social media platform could provide a secure, comfortable, and appropriate usage of social media (Fiesler et al., 2017).

6.7.3 Professionalism

A number of undergraduate dental students expressed their concerns regarding the unprofessional behaviour of other students on social media. Some students complained from the off-topic discussions they might find through student groups on social media. In addition, some negative comments on certain subjects or topics might have a negative impact on other students before learning these subjects. Some students might feel anxious before studying a certain topic, if they heard from others on the social media groups that this topic is difficult. These behaviours could be reasons behind the rejection by some students to interact on social media groups. Interestingly, the students were aware of some unprofessional behaviour such as posting patient photographs on social media without getting patient consent, hate speeches
or bullying posts or comments. These findings were supported by Brisson et al. (2015) who found that two thirds of medical students had noticed unprofessional material on their peers’ social media profiles. In a study conducted by Henry and Pieren (2014) most of the dental hygiene directors (n=146, 96.7%) in USA indicated that their program had a code of professionalism policy for students while only 55 (36.2%) had a policy that specifically addresses the use of social media. However, violations of these policies by dental students were also reported. These violations were found in form of unprofessional comments about the staff, university, or colleagues.

A study conducted by Kenny and Johnson (2016) revealed that 53% (n=82) of undergraduate dental students in Cardiff University were concerned about the unprofessional posts by other students on social media. In addition, 35% (n=54) were not aware of the General Dental Council (GDC) guidance on the unprofessional use of social media in the UK. The GDC has set out guidance for the appropriate use of social media and digital professionalism applies to all dental professionals (General Dental Council, 2016). Making negative comments in relation to individuals’ characteristics, are considered inconsistent with equality legislation and the GDC standards. Likewise, discussing patients or staff in open or closed groups without consent or full anonymity would be widely considered as inappropriate for professionals (General Dental Council, 2016). Recognizing these guidelines that determine the professional and unprofessional behaviours on social media by dental professionals is crucial. Dental students are at risk of adopting some unprofessional behaviours only because they are widespread or to develop a way of maintaining anonymity and safety regarding inappropriate attitudes because they see others doing the same actions (Greysen, Kind and Chretien, 2010; McCartney, 2012).

The online environment is continuously changing with no well-structured regulations, and the potential for social media use to backfire is ever present (Whyte and Hennessy, 2017). Whyte and Hennessy (2017) conducted a systematic review about the use of social media in medical education, and recognized many studies (Raikos and Waidyasekara, 2013; Gooi et al., 2014; Chretien et al., 2015; Parsi and Elster, 2015; Hennessy et al., 2016) that highlighted some unprofessional behaviour of medical students on social media. These included privacy and confidentiality violations and inappropriate relationships with patients. Privacy and confidentiality of patients must be maintained, as preserving patients’ trust is crucial to their care (Parsi and Elster, 2015). It is the educators’ responsibility to integrate ethics and professionalism into their teaching (Brisson et al., 2015).
6.7.4 Distractive nature of social media:
Some of the interviewed students and their teachers in this study described social media as
distractive tools. The off-topic discussions, such as watching the advertisements, playing
games, watching the entertaining videos and online shopping were the most distractive
activities outside the classroom that were reported by the participating dental students. While
dental teachers were concerned about how much time is spent on social media by dental
students for non-educational purposes. It is possible for users to become obsessive and
thereby remain continuously connected all the time and checking their social media profiles
excessively. Halboub et al. (2016) revealed that 65.8% of dental students (n=348) in Jazan
university (in Saudi Arabia) reported using social media during the lectures. 64.7% believed
that their Grade Point Average (GPA) would be improved if they reduced using social media.
Additionally, most of the participating dental students mentioned that the number of days
devoted for studying was affected negatively by using social media.

Cherian and Kandoul (2018) reported that one of the main disadvantages of using WhatsApp
for learning amongst dental students was the off-topic discussions on the WhatsApp groups.
Also, Al-rabab et al. (2019) found that 25.2% of the participating dental students (n=135)
believed that searching Facebook pages for dental information was distractive and time
consuming. On the other hand, Weiler et al. (2015) found that the main reasons behind using
social media by pharmacy students inside classrooms were getting bored during the lecture
(n=608, 65.3%) followed by catching up with friends and families (n=321, 34.5%). Additionally,
99.5% of the participating students reported watching other students using social media inside
the classroom on a daily basis. However, students disagreed that blocking access to social
media inside the classroom could improve their learning focus ability.

6.8 A new model for the use of social media in dental education
The results of the narrative review (chapter 2), systematic review (chapter 3) and analysis of
the quantitative and qualitative data generated from the questionnaires and semi-structures
interviews, were used to create the ‘Elraggal model’ for using social media in dental
education (Figure 6.1). The model brings together all the various aspects of social media
investigated and illustrates how social media can be most effectively used by undergraduate
dental students and their teachers for educational purpose.

From the model, learning through social media is, mainly, student-centred as it promotes
active, collaborative, social (knowledge construction through social interaction), problem-
based, blended and flipped classroom learning environments. In addition, using social media
as educational tools supports learning approaches. All of these learning environments are
based mainly on the students themselves who apply some learning activities through various social media platforms.

These learning activities include using social media for students’ collaboration (this includes group projects, sharing educational materials, questions, and answers, etc.), as an information resource allowing the students to learn about dental skills, practical procedures, dental materials, and cases’ diagnosis and management. Also, dental students are able to network with other dental professionals through different social media platforms. Networking with other dental professionals allow the students to learn new dental materials, skills, techniques, and treatment approaches.
Figure 6.1 The ‘Elraggal model’ for using social media in dental education
6.9 Limitations

- The research reported in this thesis was conducted in only 5 dental schools and in only two different countries (UK and Egypt). It is not clear to what extent the observations made would be similar in other dental schools and indeed in other countries. Although there are clear cultural differences between Egypt and the UK, there are also many similarities in university education since the Egyptian schools often adopt an Anglo-American approach in their pedagogical practices.

- With educational research, a good and appropriate response rate and sample size for both the questionnaires and semi-structured interviews are often difficult to determine and this is why a mixed methods approach is taken to allow further in-depth investigation. This triangulation approach is used to increase the credibility and validity of the research findings.

- Unfortunately, the global COVID-19 pandemic occurred in the middle of the research. The quantitative study was conducted pre-pandemic, whilst the qualitative study was conducted throughout the pandemic. This might have affected the results generated from the semi-structured interviews, as the participants might have been influenced by the pandemic and the significant increase in online learning.

- There were some misunderstandings from the research participants regarding what platforms they could consider as social media. The absence of a clearly stated definition given to the participants at the beginning of the study led to some conflict with analysis of the results from the quantitative research. For example, some respondents considered Email to be social media, and completed the questionnaire based on this consideration.

- The social media platforms that were mainly included in this research were Facebook, WhatsApp, Telegram, Instagram, YouTube, and Twitter. These were the main social media platforms used in the UK and Egypt. Other countries might use other platforms, and the results and observations from this study may not be applicable to all countries.

6.10 Recommendations for future research

- Social media platforms are increasing in number and scope. In addition, there are ever present and changing contentious concerns with the use of social media. A systematic approach to reviewing the literature on a regular basis is required to ensure an updated evidence base to support their use in dental education.
This research was conducted in five dental schools from two countries (UK and Egypt). Further research is required to study the use of social media in dental education in other countries. It would be interesting to see if there are variations in countries where there may be greater cultural and educational differences compared to the 2 countries studied here.

The nature of qualitative studies where there is a degree of subjectivity in the responses of the participants is such that potential shortcomings are often identified after a period of reflection on completion of these studies. Under these circumstances there is scope for further investigation of the views and perceptions of the users of social media in dental education.

The research reported in this thesis focussed on the use of social media by undergraduate students and their teachers. It would be interesting to see what the similarities or differences are for postgraduate dental students and their teachers.

The study reported here focussed primarily on the subjective views, opinions and perceptions of dental students and their teachers regarding the role of social media in dental education. In order to investigate the influence of social media on other variables such as the grades achieved by the students, a more objective randomised and controlled approach is required. Unfortunately, such approaches are often difficult to use in educational research and it is unethical to treat students differently with their education.

It would be interesting to investigate the value and validity of the Elraggal model, with its recommended considerations required to get the best out of social media for educational purposes, in other dental schools, other countries outside of Egypt and the UK, in postgraduate dental education and in other professions.

COVID-19 pandemic took place incidentally in the middle of this thesis. Further investigations are required to assess the role of social media in dental education during the pandemic.
Conclusion
7 Conclusion

Adoption or rejection of utilising social media in learning or teaching is based on a variety of factors, such as the age and the motivation of individuals to implement the new technology. Young teachers were seen to be engaged with their students through social media more than older teachers.

7.1 Definition of social media

One of the issues with social media is how it is defined. The research reported in this thesis has allowed the author to produce the following ‘bespoke’ definition for social media as a result of feedback from the participating dental students and their teachers: ‘Internet-based platforms that allow for online informal communication, interaction and sharing of online materials such as photographs, videos, and documents’. This definition is distinct from other definitions in that it has added the informal nature of social media as indicated by the research participants.

7.2 Social media platforms used for educational purposes

Facebook, Twitter, YouTube, Instagram, WhatsApp, and Telegram were the most often used social media platforms by dental students or their teachers, for educational purposes. Each platform varies in how it can be used in dental education. Facebook closed groups are useful for communication, interaction, and the sharing of educational materials amongst the students themselves or with their teachers. Also, they are useful for teaching some topics using a problem-based learning approach, as they allow dental teachers to post a problem, question or scenario and ask their students to comment with their proposed solutions. Facebook public dental pages are useful for communication and discussion amongst dental professionals around the world. Twitter is useful for teaching some topics through the tweeting of questions or problems, and the students can collaborate to solve these. YouTube is very helpful for learning about practical dental topics that require the use of video. YouTube can also be used in the flipped classroom approach by asking the students to watch a recommended YouTube video in advance of the lecture. Instagram has the advantage of posting one-minute duration informative videos for practical techniques, operations, or new dental materials. WhatsApp is useful for communication among the dental students or with their teachers. Also, it allows the participants to share some educational materials, but it has some limitations in form of the size of data that can be shared. Telegram channels are very useful for sharing educational materials with a large data size. All the above platforms encourage active, collaborative and problem-based learning (Figure 7.1).
Facebook groups and pages allow for student collaboration, sharing educational materials, and questions and answers, networking with other dental professionals and getting information about dental materials and procedures.

WhatsApp groups allow for student collaboration, communication with their fellow students and their teachers, sharing educational materials, and questions and answers.

Twitter accounts allow for problem-based learning. The teachers post a question or dental cases and ask their students to comment with solutions or differential diagnosis.

YouTube videos allow for learning about dental procedures, techniques or materials. These videos could be used by dental teachers for blended learning or flipped classrooms.

Instagram accounts allow for learning about dental materials, procedures, techniques, skills or cases through photos and short videos.

Telegram channels allow for student collaboration, communication with their fellow students and their teachers, sharing questions and answers and educational materials even those having a big size.
### 7.3 Positive aspects of using social media as educational tools

There are many positive reasons why undergraduate dental students, and their teachers should use social media in dental education. These include ease of use, accessibility, free of any costs, and allowing learning in the students own space. There appears to be a direct association between the number of students in a dental school and the need for social media as a supplementary learning tool. This is one explanation why Egyptian dental schools were engaged with learning through social media in more ways than the UK dental schools, as the former have much higher student numbers.

The use of social media by dental students for learning purposes has shifted the educational paradigm to a more student-centred approach where knowledge is socially constructed. This means that the students are given the freedom, space and opportunity to be more proactive and to construct their knowledge through social interaction with their peers within a virtual community of practice.

Social media are potentially useful and effective educational tools that can supplement classroom teaching and encourage the flipped classroom and blended learning approaches. Additionally, social media are useful tools for communication, interaction and sharing educational materials like photographs, videos, and documents either among the students themselves or with their teachers. Also, they provide a medium for educational discussions. Consequently, this encourages student-centred, collaborative, and interactive informal unofficial learning.

Social media facilitated bringing groups of students and teachers together leading to a strong sense of community. Using social networking sites in the learning process could encourage shy students to participate through social media groups as they remove the anxiety and stress felt by some inside traditional classrooms. Social media played an important role to support undergraduate dental students throughout the COVID-19 pandemic. Social media groups were useful for the students to be able to express their doubts and fears during various government directed lockdowns. Also, they were a useful medium for the students to remain connected with their universities.

Social media are potentially useful tools to search for information. Using social media in learning helps participants to retain and then recall information when required. However, there are some concerns regarding the quality of information published on social media. That is why it is highly recommended to engage students with social media under the supervision and guidance of their teachers, in order to ensure they receive accurate and evidence-based
information. Also, it is the teachers’ responsibility to protect their students from possible confusion resulting from multiple sources of information. Also, it is necessary to make sure that what the students learn from social media is compatible and in agreement with what they are taught inside the dental school.

Social media provide an opportunity for dental students and their teachers to be connected with other dental professionals through social media groups and pages relevant to dentistry. This exposes the students and their teachers to different techniques or materials adopted in different countries or other dental schools. Also, it is an opportunity for dental professionals to discuss clinical, laboratory or radiographic cases, and for the students to learn from these discussions.

7.4 Negative aspects of using social media as educational tools
The main barriers cited for partial or complete rejection of the use of social media in dental education were privacy and professionalism concerns. Guidelines produced by the General Dental Council in the UK for the professional usage of social media can be used to address these barriers. Additionally, both undergraduate dental students and their teachers should be aware and well trained for the professional use of social media. Moreover, training and the provision of equipment and technical facilities (such as internet, laptops, tablets, or smartphones) to and for both the students and teachers are required to facilitate access to and use of social media platforms.

Social media could be distractive. This is because of the nature of social media that includes many non-educational materials such as games, entertainment videos, chatting with friends, or advertisements. Distraction can also take place within the social media groups through the off-topic discussions. The students and teachers should be aware about the distractive nature of social media in order not to negatively affect the learning process.

7.5 Recommendations for educational practice
Social media should be used as a way to extend learning outside the classroom. Dental students could create their own social media groups on Facebook, WhatsApp, Telegram, etc., where they would be able to communicate, collaborate and share their thoughts. This would help the learning process to be more student-centred, collaborative, and socially constructive. Additionally, it would allow the students to learn from each other, especially for those students who may be shy or less forthcoming and who feel more anxious to participate inside the classroom. Also, these social media groups could allow the students to cooperate more with each other and with their teachers in their clinical education. This could include sharing of information and good practice under the guidance of their teachers.
Dental teachers should utilise social media (Facebook, WhatsApp, Telegram, Twitter, etc.) much more to make the learning process more active. This could happen by creating social media groups specific to each topic within the student curriculum. Through these groups, dental teachers could post questions or problems and ask their students to respond in the form of comments. Additionally, these groups could be used for announcements, or sharing educational materials (documents, PDF, PowerPoint presentations, Videos, Photographs, etc.) with their students. These groups could also be useful for the students after graduation if they needed to recall any information. With their potential of enhanced communication, these social media platforms could be of value to both future students and those who have graduated.

The use of social media by dental students as sources of information for their education should always be applied under the guidance, supervision and recommendation of their teachers.

The Elraggal model could be used by dental schools as a guide for how to use social media in dental education, so that all aspects (including both the positive and negative) are considered for the most effective implementation of this technology.

Dental councils and dental schools should produce and effectively apply guidelines for the professional use of social media. Dental students and their teachers inside UK are fortunate to have access to such guidance generated by the General Dental Council. Dental students and their teachers outside UK, should similarly follow the guidelines put in place by their Dental Councils and where they do not exist, their development by the Dental Councils in their countries should be encouraged.

7.6 The role of social media in dental education during the COVID-19 pandemic

Social media helped to bring the students together and with their teachers during the COVID-19 pandemic. They helped the students to interact with each other, to ask questions and express their concerns, fears, and doubts, to get information and updates about the pandemic and its educational consequences, to increase their awareness about the new infection control measures to combat the new virus, and they provided the dental students with a virtual sense of community during the pandemic. However, further investigations are needed in the future to assess the role of social media in dental education during the pandemic and the subsequent lock down and adoption of remote learning.

7.7 Elraggal model for using social media in dental education

The research within this thesis has also allowed the author to put forward the ‘Elraggal model’ for using social media in dental education by undergraduate dental and dental care
professional students, and their teachers. The model highlights the uses, and the positive aspects regarding the use of social media for educational purposes.

This research was conducted in five dental schools from two countries (UK and Egypt). Further studies are needed in other dental schools from other countries to further investigate the uses of social media in dental education.

7.8 A summary of information that meets the research objectives and questions.

A. Definition of social media: Internet-based platforms that allow for online informal communication, interaction and sharing of online materials such as photographs, videos, and documents.

B. Social media platforms used for dental education: Facebook, WhatsApp, Twitter, Instagram, Telegram, YouTube

C. Students` uses of social media in dental education:
   - Student-centred learning.
   - Collaborative learning: communication, interaction, sharing educational materials, asking questions, problem solving and getting answers.
   - Communication with teachers.
   - Source of information.
   - Networking with other dental professionals.

D. Teachers` uses of social media in dental education
   - Blended learning.
   - Flipped classroom.
   - Communication with their students.
   - Communication with their colleagues.
   - Networking with other dental professionals.
   - Sense of community.

E. Positive aspects:
   - Accessibility.
• Ease of use.
• Free of any costs.
• Fast way of communication.
• Allow learning at your own pace, space, and time.

F. **Negative aspects:**
• Privacy concerns.
• Professionalism concerns.
• Concerns about the quality of information.
• Confusion because of the overload of different information.
• Limited interaction.
• Distractive.
• The need for: technical facilities, motivation, and training.
8 References


pp.176-180.


Cheng, I. N. et al. (2016) ‘Effectiveness and obstacle of using Facebook as a tool to facilitate student-centred learning in higher education. In Asia-Pacific Forum on Science Learning and Teaching.’, The Education University of Hong Kong, Department of Science and Environmental Studies., 17(2) pp. 1–14.


Geirdal, A. Ø. et al. (2021) ‘Mental health, quality of life, wellbeing, loneliness and use of social


Higgins, J. and Green, S. (2008) ‘Defining the review question and developing criteria for
including studies.’, In Cochrane handbook for systematic reviews of interventions, 1, p. 83.


effective use of learning technologies. Routledge.


Selwyn, N. (2007) ‘Web 2.0 applications as alternative environments for informal learning-A


technology fuelling academic dishonesty?. Active learning in higher education, 5(2) pp.180-199.


Voorn, R. (2012) ‘Literature review on what opportunities and challenges online social networks have to offer to the marketing communications efforts of brands’, Unpublished Literature’, Study Pre-master Program Communication Science, University of Twente, Enschede, The Netherlands.


Appendices
## 9 Appendices

### Appendix 1 PRISMA check list

<table>
<thead>
<tr>
<th>Section/topic</th>
<th>#</th>
<th>Checklist Item</th>
<th>Reported on page#</th>
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<tbody>
<tr>
<td><strong>TITLE</strong></td>
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</tr>
<tr>
<td>Title</td>
<td>1</td>
<td>Identify the report as a systematic review, meta-analysis, or both.</td>
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<tr>
<td><strong>ABSTRACT</strong></td>
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<tr>
<td>Structured summary</td>
<td>2</td>
<td>Provide a structured summary including, as applicable: background, objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.</td>
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<tr>
<td><strong>INTRODUCTION</strong></td>
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<tr>
<td>Rationale</td>
<td>3</td>
<td>Describe the rationale for the review in the context of what is already known.</td>
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<tr>
<td>Objectives</td>
<td>4</td>
<td>Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).</td>
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<tr>
<td><strong>METHODS</strong></td>
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<td>Protocol and registration</td>
<td>5</td>
<td>Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.</td>
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<tr>
<td>Eligibility criteria</td>
<td>6</td>
<td>Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.</td>
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<tr>
<td>Information sources</td>
<td>7</td>
<td>Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.</td>
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<tr>
<td>Search</td>
<td>8</td>
<td>Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.</td>
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<tr>
<td>Study selection</td>
<td>9</td>
<td>State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).</td>
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<tr>
<td>Data collection process</td>
<td>10</td>
<td>Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.</td>
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<tr>
<td>Data items</td>
<td>11</td>
<td>List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.</td>
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<tr>
<td>Risk of bias in individual studies</td>
<td>12</td>
<td>Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.</td>
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<tr>
<td>Summary measures</td>
<td>13</td>
<td>State the principal summary measures (e.g., risk ratio, difference in means).</td>
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<tr>
<td>Synthesis of results</td>
<td>14</td>
<td>Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., IT for each meta-analysis).</td>
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<tr>
<td>Risk of bias across studies</td>
<td>15</td>
<td>Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).</td>
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<tr>
<td>Additional analyses</td>
<td>16</td>
<td>Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.</td>
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<tr>
<td><strong>RESULTS</strong></td>
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<tr>
<td>Study selection</td>
<td>17</td>
<td>Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.</td>
<td></td>
</tr>
<tr>
<td>Study characteristics</td>
<td>18</td>
<td>For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.</td>
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</tr>
<tr>
<td>Risk of bias within studies</td>
<td>19</td>
<td>Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).</td>
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</tr>
<tr>
<td>Results of individual studies</td>
<td>20</td>
<td>For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group; (b) effect estimates and confidence intervals, ideally with a forest plot.</td>
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<tr>
<td>Synthesis of results</td>
<td>21</td>
<td>Present results of each meta-analysis done, including confidence intervals and measures of consistency.</td>
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<tr>
<td>Risk of bias across studies</td>
<td>22</td>
<td>Present results of any assessment of risk of bias across studies (see item 15).</td>
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<tr>
<td>Additional analysis</td>
<td>23</td>
<td>Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see item 16]).</td>
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<tr>
<td><strong>DISCUSSION</strong></td>
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<tr>
<td>Summary of evidence</td>
<td>24</td>
<td>Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).</td>
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<tr>
<td>Limitations</td>
<td>25</td>
<td>Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).</td>
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<tr>
<td>Conclusions</td>
<td>20</td>
<td>Provide a general interpretation of the results in the context of other evidence, and implications for future research.</td>
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<tr>
<td><strong>FUNDING</strong></td>
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<tr>
<td>Funding</td>
<td>27</td>
<td>Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.</td>
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</table>
## Appendix 2 Version (2018) MMAT checklist

<table>
<thead>
<tr>
<th>Category of study design</th>
<th>Methodological quality criteria</th>
<th>Responses</th>
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</thead>
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<tr>
<td>Screening questions (for all types)</td>
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<td>1. Quantitative</td>
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<tr>
<td>1.1. Is the qualitative approach appropriate to answer the research question?</td>
<td>S1. Are there clear research questions?</td>
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<tr>
<td>1.2. Are the qualitative data collection methods adequate to address the research question?</td>
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<td>1.3. Are the findings adequately derived from the data?</td>
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<td>1.4. Is the interpretation of results sufficiently substantiated by data?</td>
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<td>1.5. Is there evidence between qualitative data sources, collection, analysis and interpretation?</td>
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<td>2. Quantitative randomized controlled trials</td>
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<td>2.1. Is randomization appropriately performed?</td>
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<td>2.2. Are the groups comparable at baseline?</td>
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<td>2.3. Are there complete outcome data?</td>
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<td>2.4. Are outcome assessments blinded to the intervention provided?</td>
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<td>2.5. Did the participants adhere to the assigned intervention?</td>
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<td>3. Quantitative non-randomized</td>
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<td>3.1. Are the participants representative of the target population?</td>
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<tr>
<td>3.2. Are measurements appropriate regarding both the outcome and intervention (no exposure)?</td>
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<tr>
<td>3.3. Are there complete outcome data?</td>
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<td>3.4. Are the confounders accounted for in the design and analysis?</td>
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<td>3.5. During the study period, is the intervention administered (or exposure occurred) as intended?</td>
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<td>4. Qualitative descriptive</td>
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<td>4.1. Is the sampling strategy relevant to address the research question?</td>
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<td>4.2. Is the sample representative of the target population?</td>
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<td>4.3. Are the measurements appropriate?</td>
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<tr>
<td>4.4. Is the risk of non-response low?</td>
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<tr>
<td>4.5. Is the statistical analysis appropriate to answer the research question?</td>
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<tr>
<td>5. Mixed methods</td>
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<tr>
<td>5.1. Is there an adequate rationale for using a mixed methods design to address the research question?</td>
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<tr>
<td>5.2. Are the different components of the study effectively integrated to answer the research question?</td>
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<tr>
<td>5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?</td>
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<tr>
<td>5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?</td>
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<tr>
<td>5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?</td>
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</table>

## Appendix 3 Quality appraisal of the included studies in the systematic review

<table>
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<tr>
<th>Study Included, author(s)</th>
<th>Types of mixed methods study components or primary studies</th>
<th>Screening questions and methodological quality criteria</th>
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<th>No</th>
<th>Can’t tell</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Arnett, Loewen and Romito (2013)</td>
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<td>Screening questions</td>
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<tr>
<td>Are there clear research questions?</td>
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<td>Do the collected data allow to address the research questions?</td>
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<td>Quantitative descriptive</td>
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<td>Is the sampling strategy relevant to address the research question?</td>
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<td>Is the sample representative of the target population?</td>
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<td>Convenience sampling</td>
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<td>Convenience sampling with 50% response rate</td>
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<tr>
<td>Arnett, Christensen and Nelson (2014) 60%</td>
<td>Screening questions</td>
<td>Are there clear research questions?</td>
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<td>Undergraduate dental, dental hygiene and resident students</td>
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<td></td>
<td>Do the collected data allow to address the research questions?</td>
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<td>Low response rate (30%) can’t be representative to the population</td>
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<tr>
<td>Quantitative descriptive</td>
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<td>Piloting of the validity and reliability was not mentioned</td>
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<td>Response rate was 30%</td>
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<td>Are the measurements appropriate?</td>
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<td>Frequency counts and descriptive statistics</td>
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<td>Screening questions</td>
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<td>Do the collected data allow to address the research questions?</td>
<td>Quantitative descriptive</td>
<td>Is the sampling strategy relevant to address the research question?</td>
<td>Is the sample representative of the target population?</td>
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<tr>
<td>Lee and Gould (2014) 40%</td>
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<td>Henry and Pieren (2014) 66.6%</td>
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<td>Methods adequate</td>
<td>Are the findings adequately derived from the data?</td>
<td>* Themes and examples of the participants’ perceptions were not mentioned.</td>
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<td>Are the findings</td>
<td>Is the interpretation of results sufficiently substantiated by data?</td>
<td>* Themes and examples of the participants’ perceptions were not mentioned.</td>
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<td>Is the interpretation of</td>
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<td>* The link was not clear.</td>
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<td>results sufficiently</td>
<td>and interpretation?</td>
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<td>Is the sampling</td>
<td>Is the sampling strategy relevant to address the research question?</td>
<td>Dental hygiene directors listed on the American Dental Hygienists’</td>
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<tr>
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<td>Are the measurements</td>
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<td>* Validity and readability were established through a peer review by a</td>
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<td>Is the risk of nonresponse</td>
<td></td>
<td>* Response rate was 48.3%.</td>
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<td>bias low?</td>
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<tr>
<td>Is the statistical analysis</td>
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<td>* Statistical analysis ways were mentioned clearly.</td>
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<td>appropriate to answer the</td>
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<td>*</td>
<td>To address the research question.</td>
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<td>Are the different components of the study effectively integrated to answer the research question?</td>
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<td>Are the outputs of the integration of qualitative and quantitative components adequately interpreted?</td>
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<td>Meta-inference occurred as integration of both quantitative and qualitative approaches added value to the results.</td>
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<tr>
<td>Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?</td>
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<td>No divergences were found</td>
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<tr>
<td>Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?</td>
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</table>

| Alshiekhly et al (2015) 80% | Screening questions | Are there clear research questions? | * |
| Are the collected data allow to address the research questions? | * |

<p>| Quantitative descriptive | Is the sampling strategy relevant to address the research question? | * | The participants were undergraduate dental students |
| Is the sample representative of | * | 47.4% of the population filled |</p>
<table>
<thead>
<tr>
<th>Kenny and Johnson (2016)</th>
<th>Screening questions</th>
<th>Are there clear research questions?</th>
<th>*</th>
<th>Are the measurements appropriate?</th>
<th>*</th>
<th>Descriptive analysis appropriate to answer the research question?</th>
<th>*</th>
<th>47.4% of the population filled the two questionnaires.</th>
<th>100%</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>Descriptive analyses, Wilcoxon signed ranks, Mann-Whitney U-test and Fisher exact test were used.</td>
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<td>Research Questions</td>
<td>Adequacy</td>
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<tr>
<td>Kazi, Saxena and Vineet Vinay (2016)</td>
<td>Screening questions</td>
<td>Are there clear research questions?</td>
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<td>Do the collected data allow to address the research questions?</td>
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<tr>
<td>Quantitative randomized control trial</td>
<td>Is randomization appropriately performed?</td>
<td></td>
<td>All participants had an equal opportunity to participate in the study by assigning a random selection strategy.</td>
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<td>Are the groups comparable at baseline?</td>
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<td></td>
<td>Are there complete outcome data?</td>
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<td>Are outcome assessors blinded to the intervention provided?</td>
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<td></td>
<td>Did the participants adhere to the assigned intervention?</td>
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<tr>
<td>Gonzalez and Gadbury-Amyot (2016)</td>
<td>Screening questions</td>
<td>Are there clear research questions?</td>
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<tr>
<td>Qualitative</td>
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<td>Open ended questions were used</td>
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<td>Are the qualitative data collection methods adequate</td>
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<td>Open ended questions were used</td>
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<tr>
<td>Method</td>
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<td>Adequate</td>
<td>Reasoning</td>
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<td>Is the sampling strategy relevant to address the research question?</td>
<td>*</td>
<td>Second year dental students</td>
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<td></td>
<td>Is the sample representative of the target population?</td>
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<td></td>
<td>Are the measurements appropriate?</td>
<td>*</td>
<td>The questionnaire was piloted before the study</td>
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<td></td>
<td>Is the risk of nonresponse bias low?</td>
<td>*</td>
<td>The response rate was 88.9%</td>
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<td>Is the statistical analysis appropriate to answer the research question?</td>
<td>*</td>
<td>Statistical analysis methods were not clearly presented</td>
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<tr>
<td>Mixed Methods</td>
<td>Is there an adequate rationale for using a mixed method design to address the research question?</td>
<td>*</td>
<td>To evaluate dental students` use and perceptions about using Twitter in an oral radiology.</td>
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<td>Are the different components of the</td>
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<td>Study</td>
<td>Notes</td>
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<td>Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?</td>
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<td>No divergences were found</td>
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<td>Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?</td>
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**Sen et al. (2016)** | 100% |

**Screening questions** | Are there clear research questions? | * |
<p>| Is the sampling strategy relevant to address the research question? | * |
| Is the sample representative of the target population? | * | All the dental students (n=500) who received the questionnaire filled it. |
| Are the measurements appropriate? | * | Content, validity, and reliability were reviewed by |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Research Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seo et al. (2018) 80%</td>
<td>Screening</td>
<td>Are there clear research questions?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do the collected data allow to address the research questions?</td>
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<tr>
<td></td>
<td>Quantitative descriptive</td>
<td>Is the sampling strategy relevant to address the research question?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is the sample representative of the target population?</td>
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<tr>
<td></td>
<td></td>
<td>Are the measurements appropriate?</td>
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<td></td>
<td></td>
<td>Is the risk of nonresponse bias low?</td>
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<tr>
<td>Indu, Cherian and Kandoul (2018) 80%</td>
<td>Screening</td>
<td>Are there clear research questions?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Do the collected data allow to address the research questions?</td>
</tr>
<tr>
<td>Research Questions</td>
<td>Did Randomization Appropriately Perform?</td>
<td>Participants Were Randomly Divided Into Two Groups (A &amp; B).</td>
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<tr>
<td>Are the Groups Comparable at Baseline?</td>
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<td>Are There Complete Outcome Data?</td>
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<tr>
<td>Are Outcome Assessors Blinded to the Intervention Provided?</td>
<td>*</td>
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<tr>
<td>Did the Participants Adhere to the Assigned Intervention?</td>
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<thead>
<tr>
<th>Screening Questions</th>
<th>Are There Clear Research Questions?</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Quantitative Descriptive</th>
<th>Is the Sampling Strategy Relevant to Address the Research Question?</th>
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<tr>
<td>Is the Sample Representative of the Target Population?</td>
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<td>3rd year dental students</td>
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<td>Are the Measurements Appropriate?</td>
<td>*</td>
<td>Validity and reliability were piloted</td>
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<td>Is the Risk of Nonresponse Bias Low?</td>
<td>*</td>
<td>100% response rate</td>
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<td>Is the Statistical Analysis Appropriate to</td>
<td>*</td>
<td>Statistical analysis using SPSS v 16</td>
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<td>Study</td>
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<td>Quantitative descriptive</td>
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<tr>
<td>Aldallal, Yates and Ajrash (2019)</td>
<td>Are there clear research questions?</td>
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<td></td>
<td>Do the collected data allow to address the research questions?</td>
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<tr>
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<td>Is the sampling strategy relevant to address the research question?</td>
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<tr>
<td></td>
<td>Is the sample representative of the target population?</td>
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<td>Are the measurements appropriate?</td>
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<td></td>
<td>Is the risk of nonresponse bias low?</td>
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<td>Is the statistical analysis appropriate to answer the research question?</td>
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<td></td>
<td></td>
<td>4th and 5th year dental students</td>
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<td>Insufficient information about the participants</td>
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<tr>
<td>Al-rabab et al. (2019) 73%</td>
<td>Are there clear research questions?</td>
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<td>Do the collected data allow to address the research questions?</td>
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<td>Is the qualitative approach appropriate to answer the research question?</td>
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<td>Are the qualitative data collection methods adequate</td>
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<td>Structured interviews with open ended questions.</td>
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<tr>
<td>Question</td>
<td>Type</td>
<td>Description</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>Are the findings adequately derived from the data?</td>
<td>open ended</td>
<td>Descriptive data analysis was applied</td>
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<tr>
<td>Is the interpretation of results sufficiently substantiated by data?</td>
<td>*</td>
<td>This was not clear as themes and examples of students’ perceptions were not clearly identified</td>
</tr>
<tr>
<td>Is there coherence between qualitative data sources, collection, analysis and interpretation?</td>
<td>*</td>
<td>The link was not clear.</td>
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</table>

**Quantitative descriptive**

<table>
<thead>
<tr>
<th>Question</th>
<th>Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Is the sampling strategy relevant to address the research question?</td>
<td>*</td>
<td>4th and 5th year undergraduate dental students</td>
</tr>
<tr>
<td>Is the sample representative of the target population?</td>
<td>*</td>
<td>Because of the low response rate 57.3% and 20.3% for the 4th and 5th years respectively</td>
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<td>Are the measurements appropriate?</td>
<td>*</td>
<td>Piloting of the validity and reliability was not mentioned</td>
</tr>
<tr>
<td>Is the risk of nonresponse bias low?</td>
<td>*</td>
<td>Response rate was 57.3% of the 4th year and 20.3% from the 5th year</td>
</tr>
<tr>
<td>Is the statistical analysis appropriate to answer the research question?</td>
<td>*</td>
<td>Chi square test was applied using SPSS V. 16.0 to examine differences between groups. Descriptive statistics were generated as well.</td>
</tr>
<tr>
<td>Method</td>
<td>Question</td>
<td>Answer</td>
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<td>Mixed Methods</td>
<td>Is there an adequate rationale for using a mixed method design to address the research question?</td>
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<td>Are the different components of the study effectively integrated to answer the research question?</td>
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<td>Are the outputs of the integration of qualitative and quantitative components adequately interpreted?</td>
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<td>Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?</td>
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<td>Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?</td>
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<tr>
<td>Souza et al. (2019)</td>
<td>Are there clear research questions?</td>
<td>*</td>
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<tr>
<td>60%</td>
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<td>Is the sampling strategy relevant to address the research question?</td>
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<td></td>
<td>Meta-inference occurred as integration of both quantitative and qualitative approaches added value to the results.</td>
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<td>No divergences were found</td>
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<td></td>
<td>Convenient sample</td>
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|                                       | Piloting of the validity and reliability was not mentioned |
|                                       | convenient sample |
|                                       | descriptive and inferential statistical using SPSS v 23.0 |

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FAVOURABLE ETHICAL OPINION – WITH CONDITIONS

Study Title: The role of social networks in dental education; a mixed methods study

Reference Number: SFEC 2019-081 Date Submitted: 24 July 2019

Thank you for submitting your application to the Science and Health Faculty Ethics Committee (SFEC) for ethical review in accordance with current procedures.

I am pleased to inform you that SFEC was content to grant a favourable ethical opinion of the above research on the basis described in the submitted documents listed at Annex A, and subject to standard general conditions (See Annex B), and the following specific minor conditions:

1. **Conditions**

   A. Please review and ensure that your focus groups include sufficient but not an excessive number of participants, and give adequate consideration to how gender and cultural factors will influence participants' contribution and therefore the data collected. The composition for the focus groups must therefore be carefully considered.

   B. Please ensure that an adequate analysis plan is in place prior to participant recruitment; sample size and statistical tests that will be used need to be given further consideration and justification.

Please resubmit an updated application form incorporating the changes as per the above conditions for the final SFEC records on this application.

If you would find it helpful to discuss any of the matters raised above or seek further clarification from a member of the Committee, you are welcome to contact ethicssci@port.ac.uk who will circulate your queries to SFEC.

Please note that the favourable opinion of SFEC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including the University of Portsmouth or supervisor, prior to the start of the study.

Wishing you every success in your research

Dr Helena Herrera
Vice Chair Science and Health Faculty Ethics Committee

---

1 The favourable opinion given is dependent upon the study adhering to the conditions stated, which are based on the application document(s) submitted. It is appreciated that Principal Investigators may wish to challenge conditions or propose amendments to these. In that case, please consider the favourable opinion suspended, and simply make your case for amending or discarding conditions in writing as you would an application resubmission following ethical review.
FAVOURABLE ETHICAL OPINION – NOTIFICATION OF SUBSTANTIAL AMENDMENT

Study Title: The role of social networks in dental education; a mixed methods study

Reference Number: SFEC 2019-081A

Date Submitted: 2 October 2019

Thank you for submitting your proposal amendment to the Science and Health Faculty Ethics Committee (SFEC) for ethical review in accordance with current procedures.

I am pleased to inform you that SFEC was content to grant a favourable ethical opinion of this proposal amendment on the basis described in the submitted documents listed at Annex A, and subject to standard general conditions (See Annex B).

Please note that the favourable opinion of SFEC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including the University of Portsmouth or supervisor, prior to the start of the study.

Wishing you every success in your research

Helena Herrera

Dr Helena Herrera
Vice Chair Science and Health Faculty Ethics Committee
FAVOURABLE ETHICAL OPINION – NOTIFICATION OF SUBSTANTIAL AMENDMENT

Study Title: The role of social networks in dental education; a mixed methods study

Reference Number: SFEC 2019-081B

Date Submitted: 15 May 2020

Thank you for submitting your proposal amendment to the Science and Health Faculty Ethics Committee (SFEC) for ethical review in accordance with current procedures.

I am pleased to inform you that SFEC was content to grant a favourable ethical opinion of this proposal amendment on the basis described in the submitted documents listed at Annex A, and subject to standard general conditions (See Annex B).

Please note that the favourable opinion of SFEC does not grant permission or approval to undertake the research. Management permission or approval must be obtained from any host organisation, including the University of Portsmouth or supervisor, prior to the start of the study.

Wishing you every success in your research

Dr Paul Morris
Chair, Science and Health Faculty Ethics Committee
Hi,

Yes this will be covered under the UoP Public Liability insurance. However, please note that you will need to comply with the UoP Travel Overseas procedures which includes producing a travel risk assessment. See link below:

http://www2.port.ac.uk/special/overseastravel/

Kind Regards,
Appendix 8 Invitation letter to MSA university

Tuesday 2 July 2019

Professor Faten Kamel
Dean of Faculty of Dentistry
MSA University
Egypt

Dear Professor Kamel

Re. Dr Amr Elraggal

I hope this letter finds you well. Amr is a PhD student at the University of Portsmouth Dental Academy, UK and he is currently approaching the end of his first year of study. His educational research project is looking at the role of social media in dental learning and education. He would like to collect data from both UK and Egyptian universities.

The research project will include a quantitative study using an online questionnaire and a qualitative study based on focus group meetings. We are hoping that the study sample will include both undergraduate dental students and their teachers within the Faculty of Dentistry at MSA University.

Amr is in the process of gaining approval from the University of Portsmouth Research Ethics Committee.

I would be very grateful if you would be willing to support Amr with his PhD study by giving him access to both the undergraduate dental students and their teachers. The questionnaire will be online, and the focus group discussions will require access to some room space. Your cooperation is very highly appreciated, and I hope you will be able to support Amr.

I look forward to hearing from you and if you need further information, please do not hesitate to contact me. Thank you very much for your hopeful cooperation.

Yours sincerely

Professor Chris Louca
Director/Head of School
University of Portsmouth
Tuesday 2 July 2019

Professor Ahmed Adel Abdelhakim
The postgraduate coordinator
The faculty of Dentistry
Alexandria University
Egypt

Dear Professor Abdelhakim

Re. Dr Amr Elraggal

I hope this letter finds you well. Amr is a PhD student at the University of Portsmouth Dental Academy, UK and he is currently approaching the end of his first year of study. His educational research project is looking at the role of social media in dental learning and education. He would like to collect data from both UK and Egyptian universities.

The research project will include a quantitative study using an online questionnaire and a qualitative study based on focus group meetings. We are hoping that the study sample will include undergraduate dental students and their teachers within the Faculty of Dentistry at Alexandria University.

Amr is in the process of gaining approval from the University of Portsmouth Research Ethics Committee.

I would be very grateful if you would be willing to support Amr with his PhD study by giving him access to both the undergraduate dental students and their teachers. The questionnaire will be online and the focus group discussions will require access to some room space. Your cooperation is very highly appreciated and I hope you will be able to support Amr.

I look forward to hearing from you and if you need further information, please do not hesitate to contact me. Thank you very much for your hopeful cooperation.

Yours sincerely,

Professor Chris Louca
Director/Head of School
University of Portsmouth
Tuesday 14 January 2020

Professor Fayza Eldaly
The vice dean
The faculty of Dentistry
Pharos University
Egypt

Dear Professor Eldaly

Re. Dr Amr Elraggal

I hope this letter finds you well. Amr is a PhD student at the University of Portsmouth Dental Academy, UK and he is currently approaching the end of his first year of study. His educational research project is looking at the role of social media in dental learning and education. He would like to collect data from both UK and Egyptian universities.

The research project will include a quantitative study using an online questionnaire and a qualitative study based on focus group meetings. We are hoping that the study sample will include undergraduate dental students and their teachers within the Faculty of Dentistry at Pharos University.

Amr have got the ethical committee approval from the University of Portsmouth.

I would be very grateful if you would be willing to support Amr with his PhD study by giving him access to both the undergraduate dental students and their teachers. The questionnaire will be online and the focus group discussions will require access to some room space. Your cooperation is very highly appreciated and I hope you will be able to support Amr.

I look forward to hearing from you and if you need further information, please do not hesitate to contact me. Thank you very much for your hopeful cooperation.

Yours sincerely,


Professor Chris Louca
Director/Head of School
University of Portsmouth
Dear Igor

Kristina and I have a PhD student (Amr Elraggal – copied in here) looking at:

The role of social networks in dental education; a mixed methods study

He will investigate the above using a questionnaire and focus group discussions for both final year dental students and their dental teachers. He would like to access the students and teachers in Portsmouth and London/Norwood Hall and we hereby seek your permission for this.

Amr is finalising a University of Portsmouth Research Ethics Committee application form and will require evidence of your approval as part of this process

Kind regards

Chris
Dear Prof/ Chris
Hope this email finds you well...

kindly note that we will support Amr for his thesis and we will give him all the required data to accomplish his work, also I would like to ask for Assistant supervisor from our Dental School.

--

Prof Faten M Kamel
Professor of Restorative Dentistry - Cairo University
Dean of Dental School - MSA University

+202-383-71114/5/6
Ext: 1234
Mob: 01212254007

MSA University
26th July Mehwar Road Intersection with Wahat Road, 6th of October City, Egypt.
Tel: +202-383-71114/5/6
Fax: +202-383-71543
www.msa.edu.eg

The Best Of British higher education in Egypt
Hi Amr
I will do my best to facilitate your work, but I can get you the final official acceptance by mid next week.
Best regards

Ahmed Adel AbdelHakim
Vice Dean for Graduate Studies and Research
Professor of Prosthodontics, Alex Univ, Egypt.
BDS, MDSc, PhD, F.I.C.D., F.I.C.O.I., F.A.O.I.A.
http://dentalaestheticscentre.com/
Regent ICD Egypt/Sudan.
Chairperson PFA, Section 11, North Africa.
Certified CEREC Trainer, ISCD.
World Recognized LASER Trainer, WCLI.
General Secretary AIDC 2020
http://webmail.aidconline.org/
Phone +201020000103, +201223160402.
Dear Amr

I hope this email finds you well. This is to confirm that we are happy to help you with your studies. We agree to conduct a part of your studies at the Faculty of Dentistry Pharos University. We will do our best in order to facilitate your work through either the online questionnaires or the focus group discussions. If you have any inquiries, please do not hesitate to contact me.

Best regards

Prof Fayza Eldaly
Vice dean of the faculty of dentistry
Pharos University
Appendix 15 Acceptance email from King’s College London

17 July 2019

To the University of Portsmouth Research Ethics Committee

Re: proposed PhD project of Mr Amin El-Agaggel

I am writing to confirm that I am happy for Mr. Amin El-Agaggel, PhD student at the University of Portsmouth, to approach King’s College London (KCL) final year dental students and KCL-employed clinical teachers in outreach based in Portsmouth, Netwood Hall and Denmark Hill to help with his PhD project.

Igor Blaim

Dr. Igor Blaim
Appendix 16 Questionnaire for dental students

The role of social media in dental education: the students’ perspective

Thank you for taking the time to complete this short questionnaire, which should take around 15 minutes. Your responses are completely anonymous and will be treated in strict confidence.

This questionnaire is part of a PhD study at the University of Portsmouth Dental Academy, UK. Social media are web-based collections of online sites, services and platforms that allow people to build social relations with others who share similar personal or career interests, activities, backgrounds or real-life connections. Since their introduction, social media such as Twitter, Facebook, YouTube, LinkedIn, WhatsApp, Instagram, Google apps, Wikipedia etc. have attracted millions of people who have integrated these sites into daily use.

The objectives of this study are to:
1. Investigate what, how and when social media are used by dental students and their teachers.
2. Explore perceptions of dental students and teachers about the use of social media in dental education.
3. Investigate how dental students and their teachers can utilise social media in the dental educational process effectively.

Thank you for completing this online questionnaire.

Yours sincerely,

Amr Elraggal, PhD student at the University of Portsmouth Dental Academy, UK.

Professor Chris Louca, Director & Head of the University of Portsmouth Dental Academy, UK.

Dr Kristina Wanyonyi, Research Lead/Senior Lecturer at the University of Portsmouth Dental Academy, UK.

*Required

Please tick this box to confirm you consent to participating in this study *

Demographic data:

1. What is the name of your university? Please tick the appropriate box *
   - University of Portsmouth
   - King’s College, London
   - Alexandria University
   - MSA University
   - Pharos University

2. Are you an undergraduate or postgraduate dental student? Please tick the appropriate box *
   - Undergraduate
   - Postgraduate
3. What is your year of study? Please tick the appropriate box *
- First year
- Second year
- Third year
- Fourth year
- Fifth year
- Other:

4. What is your Gender? Please tick the appropriate box *
- Female
- Male
- Prefer not to say
- Other:

5. What is your age? Please tick the appropriate box *
- 16-20
- 21-25
- 26-30
- 31-35
- more than 35

The use of social media

6. Do you use social media? (Facebook, Twitter, YouTube, Wikipedia, WhatsApp etc.) *
- Yes
- No

7. Please list the social media applications you use. List them according to the frequency of use (most frequently used network first). *

8. What do you use social media for? Please tick all that apply *
- Personal communication
- Professional Communication
- Education
- Entertainment
- Work related
- Other:

9. How does your university communicate with you? Please tick all that apply *
- Email
- Facebook
- Mobile SMS
The use of social media for educational purposes: please indicate your level of agreement for the following statements 5-point Likert scale, where: 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree.

10. I believe that social media can successfully supplement classroom learning. *
Strongly disagree 1 2 3 4 5 Strongly agree

11. I believe that social media are useful for communicating with my tutors. *
Strongly disagree 1 2 3 4 5 Strongly agree

12. I believe that social media are useful for communicating with my fellow students. *
Strongly disagree
Strongly disagree 1 2 3 4 5 Strongly agree

13. I believe that social media should be used more by my university to help my learning. *
Strongly disagree 1 2 3 4 5 Strongly agree

14. I believe that social media are useful to search for information. *
Strongly disagree 1 2 3 4 5 Strongly agree

15. I am confident with the accuracy of information found from social media.
Strongly disagree 1 2 3 4 5 Strongly agree

The communication with others for educational purposes: (never, once a month, once a week, once a day, and more than 3 times per day)

16. How often do you use social media to communicate with fellow students in your dental school or university? *
Never  Once a month  Once a week  Once a day  More than 3 times per day

17. How often do you use social media to share educational materials (for example: videos, papers, articles, research, case studies, etc…) with your fellow STUDENTS? *
Never  Once a month  Once a week  Once a day  More than 3 times per day
18. How often do you use social media to share educational materials (for example: videos, papers, articles, research, case studies, etc…) with your TEACHERS? *
   Never  Once a month  Once a week  Once a day  More than 3 times per day

19. How often do you use social media to get information from other dental schools or international associations? *
   Never  Once a month  Once a week  Once a day  More than 3 times per day

20. How often do you read/interact with blogs, posts or Wikis for education-related information? *
   Never  Once a month  Once a week  Once a day  More than 3 times per day

**Students’ perceptions regarding the use of social media for educational purposes: please indicate your level of agreement for the following statements 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree.**

21. I believe that learning through social media is effective *
   Strongly disagree  1  2  3  4  5  Strongly agree

22. I believe that interaction with other students from my university or other universities through social media is effective. *
   Strongly disagree  1  2  3  4  5  Strongly agree

23. I believe that interaction with my dental teachers through social media is effective. *
   Strongly disagree  1  2  3  4  5  Strongly agree

24. I believe that utilising social media in the educational process is more effective for learning than traditional teaching. *
   Strongly disagree  1  2  3  4  5  Strongly agree

25. I feel comfortable to participate in the learning process through social media more than inside a classroom setting. *
   Strongly disagree  1  2  3  4  5  Strongly agree
The role of social media in dental education: the teachers' perspective

Thank you for taking the time to complete this short questionnaire, which should take around 15 minutes. Your responses are completely anonymous and will be treated in strict confidence. This questionnaire is part of a PhD study at the University of Portsmouth Dental Academy, UK. Social media are web-based collections of online sites, services and platforms that allow people to build social relations with others who share similar personal or career interests, activities, backgrounds, or real-life connections. Since their introduction, social media such as Twitter, Facebook, YouTube, LinkedIn, WhatsApp, Instagram, Google apps, Wikipedia etc. have attracted millions of people who have integrated these sites into daily use.

The objectives of this study are to:
1. Investigate what, how and when social networks are used by dental students and their teachers.
2. Explore perceptions of dental students and teachers about the use of social networks in dental education.
3. Investigate how dental students and their teachers can utilise social networks in the dental educational process effectively.

Thank you for completing this online questionnaire.

Yours sincerely,
Amr Elraggal, PhD student at the University of Portsmouth Dental Academy, UK.
Professor Chris Louca, Director & Head of the University of Portsmouth Dental Academy, UK.
Dr Kristina Wanyonyi, Research Lead/Senior Lecturer at the University of Portsmouth Dental Academy, UK.

*Required

Please tick this box to confirm you consent to participating in this study *

Demographic data:
1. What is the name of your university? *
   - University of Portsmouth
   - King’s College, London
   - Alexandria University
   - MSA University
   - Pharos University
2. What is your Gender? Please tick the appropriate box. *
   - Female
Male
☐ Prefer not to say
☐ Other:

3. What is your age? Please tick the appropriate box *
☐ 21-30
☐ 31-40
☐ 41-50
☐ 51-60
☐ Over 60

The use of social media

4. Do you use social media? (For example: Facebook, Twitter, YouTube, Wikipedia, WhatsApp etc.) *
☐ yes
☐ No

5. Please list the social media you use. List them according to the frequency of use (most frequently used network first). *

6. What do you use social media for? Please tick all that apply *
☐ Personal communication
☐ Professional communication
☐ Education
☐ Entertainment
☐ Other:

7. How does your university communicate with you? Please tick all that apply *
☐ Email
☐ Facebook
☐ Mobile SMS
☐ Posted letters
☐ Other:

The use of social media for teaching purposes: please indicate your level of agreement for the following statements 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree.

8. I believe that social media can successfully supplement classroom teaching. *
Strongly disagree 1 2 3 4 5 Strongly agree

9. I believe that social media are useful for communicating with my students. *
10. I believe that social media are useful for communicating with my fellow staff members. *

11. I believe that social media should be used more by my university for teaching purposes. *

12. I believe that social media are useful to search for information. *

13. I am confident with the accuracy of information found from social networks. *

The communication with others for educational purposes: (never, once a month, once a week, once a day, and more than 3 times per day)

14. How often do you use social media to communicate with your teacher colleagues in your dental school or university? *

15. How often do you use social media to share educational materials (For example: videos, papers, articles, research, case studies, etc…) with your TEACHER colleagues? *

16. How often do you use social networks to share educational materials (For example: videos, papers, articles, research, case studies, etc…) with your STUDENTS? *

17. How often do you use social media to get information from other dental schools or international associations? *

18. How often do you read/interact with blogs, posts or Wikis for education-related information? *
Teachers’ perceptions regarding the use of social media for educational purposes: please indicate your level of agreement for the following statements 5-point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4= agree, and 5= strongly agree.

19. I believe that teaching through social media is effective. *
   Strongly disagree  1  2  3  4  5  Strongly agree

20. I believe that interaction with teacher colleagues from my university or other universities through social media is effective. *
   Strongly disagree  1  2  3  4  5  Strongly agree

21. I believe that interaction with my dental students through social media is effective. *
   Strongly disagree  1  2  3  4  5  Strongly agree

22. I believe that utilising social media in the teaching process is more effective than traditional teaching. *
   Strongly disagree  1  2  3  4  5  Strongly agree

23. I believe that utilising social media in the teaching process can encourage students to participate better than in the traditional classroom setting *
   Strongly disagree  1  2  3  4  5  Strongly agree

Appendix 18 Interview guide

1. Introduction:
   1.1. Introduction and information sheet:
   I introduce myself and state the aim of the study, which is to explore the role of social media in dental education. Then, I ensure that the participant had a copy of the information sheet and understands the scope of the research.

   1.2. Consent
   I ensure that the ethics protocol is followed, and the participant received the consent form and signed it. Then, I remind the participant that he/she can withdraw at any time and confirm the permission to record the interview.

   1.3. Participant identification
The participant was identified using a pre-arranged code and the date and time of recording was noted.

2. Interview questions/points to be covered:

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<th>Teachers</th>
<th>Students</th>
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<td><strong>Definition of social media</strong></td>
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<td><strong>Using social media for educational purpose</strong></td>
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<td>2. Do you use social media for educational purposes? How? (if the answer is no, then I will follow up with why instead of how)</td>
<td>2. Do you use social media for educational purposes? How? (if the answer is no, then I will follow up with why instead of how)</td>
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<td><strong>Using social media to search for information</strong></td>
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<td>3. How do you use social media to search for dental information?</td>
<td>3. How do you use social media to search for dental information?</td>
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<td>4. What are the most popular dental topics you look for in social media for your students? (if the participant does not use SM, then I will ask him/her his concerns to do with examples)</td>
<td>4. What are the most popular dental topics you look for in social media? (if the participant does not use SM, then I will ask him/her his concerns to do with examples)</td>
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<td>5. How can social media be used for communication with your fellow tutors?</td>
<td>5. How can social media be used for communication with your colleagues?</td>
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<td>6. How can social media be used for communication with your fellow students?</td>
<td>6. How can social media be used for communication with your tutors?</td>
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<td>7. In your opinion, what are the strengths of using social media in dental education?</td>
<td>7. In your opinion, what are the strengths of using social media in dental education?</td>
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<td>8. What are your main concerns about using social media in teaching?</td>
<td>8. What are your main concerns about using social media in learning?</td>
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<td>9. In your opinion, how teaching through social media is compared to classroom teaching?</td>
<td>9. In your opinion, how learning through social media is compared to classroom learning?</td>
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<td>The use of social media in dental education during COVID-19 pandemic</td>
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<td>10. Do you think that the COVID-19 pandemic has affected the use of social media for educational purposes? And how?</td>
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<td>11. Do you believe that social media support teaching during the COVID-19 pandemic? How?</td>
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<th>Limitations</th>
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<tr>
<td>12. In your opinion, what are the limitations of using social media in dental education?</td>
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</table>
**Consent form**

**Ethics committee reference number:** SFEC 2019-081B

**Title of Project:** The role of social media in dental education.

**Name and Contact Details of Researcher:** Amr Elraggal, research student, Email address: up914469@myport.ac.uk

**Information Disclosure and Complaints Manager:** Samantha Hill, +44 02392843642 samantha.hill@port.ac.uk or data-protection@port.ac.uk

Please write your initials in each box you consent to.

| 1. | I confirm that I have read and understood the information sheet for the above study.  
|    | I have had the opportunity to consider the information, ask questions and have had  
|    | these answered satisfactorily. |

| 2. | I understand that my participation is voluntary and that I am free to withdraw at any  
|    | time without giving any reason. |

| 3. | I consent to audio recording for purposes of data collection |

| 4. | I understand that data collected during this study will be retained in accordance with  
|    | the University’s data retention policy and could also be requested by UK regulatory  
|    | authorities |

| 5. | I understand that the results of this study may be published and / or presented at  
|    | meetings or academic conferences, and I give my permission for my anonymous data,  
|    | which does not identify me, to be disseminated in this way. |

<table>
<thead>
<tr>
<th>Name of the participant</th>
<th>Date</th>
<th>Signature of the participant</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Name of person taking consent</th>
<th>Date</th>
<th>Signature of the participant</th>
</tr>
</thead>
</table>

*Amr Elraggal*

Copies: Please sign two copies of this consent form. You will need to keep one copy of this consent form for your own records and return one copy to the researcher: Amr elraggal, Email: up914469@myport.ac.uk
# Participant information sheet

## Ethics committee reference number:
SFEC 2019 - 081B

## Study title
The role of social media in dental education.

## Name(s) and Contact Details of Research Team:

**Principal investigator:** Amr Elraggal.  
Email address: up914469@myport.ac.uk

**Supervisors:**  
Prof Chris Louca, University of Portsmouth, Email address: chris.louca@port.ac.uk  
Dr Stuart Sims, University of Portsmouth, Email address: stuart.sims@port.ac.uk  
Dr Marianna Cerasuolo, University of Portsmouth, Email address: marianna.cerasuolo@port.ac.uk

## Invitation
I would like to invite you to take part in a research study undertaken by the University of Portsmouth, in collaboration with King’s College, Alexandria University, Pharos University and MSA University. This research forms part of a PhD in Science Research project. Before you decide whether to take part, please read this information sheet to understand why this research is taking place and what it involves. The researcher will go through this information sheet with you at the initial meeting and you are free to ask questions before signing a consent form if you wish to take part.

## What is the purpose of the study?
The aim of this study is to explore the role of social media, which are used by undergraduate dental students and their teachers, in dental education.

## Why have I been invited?
You have been invited to take part in this study because you are an undergraduate dental student, dental care professional student or dental teacher at the University of Portsmouth, King’s College, Alexandria University, Pharos University or MSA University.

## Do I have to take part?
No, you do not have to take part in this study. You have the choice to withdraw at any given time and it will not affect your standing as an undergraduate dental student.

## What will happen to me if I take part?
- If you do decide to take part, you will be invited to take part in a semi structured interview which is estimated to be around 30 minutes duration. Prior to starting the
interview there will be an overview of what the research project is about and an
opportunity to ask any questions. If you agree to take part, you will also be asked to
sign a consent form.

- The interview will be recorded. All data will be transcribed and analysed by the
  principal investigator (Amr Elraggal); it may also be heard by a supervisor to ensure
  the project adheres to the research parameters. All digital data that is collected will
  be encrypted and all participants will remain anonymous. Both supervisor and the
  principle investigator are required to respect the confidentiality of all participants.

**Will my taking part in the study be kept confidential?**

- Your contribution to the interview will be kept confidential by the interviewer, and
  your individual views will not be discussed with anyone outside the research team.
  Those members of the research team not involved in the interview will only have
  access to anonymised data. Any transcription undertaken by professional services
  will be bound by confidentiality and no names will be included in raw data. Audio
  records will be destroyed immediately after transcription.

- Any raw data, which identifies you, will be kept securely by the principal investigator
  on a secure google drive folder, and will be destroyed once data analysis has been
  completed.

- The findings of this study may be published in academic articles, journals or
  presented at conferences. Direct quotations may be used in these publications but
  will have been anonymised.

- The raw data, which would identify you, will not be passed to anyone outside the
  research team without your express written permission. The exception to this will be
  any regulatory authority, which may have the legal right to access the data for the
  purposes of conducting an audit or enquiry, in exceptional cases. These agencies
  treat your personal data in confidence. In addition, should any information shared
  indicate a risk to patients or the public, this information will be reported to the relevant
  body. The anonymised transcript will be retained for up to 10 years. When it is no
  longer required, the data will be disposed of securely.

*Your data will be anonymised by coding.*
• The findings of this study may be published in academic articles, journals or presented at conferences. Direct quotations may be used in these publications but will have been anonymised.

• The raw data, which would identify you, will not be passed to anyone outside the research team without your express written permission. The exception to this will be any regulatory authority, which may have the legal right to access the data for the purposes of conducting an audit or enquiry, in exceptional cases. These agencies treat your personal data in confidence. In addition, should any information shared indicate a risk to patients or the public, this information will be reported to the relevant body. The anonymised transcript will be retained for up to 10 years. When it is no longer required, the data will be disposed of securely.

What are the possible disadvantages and risks of taking part?
There are no risks from taking part. The only disadvantage would be utilising your time to take part.

What are the possible benefits of taking part?
Volunteers who decide to take part will help identify the role of social media in dental education.

What if there is a problem?
If you have a query, concern or complaint about any aspect of this study, in the first instance you should contact the principal investigator (details above). If the complaint remains unresolved, please you may contact:
The University Complaints Officer, 023 9284 3642, complaintsadvice@port.ac.uk
Amr Elraggal, research student, Email address: up914469@myport.ac.uk
Prof Chris Louca, Head of School, University of Portsmouth Dental Academy, chris.louca@port.ac.uk

Who has reviewed the study?
Research involving human participants is reviewed by an ethics committee to ensure that the dignity and well-being of participants is respected. This study has been reviewed by the University of Portsmouth Science Faculty Ethics Committee; and has been given a favourable ethical opinion.

Thank you
Thank you for taking the time to read this information sheet and for considering volunteering for this research. If you do agree to participate your consent will be sought; please see the
accompanying consent form. You will then be given a copy of this information sheet and your signed consent form, to keep.

Appendix 21 Invitation email for participation in the interviews

**Interview zoom link, date, and time**

Dear Participant,

Thank you for choosing to take part in my research project.

The interview will take place through zoom:

Link:

Date:

Time:

The aim of this study is to explore the role of social media, which are used by undergraduate dental (including dental care professions) students and their teachers, in dental education.

**Secondary objectives:**

1. To investigate what social media were used by undergraduate dental students and/or their teachers for educational purposes.

2. To investigate how undergraduate dental students and their teachers used social media for educational purposes.

3. To explore the perceptions of undergraduate dental students and their teachers about incorporating social media in dental education?

4. To explore the benefits and disadvantages of using social media in dental education.

5. To discover the impact of COVID-19 pandemic on the use of social media by undergraduate dental students and/or their teachers in dental education.

Thank you once again, I look forward to seeing you on ......

Kind Regards

Amr Elraggal

PhD student at The University of Portsmouth Dental Academy
### Appendix 12: Quantitative Results of Dental Students

<table>
<thead>
<tr>
<th>Q</th>
<th>Alexandina (n=250)</th>
<th>MSA (n=422)</th>
<th>Pharos (n=80)</th>
<th>UK (n=171)</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is your age?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>68(27.2%)</td>
<td>212(50.2%)</td>
<td>11(13.8%)</td>
<td>15(8.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-25</td>
<td>179(71.6%)</td>
<td>202(47.9%)</td>
<td>68(85%)</td>
<td>105(61.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-30</td>
<td>3(1.2%)</td>
<td>7(1.7%)</td>
<td>0(0%)</td>
<td>40(23.4%)</td>
<td>273.792$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>31-35</td>
<td>0(0%)</td>
<td>1(0.2%)</td>
<td>1(1.3%)</td>
<td>7(4.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 35</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4(2.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What is your year of study?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First year</td>
<td>45(18%)</td>
<td>53(12.6%)</td>
<td>0(0%)</td>
<td>33(19.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second year</td>
<td>5(2%)</td>
<td>164(38.9%)</td>
<td>8(10%)</td>
<td>24(14%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third year</td>
<td>54(21.6%)</td>
<td>67(15.9%)</td>
<td>11(13.8%)</td>
<td>6(3.5%)</td>
<td>322.346$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Fourth year</td>
<td>55(22%)</td>
<td>74(17.5%)</td>
<td>15(18.8%)</td>
<td>2(1.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth year</td>
<td>79(31.6%)</td>
<td>64(15.2%)</td>
<td>46(57.5%)</td>
<td>106(62%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>12(4.8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What is your gender?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>178(71.2%)</td>
<td>241(57.1%)</td>
<td>57(71.3%)</td>
<td>121(70.8%)</td>
<td>24.671$^*$</td>
<td>pMC 0.005$^*$</td>
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<tr>
<td>Male</td>
<td>68(27.2%)</td>
<td>173(41%)</td>
<td>23(28.8%)</td>
<td>50(29.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>4(1.6%)</td>
<td>8(1.9%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Do you use social media?</strong></td>
<td>Yes</td>
<td>250(100%)</td>
<td>417(100%)</td>
<td>78(100%)</td>
<td>171(100%)</td>
<td>–</td>
</tr>
<tr>
<td>No</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Please list the social media you use</strong></td>
<td>Facebook</td>
<td>244(97.6%)</td>
<td>375(89.9%)</td>
<td>69(88.5%)</td>
<td>126(73.7%)</td>
<td>59.590$^*$</td>
</tr>
<tr>
<td>WhatsApp</td>
<td>185(74%)</td>
<td>352(84.4%)</td>
<td>61(78.2%)</td>
<td>136(79.5%)</td>
<td>10.924$^*$</td>
<td>pMC 0.012$^*$</td>
</tr>
<tr>
<td>Facebook messenger</td>
<td>29(11.6%)</td>
<td>9(2.2%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>50.031$^*$</td>
<td>p MC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Instagram</td>
<td>141(56.4%)</td>
<td>233(55.9%)</td>
<td>48(61.5%)</td>
<td>126(73.7%)</td>
<td>17.688$^*$</td>
<td>pMC 0.003$^*$</td>
</tr>
<tr>
<td>Twitter</td>
<td>76(30.4%)</td>
<td>128(30.7%)</td>
<td>27(34.6%)</td>
<td>34(19.9%)</td>
<td>8.928$^*$</td>
<td>pMC 0.03$^*$</td>
</tr>
<tr>
<td>YouTube</td>
<td>147(58.8%)</td>
<td>186(44.6%)</td>
<td>36(46.2%)</td>
<td>78(45.6%)</td>
<td>13.857$^*$</td>
<td>pMC 0.003$^*$</td>
</tr>
<tr>
<td>Telegram</td>
<td>22(8.8%)</td>
<td>38(9.1%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>23.994$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Google</td>
<td>16(6.4%)</td>
<td>12(2.9%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>17.326$^*$</td>
<td>pMC 0.001$^*$</td>
</tr>
<tr>
<td>Wikipedia</td>
<td>18(7.2%)</td>
<td>39(9.4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>23.932$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Email</td>
<td>24(9.6%)</td>
<td>92(22.1%)</td>
<td>6(7.7%)</td>
<td>64(37.4%)</td>
<td>57.146$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Pinterest</td>
<td>5(2%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>8.946$^*$</td>
<td>pMC 0.006$^*$</td>
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<tr>
<td>Snapchat</td>
<td>10(4%)</td>
<td>25(6%)</td>
<td>4(5.1%)</td>
<td>47(27.5%)</td>
<td>81.670$^*$</td>
<td>pMC &lt;0.001$^*$</td>
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<tr>
<td>Ask.fm</td>
<td>7(2.8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0.006</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>LinkedIn</td>
<td>2(0.8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.841</td>
<td>0.193</td>
</tr>
<tr>
<td>Other</td>
<td>0(0%)</td>
<td>49(11.8%)</td>
<td>35(44.9%)</td>
<td>60(35.1%)</td>
<td>150.032$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Zoom</td>
<td>0(0%)</td>
<td>19(4.6%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>22.303$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td>Google</td>
<td>0(0%)</td>
<td>15(3.6%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>16.526$^*$</td>
<td>pMC &lt;0.001$^*$</td>
</tr>
<tr>
<td><strong>What do you use social media for?</strong></td>
<td>Personal communication</td>
<td>213(85.2%)</td>
<td>372(89.2%)</td>
<td>67(85.9%)</td>
<td>171(100%)</td>
<td>29.272$^*$</td>
</tr>
<tr>
<td>Professional communication</td>
<td>66(26.4%)</td>
<td>123(29.5%)</td>
<td>26(33.3%)</td>
<td>87(50.9%)</td>
<td>31.977$^*$</td>
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<tr>
<td>Education</td>
<td>195(78%)</td>
<td>322(77.2%)</td>
<td>56(71.8%)</td>
<td>120(70.2%)</td>
<td>4.718</td>
<td>0.194</td>
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<tr>
<td>Entertainment</td>
<td>210(84%)</td>
<td>329(78.9%)</td>
<td>63(80.8%)</td>
<td>154(90.1%)</td>
<td>12.05$^*$</td>
<td>pMC 0.007$^*$</td>
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<tr>
<td>Work related</td>
<td>50(20%)</td>
<td>82(19.7%)</td>
<td>25(32.1%)</td>
<td>59(34.5%)</td>
<td>19.754$^*$</td>
<td>pMC &lt;0.001$^*$</td>
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<td>Others</td>
<td>2(0.8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.841</td>
<td>pMC 0.193</td>
</tr>
</tbody>
</table>
9 How does your university communicate with you?

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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</thead>
<tbody>
<tr>
<td>Email</td>
<td>50(20%)</td>
<td>420(99.5%)</td>
<td>35(43.8%)</td>
<td>168(98.2%)</td>
<td>595.771* &lt;0.001*</td>
</tr>
<tr>
<td>Facebook</td>
<td>181(72.4%)</td>
<td>192(45.5%)</td>
<td>41(51.3%)</td>
<td>20(11.7%)</td>
<td>151.264* &lt;0.001*</td>
</tr>
<tr>
<td>Mobile SMS</td>
<td>6(2.4%)</td>
<td>37(8.8%)</td>
<td>5(6.3%)</td>
<td>1(0.6%)</td>
<td>21.984* &lt;0.001*</td>
</tr>
<tr>
<td>Posted letters</td>
<td>33(13.2%)</td>
<td>8(1.9%)</td>
<td>17(21.3%)</td>
<td>31(18.1%)</td>
<td>59.204* &lt;0.001*</td>
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<tr>
<td>Others</td>
<td>46(18.4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>130.327* p&lt;0.001*</td>
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<td>Moodle</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3(1.8%)</td>
<td>7.565* p&lt;0.015*</td>
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<tr>
<td>Online portal</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1(0.6%)</td>
<td>4.082 p&lt;0.274</td>
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<td>Whatsapp</td>
<td>0(0%)</td>
<td>6(1.4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.781 p&lt;0.114</td>
</tr>
<tr>
<td>Learning</td>
<td>0(0%)</td>
<td>25(5.9%)</td>
<td>1(1.3%)</td>
<td>0(0%)</td>
<td>29.264* p&lt;0.001*</td>
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<td>Announcements</td>
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<td>1(1.3%)</td>
<td>0(0%)</td>
<td>5.601 0.086</td>
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<td>University website</td>
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<td>0(0%)</td>
<td>16.265* p&lt;0.001*</td>
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<tr>
<td>No communication</td>
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<td>0(0%)</td>
<td>0(0%)</td>
<td>2.275 1.000</td>
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<td>Lms</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1(1.3%)</td>
<td>0(0%)</td>
<td>5.601 p&lt;0.086</td>
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<td>Zoom</td>
<td>0(0%)</td>
<td>2(0.5%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1.767 p&lt;0.757</td>
</tr>
</tbody>
</table>

10 I believe that social media can successfully supplement classroom learning.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>18(7.2%)</td>
<td>91(21.6%)</td>
<td>5(6.3%)</td>
<td>11(6.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22(8.8%)</td>
<td>81(19.2%)</td>
<td>8(10%)</td>
<td>10(5.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61(24.4%)</td>
<td>114(27.3%)</td>
<td>20(25%)</td>
<td>47(27.5%)</td>
<td>99.818* &lt;0.001*</td>
<td></td>
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<tr>
<td>84(33.6%)</td>
<td>87(20.6%)</td>
<td>25(31.3%)</td>
<td>63(36.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65(26%)</td>
<td>49(11.6%)</td>
<td>22(27.5%)</td>
<td>40(23.4%)</td>
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<td></td>
</tr>
</tbody>
</table>

11 I believe that social media are useful to communicate with my tutors.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tbody>
<tr>
<td>10(4%)</td>
<td>60(14.2%)</td>
<td>3(3.8%)</td>
<td>23(13.5%)</td>
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</tr>
<tr>
<td>24(9.6%)</td>
<td>57(13.5%)</td>
<td>4(5%)</td>
<td>20(11.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39(15.6%)</td>
<td>115(27.3%)</td>
<td>20(25%)</td>
<td>31(18.1%)</td>
<td>60.890* &lt;0.001*</td>
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</tr>
<tr>
<td>89(35.6%)</td>
<td>109(25.8%)</td>
<td>24(30%)</td>
<td>50(29.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88(35.2%)</td>
<td>81(19.2%)</td>
<td>29(36.3%)</td>
<td>47(27.5%)</td>
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<td></td>
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</tbody>
</table>

12 I believe that social media are useful for communicating with my fellow students.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tbody>
<tr>
<td>7(2.8%)</td>
<td>34(8.1%)</td>
<td>2(2.5%)</td>
<td>2(1.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6(2.4%)</td>
<td>33(7.8%)</td>
<td>3(3.8%)</td>
<td>5(2.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34(13.6%)</td>
<td>98(23.2%)</td>
<td>7(8.8%)</td>
<td>7(4.1%)</td>
<td>106.717* p&lt;0.001*</td>
<td></td>
</tr>
<tr>
<td>76(30.4%)</td>
<td>120(28.4%)</td>
<td>17(21.3%)</td>
<td>39(22.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>127(50.8%)</td>
<td>137(32.5%)</td>
<td>51(63.8%)</td>
<td>118(69%)</td>
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13 I believe that social media should be used more by my university to help my learning.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tbody>
<tr>
<td>15(6%)</td>
<td>65(15.4%)</td>
<td>3(3.8%)</td>
<td>13(7.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11(4.4%)</td>
<td>65(15.4%)</td>
<td>4(5%)</td>
<td>23(13.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50(20%)</td>
<td>105(24.9%)</td>
<td>11(13.8%)</td>
<td>45(26.3%)</td>
<td>108.223* p&lt;0.001*</td>
<td></td>
</tr>
<tr>
<td>63(25.2%)</td>
<td>115(27.3%)</td>
<td>21(26.3%)</td>
<td>55(32.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111(44.4%)</td>
<td>72(17.1%)</td>
<td>41(51.3%)</td>
<td>35(20.5%)</td>
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<td></td>
</tr>
</tbody>
</table>

14 I believe that social media are useful to search for information.

<table>
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<tr>
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<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tbody>
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<td>6(2.4%)</td>
<td>30(7.1%)</td>
<td>3(3.8%)</td>
<td>9(5.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9(3.6%)</td>
<td>31(7.3%)</td>
<td>3(3.8%)</td>
<td>17(9.9%)</td>
<td>54.741* p&lt;0.001*</td>
<td></td>
</tr>
<tr>
<td>32(12.8%)</td>
<td>75(17.8%)</td>
<td>7(8.8%)</td>
<td>23(13.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57(22.8%)</td>
<td>146(34.6%)</td>
<td>24(30%)</td>
<td>58(33.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>146(58.4%)</td>
<td>140(33.2%)</td>
<td>43(53.8%)</td>
<td>64(37.4%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15 I am confident with the accuracy of information found from social media.

<table>
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<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Natural</th>
<th>Agree</th>
<th>Strongly agree</th>
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<tr>
<td>16(6.4%)</td>
<td>62(14.7%)</td>
<td>8(10%)</td>
<td>29(17%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69(27.6%)</td>
<td>93(22%)</td>
<td>16(20%)</td>
<td>52(30.4%)</td>
<td>27.874* p&lt;0.008*</td>
<td></td>
</tr>
<tr>
<td>88(35.2%)</td>
<td>169(40%)</td>
<td>34(42.5%)</td>
<td>57(33.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56(22.4%)</td>
<td>74(17.5%)</td>
<td>19(23.8%)</td>
<td>25(14.6%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21(8.4%)</td>
<td>24(5.7%)</td>
<td>3(3.8%)</td>
<td>8(4.7%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16 How often do you use social media to communicate with fellow students in your dental school or university?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>1(2.4%)</th>
<th>6(7.5%)</th>
<th>3(1.8%)</th>
<th>27.064*</th>
</tr>
</thead>
<tbody>
<tr>
<td>14(5.6%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Never</td>
<td>Once a month</td>
<td>Once a week</td>
<td>Once a day</td>
<td>More than 3 times per day</td>
</tr>
<tr>
<td>----------------------</td>
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<td>-----------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Share educational materials with your fellow students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>40(16.0%)</td>
<td>58(23.2%)</td>
<td>66(26.4%)</td>
<td>49(19.6%)</td>
<td>27(10.8%)</td>
</tr>
<tr>
<td>Once a month</td>
<td>58(23.2%)</td>
<td>88(35.2%)</td>
<td>53(21.2%)</td>
<td>19(7.6%)</td>
<td>6(2.4%)</td>
</tr>
<tr>
<td>Once a week</td>
<td>88(35.2%)</td>
<td>104(42.6%)</td>
<td>130(30.8%)</td>
<td>71(16.8%)</td>
<td>35(8.3%)</td>
</tr>
<tr>
<td>Once a day</td>
<td>19(7.6%)</td>
<td>71(16.8%)</td>
<td>130(30.8%)</td>
<td>21(15.0%)</td>
<td>3(3.8%)</td>
</tr>
<tr>
<td>More than 3 times per day</td>
<td>11(4.4%)</td>
<td>100(23.7%)</td>
<td>100(23.7%)</td>
<td>13(16.3%)</td>
<td>2(1.2%)</td>
</tr>
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<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Once a month</th>
<th>Once a week</th>
<th>Once a day</th>
<th>More than 3 times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Share educational materials with your tutors</strong></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Never</td>
<td>143(57.2%)</td>
<td>143(57.2%)</td>
<td>143(57.2%)</td>
<td>143(57.2%)</td>
<td>143(57.2%)</td>
</tr>
<tr>
<td>Once a month</td>
<td>44(17.6%)</td>
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<td>88(35.2%)</td>
<td>88(35.2%)</td>
<td>88(35.2%)</td>
</tr>
<tr>
<td>Once a week</td>
<td>38(15.2%)</td>
<td>125(29.6%)</td>
<td>125(29.6%)</td>
<td>125(29.6%)</td>
<td>125(29.6%)</td>
</tr>
<tr>
<td>Once a day</td>
<td>19(7.6%)</td>
<td>71(16.8%)</td>
<td>71(16.8%)</td>
<td>71(16.8%)</td>
<td>71(16.8%)</td>
</tr>
<tr>
<td>More than 3 times per day</td>
<td>6(2.4%)</td>
<td>35(8.3%)</td>
<td>35(8.3%)</td>
<td>35(8.3%)</td>
<td>35(8.3%)</td>
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<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Once a month</th>
<th>Once a week</th>
<th>Once a day</th>
<th>More than 3 times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Get information from other dental schools or international associations?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>56(22.4%)</td>
<td>56(22.4%)</td>
<td>56(22.4%)</td>
<td>56(22.4%)</td>
<td>56(22.4%)</td>
</tr>
<tr>
<td>Once a month</td>
<td>66(26.4%)</td>
<td>101(23.9%)</td>
<td>101(23.9%)</td>
<td>101(23.9%)</td>
<td>101(23.9%)</td>
</tr>
<tr>
<td>Once a week</td>
<td>56(22.4%)</td>
<td>114(27.0%)</td>
<td>114(27.0%)</td>
<td>114(27.0%)</td>
<td>114(27.0%)</td>
</tr>
<tr>
<td>Once a day</td>
<td>45(18.0%)</td>
<td>76(18.0%)</td>
<td>76(18.0%)</td>
<td>76(18.0%)</td>
<td>76(18.0%)</td>
</tr>
<tr>
<td>More than 3 times per day</td>
<td>27(10.8%)</td>
<td>40(9.5%)</td>
<td>40(9.5%)</td>
<td>40(9.5%)</td>
<td>40(9.5%)</td>
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<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Once a month</th>
<th>Once a week</th>
<th>Once a day</th>
<th>More than 3 times per day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Read/interact with blogs, posts or Wikis for education-related information?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>27(10.8%)</td>
<td>53(12.6%)</td>
<td>53(12.6%)</td>
<td>53(12.6%)</td>
<td>53(12.6%)</td>
</tr>
<tr>
<td>Once a month</td>
<td>49(19.6%)</td>
<td>107(25.4%)</td>
<td>107(25.4%)</td>
<td>107(25.4%)</td>
<td>107(25.4%)</td>
</tr>
<tr>
<td>Once a week</td>
<td>76(30.4%)</td>
<td>146(34.6%)</td>
<td>146(34.6%)</td>
<td>146(34.6%)</td>
<td>146(34.6%)</td>
</tr>
<tr>
<td>Once a day</td>
<td>71(28.4%)</td>
<td>85(20.1%)</td>
<td>85(20.1%)</td>
<td>85(20.1%)</td>
<td>85(20.1%)</td>
</tr>
<tr>
<td>More than 3 times per day</td>
<td>27(10.8%)</td>
<td>31(7.3%)</td>
<td>31(7.3%)</td>
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<table>
<thead>
<tr>
<th>Frequency</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning through social media is effective.</strong></td>
<td>19(7.6%)</td>
<td>23(9.2%)</td>
<td>66(26.4%)</td>
<td>84(33.6%)</td>
<td>58(23.2%)</td>
</tr>
<tr>
<td></td>
<td>81(19.2%)</td>
<td>94(22.3%)</td>
<td>121(28.7%)</td>
<td>80(19%)</td>
<td>46(10.9%)</td>
</tr>
<tr>
<td></td>
<td>5(6.3%)</td>
<td>5(6.3%)</td>
<td>24(30%)</td>
<td>23(28.8%)</td>
<td>23(28.8%)</td>
</tr>
<tr>
<td></td>
<td>14(8.2%)</td>
<td>18(10.5%)</td>
<td>33(19.3%)</td>
<td>80(46.8%)</td>
<td>26(15.2%)</td>
</tr>
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<table>
<thead>
<tr>
<th>Frequency</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interaction with fellow students from my university or other universities through social media is effective.</strong></td>
<td>9(3.6%)</td>
<td>15(6%)</td>
<td>31(12.4%)</td>
<td>90(36%)</td>
<td>105(42%)</td>
</tr>
<tr>
<td></td>
<td>38(9%)</td>
<td>33(7.8%)</td>
<td>117(27.7%)</td>
<td>143(33.9%)</td>
<td>91(21.6%)</td>
</tr>
<tr>
<td></td>
<td>4(5%)</td>
<td>5(6.3%)</td>
<td>13(16.3%)</td>
<td>25(31.3%)</td>
<td>33(41.3%)</td>
</tr>
<tr>
<td></td>
<td>5(2.9%)</td>
<td>6(3.5%)</td>
<td>26(15.2%)</td>
<td>68(39.8%)</td>
<td>66(38.6%)</td>
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</table>

<table>
<thead>
<tr>
<th>Frequency</th>
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<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interaction with my dental teachers through social media is effective.</strong></td>
<td>28(11.2%)</td>
<td>32(12.8%)</td>
<td>31(12.4%)</td>
<td>90(36%)</td>
<td>105(42%)</td>
</tr>
<tr>
<td></td>
<td>59(14%)</td>
<td>67(15.9%)</td>
<td>117(27.7%)</td>
<td>143(33.9%)</td>
<td>91(21.6%)</td>
</tr>
<tr>
<td></td>
<td>5(6.3%)</td>
<td>9(11.3%)</td>
<td>13(16.3%)</td>
<td>25(31.3%)</td>
<td>33(41.3%)</td>
</tr>
<tr>
<td></td>
<td>28(16.4%)</td>
<td>30(17.5%)</td>
<td>68(39.8%)</td>
<td>66(38.6%)</td>
<td>66(38.6%)</td>
</tr>
</tbody>
</table>
I believe that utilising social media in the educational process is more effective for learning than traditional teaching.

I feel comfortable to participate in the learning process through social media more than inside a classroom setting.

χ²: Chi square test
p: p value for comparing between the studied groups
pMC: Monte Carlo corrected p value
pFE: Fisher exact p value
*: Statistically significant at p ≤ 0.05

Appendix 23 quantitative results of dental teachers
I believe that social media can successfully supplement classroom teaching.

I believe that social media are useful for communicating with my students.

I believe that social media are useful for communicating with my fellow staff members.

I believe that social media should be used more by my university for teaching purposes.

LinkedIn 1(2.6%) 2 (1.8%) 0 (0%) 0 (0%) 0.992 PFE= 1.000
Instagram 21(53.8%) 47 (43.1%) 9(47.4%) 14(56.0%) 2.193 0.533
Facebook messenger 5(12.8%) 0 (0%) 0 (0%) 0 (0%) 12.617* PFE= 0.002*
Pinterest 1(2.6%) 0 (0%) 0 (0%) 0 (0%) 4.202 PFE= 0.428
Twitter 6(15.4%) 14 (12.8%) 0 (0%) 7(28.0%) 7.124 PFE= 0.057
Telegram 2(5.1%) 0 (0%) 0 (0%) 0 (0%) 5.367 PFE= 0.135
E Learning 1 (2.6%) 3 (2.8%) 0 (0%) 0 (0%) 1.171 PFE= 0.798

What do you use social media for?

Personal communication 38 (97.4%) 98 (89.9%) 18 (94.7%) 24 (96%) 2.349 0.503
Professional communication 24 (61.5%) 86 (78.9%) 15 (78.9%) 23 (92%) 8.725* 0.033*
Education 29 (74.4%) 92 (84.4%) 18 (94.7%) 16 (64%) 8.423* 0.030*
Entertainment 32 (82.1%) 92 (84.4%) 17 (89.5%) 21 (84%) 0.519 0.936
Research 1 (2.6%) 0 (0%) 0 (0%) 0 (0%) 4.202 PFE= 0.428
News 0 (0%) 2 (1.8%) 0 (0%) 0 (0%) 1.223 PFE= 1.000
Shopping 0 (0%) 1 (0.9%) 0 (0%) 0 (0%) 2.146 PFE= 1.000

How does your university communicate with you?

Email 18 (46.2%) 109 (100 %) 18 (94.7) 25 (100%) 68.375* <0.001*
Facebook 8 (20.5%) 30 (27.5%) 3 (15.8%) 1 (4%) 7.163 PFE= 0.067
Mobile SMS 3 (7.7%) 55 (50.5%) 0 (0%) 1 (4%) 46.475* PFE <0.001*
Posted letters 13 (33.3%) 4 (3.7%) 3 (15.8%) 6 (24%) 24.360* PFE <0.001*
WhatsApp 13 (33.3%) – – – 20.480* <0.001*
learning - 9 (8.3%) 9 (47.4%) – 0.454 1.000
Phone calls - 3 (2.8%) 0 (0%) 0 (0%) 1.252 1.000
Staff bulletins - 1 (0.9%) 0 (0%) 0 (0%) 0.001 1.000
Google plus - 0 (0%) 0 (0%) 0 (0%) 1 (4%) 5.091 PFE= 0.227

I believe that social media can successfully supplement classroom teaching.

Strongly disagree 3 (7.7%) 2 (0.8%) 2 (10.5%) 1 (4%) 0.227
Disagree 4 (10.3%) 5 (4.6%) 1 (5.3%) 1 (4%) 1.000
Neutral 6 (15.4%) 23 (21.1%) 5 (26.3%) 9 (36%) 17.334 PFE= 0.137
Agree 15 (38.5%) 37 (33.9%) 2 (10.5%) 10 (40%) 0.428
Strongly agree 11 (28.2%) 42 (38.5%) 9 (47.4%) 4 (16%) 0.002

I believe that social media are useful for communicating with my students.

Strongly disagree 1 (2.6%) 0 (0%) 0 (0%) 0 (0%) 0.002
Disagree 0 (0%) 3 (2.8%) 0 (0%) 4 (16%) 0.428
Neutral 6 (15.4%) 14 (12.8%) 4 (21.1%) 5 (20%) 19.546 PFE= 0.090
Agree 9 (23.1%) 30 (27.5%) 5 (26.3%) 6 (24%) 0.798
Strongly agree 23 (59%) 62 (56.9%) 10 (52.6%) 10 (40%) 1.000

I believe that social media are useful for communicating with my fellow staff members.

Strongly disagree 1 (2.6%) 1 (0.9%) 0 (0%) 2 (8%) 0.002
Disagree 12 (6%) 1 (0.9%) 0 (0%) 1 (4%) 0.002
Neutral 4 (10.3%) 5 (4.6%) 3 (15.8%) 6 (24%) 19.957 PFE= 0.075
Agree 9 (23.1%) 37 (33.9%) 4 (21.1%) 5 (20%) 0.002
Strongly agree 24 (61.5%) 65 (59.6%) 12 (63.2%) 11 (44%) 0.002

I believe that social media should be used more by my university for teaching purposes.

Strongly disagree 1 (2.6%) 1 (0.9%) 0 (0%) 1 (4%) 21.102 PFE= 0.227

287
| Disagree | 0 (0%) | 6 (5.5%) | 0 (0%) | 3 (12%) | 0.058 |
| Neutral | 8 (20.5%) | 26 (23.9%) | 6 (31.6%) | 12 (48%) |
| Agree | 9 (23.1%) | 38 (34.9%) | 4 (21.1%) | 5 (20%) |
| Strongly agree | 21 (53.8%) | 38 (34.9%) | 9 (47.4%) | 4 (16%) |

I believe that social media are useful to search for information.
| Strongly disagree | 1 (2.6%) | 3 (2.8%) | 0 (0%) | 2 (8%) | $p_{MC}^* = 0.03^*$ |
| Disagree | 4 (10.3%) | 0 (0%) | 1 (5.3%) | 2 (8%) |
| Neutral | 7 (17.9%) | 8 (7.3%) | 2 (10.5%) | 8 (32%) | 30.195$^* \quad p_{MC} = 0.003^*$ |
| Agree | 6 (15.4%) | 22 (20.2%) | 3 (15.8%) | 6 (24%) |
| Strongly agree | 21 (53.8%) | 76 (69.7%) | 13 (68.4%) | 7 (28%) |

I am confident with the accuracy of information found from social media.
| Strongly disagree | 6 (15.4%) | 4 (3.7%) | 2 (10.5%) | 7 (28%) |
| Disagree | 9 (23.1%) | 15 (3.8%) | 2 (10.5%) | 9 (36%) |
| Neutral | 17 (43.6%) | 49 (45%) | 10 (52.6%) | 6 (24%) | 30.709$^* \quad p_{MC} = 0.002^*$ |
| Agree | 4 (10.3%) | 27 (24.8%) | 3 (15.8%) | 1 (4%) |
| Strongly agree | 3 (7.7%) | 14 (2.8%) | 2 (10.5%) | 2 (8%) |

14 How often do you use social media to communicate with your teacher colleagues in your dental school or university?''
| Never | 2 (5.1%) | 2(1.8%) | 1 (5.3%) | 5 (20%) |
| Once a month | 3 (7.7%) | 6(5.5%) | 1 (5.3%) | 7 (28%) |
| Once a week | 10 (25.6%) | 12(11%) | 3 (15.8%) | 3 (12%) |
| Once a day | 16 (41%) | 41(37.6%) | 11 (57.9%) | 3 (12%) |
| More than 3 times per day | 8 (20.5%) | 48(44%) | 3 (15.8%) | 7 (28%) |

15 How often do you use social media to share educational materials with your fellow teachers
| Never | 5 (12.8%) | 5(4.6%) | 2 (10.5%) | 7 (28%) |
| Once a month | 11 (28.2%) | 17(15.6%) | 8 (42.1%) | 0 (0%) |
| Once a week | 12 (30.8%) | 41(37.6%) | 3 (15.8%) | 2 (8%) |
| Once a day | 8 (20.5%) | 35(32.1%) | 5 (26.3%) | 8 (32%) |
| More than 3 times per day | 3 (7.7%) | 11(10.1%) | 1 (5.3%) | 8 (32%) |

16 How often do you use social media to share educational materials with your students
| Never | 19 (48.7%) | 8(7.3%) | 2 (10.5%) | 9 (36%) |
| Once a month | 8 (20.5%) | 19(17.4%) | 8 (42.1%) | 0 (0%) |
| Once a week | 9 (23.1%) | 43(39.4%) | 4 (21.1%) | 2 (8%) |
| Once a day | 2 (5.1%) | 29(26.6%) | 3 (15.8%) | 5 (20%) |
| More than 3 times per day | 1 (2.6%) | 10(9.2%) | 2 (10.5%) | 9 (36%) |

17 How often do you use social media to get information from other dental schools or international associations?
| Never | 3 (7.7%) | 7(6.4%) | 0 (0%) | 6 (24%) |
| Once a month | 12 (30.8%) | 25(22.9%) | 7 (36.8%) | 0 (0%) |
| Once a week | 13 (33.3%) | 32(29.4%) | 5 (26.3%) | 4 (16%) |
| Once a day | 9 (23.1%) | 33(30.3%) | 6 (31.6%) | 4 (16%) |
| More than 3 times per day | 2 (5.1%) | 12(11%) | 1 (5.3%) | 11 (44%) |

18 How often do you read/interact with blogs, posts or Wikis for education-related information?''
| Never | 6 (15.4%) | 8(7.3%) | 1 (5.3%) | 4 (16%) |
| Once a month | 8 (20.5%) | 20(18.3%) | 2 (10.5%) | 9 (36%) |
| Once a week | 13(33.3%) | 33(30.3%) | 7 (36.8%) | 8 (32%) |
| Once a day | 7 (17.9%) | 34(31.2%) | 5 (26.3%) | 3 (12%) |
| More than 3 times per day | 5 (12.8%) | 14(12.8%) | 4 (21.1%) | 10 (40%) |

288
<table>
<thead>
<tr>
<th>I believe that teaching through social media is effective</th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Strongly disagree</td>
<td>0 (0%)</td>
<td>1 (0.9%)</td>
<td>1 (5.3%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Disagree</td>
<td>3 (7.7%)</td>
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<td>2 (10.5%)</td>
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<tr>
<td>Natural</td>
<td>15 (38.5%)</td>
<td>36 (33%)</td>
<td>4 (21.1%)</td>
<td>9 (36%)</td>
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<tr>
<td>Agree</td>
<td>11 (28.2%)</td>
<td>38 (34.9%)</td>
<td>5 (26.3%)</td>
<td>5 (20%)</td>
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<tr>
<td>Strongly agree</td>
<td>10 (25.6%)</td>
<td>26 (23.9%)</td>
<td>7 (36.8%)</td>
<td>3 (12%)</td>
</tr>
</tbody>
</table>

| I believe that interaction with teacher colleagues from my university or other universities through social media is effective. |  |  |  |
|---|---|---|
| Strongly disagree | 0 (0%) | 0 (0%) | 0 (0%) | 0(0%) |
| Disagree | 2 (5.1%) | 4 (3.7%) | 2 (10.5%) | 7(28%) |
| Natural | 6 (15.4%) | 20 (18.3%) | 2 (10.5%) | 7 (28%) |
| Agree | 19 (48.7%) | 51 (46.8%) | 8 (42.1%) | 7 (28%) |
| Strongly agree | 12 (30.8%) | 34 (31.2%) | 7 (36.8%) | 4 (16%) |

| I believe that interaction with my dental students through social media is effective. |  |  |  |
|---|---|---|
| Strongly disagree | 1 (2.6%) | 2 (1.8%) | 0 (0%) | 1(4%) |
| Disagree | 3 (7.7%) | 4 (3.7%) | 1 (5.3%) | 7(28%) |
| Natural | 6 (15.4%) | 28 (25.7%) | 4 (21.1%) | 7 (28%) |
| Agree | 13 (33.3%) | 43 (39.4%) | 7 (36.8%) | 7 (28%) |
| Strongly agree | 16 (41%) | 32 (29.4%) | 7 (36.8%) | 3(12%) |

| I believe that utilising social media in the teaching process is more effective than traditional teaching. |  |  |  |
|---|---|---|
| Strongly disagree | 5 (12.8%) | 8 (7.3%) | 3 (15.8%) | 6(24%) |
| Disagree | 7 (17.9%) | 22 (20.2%) | 3 (15.8%) | 5(20%) |
| Natural | 11 (28.2%) | 37 (33.9%) | 8 (42.1%) | 12(48%) |
| Agree | 9 (23.1%) | 21 (19.3%) | 1 (5.3%) | 2(8%) |
| Strongly agree | 7 (17.9%) | 21 (19.3%) | 4 (21.1%) | 0(0%) |

| I believe that utilising social media in the teaching process can encourage students to participate better than in the traditional classroom setting. |  |  |  |
|---|---|---|
| Strongly disagree | 2 (5.1%) | 4 (3.7%) | 1 (5.3%) | 2(8%) |
| Disagree | 3 (7.7%) | 16 (14.7%) | 2 (10.5%) | 2(8%) |
| Natural | 7 (17.9%) | 35 (32.1%) | 5 (26.3%) | 10(40%) |
| Agree | 16 (41%) | 30 (27.5%) | 5 (26.3%) | 9 (36%) |
| Strongly agree | 11 (28.2%) | 24 (22%) | 6 (31.6%) | 2(8%) |

χ²: Chi square test  
p: p value for comparing between the studied groups  
P_{MC}: Monte Carlo corrected p value  
P_{FE}: Fisher exact p value  
*: Statistically significant at p ≤ 0.05
Form UPR16
Research Ethics Review Checklist

Please include this completed form as an appendix to your thesis (see the Research Degrees Operational Handbook for more information)

<table>
<thead>
<tr>
<th>Postgraduate Research Student (PGRS) Information</th>
<th>Student ID: 914469</th>
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<tbody>
<tr>
<td>PGRS Name: Amr Ahmed Ahmed Elraggal</td>
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<tr>
<td>Department: Dental Academy</td>
<td></td>
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<tr>
<td>First Supervisor: Chris Louca</td>
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<tr>
<td>Start Date: 1 October 2018</td>
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<td>Study Mode and Route:</td>
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</tbody>
</table>

If you are unsure about any of the following, please contact the local representative on your Faculty Ethics Committee for advice. Please note that it is your responsibility to follow the University’s Ethics Policy and any relevant University, academic or professional guidelines in the conduct of your study. Although the Ethics Committee may have given your study a favourable opinion, the final responsibility for the ethical conduct of this work lies with the researcher(s).

UKRIO Finished Research Checklist:
(If you would like to know more about the checklist, please see your Faculty or Departmental Ethics Committee rep or see the online version of the full checklist at: http://www.ukrio.org/what-we-do/code-of-practice-for-research/)

- Have all of your research and findings been reported accurately, honestly and within a reasonable time frame? YES □ NO □
- Have all contributions to knowledge been acknowledged? YES □ NO □
- Have you complied with all agreements relating to intellectual property, publication and authorship? YES □ NO □
- Has your research data been retained in a secure and accessible form and will it remain so for the required duration? YES □ NO □
- Does your research comply with all legal, ethical, and contractual requirements? YES □ NO □

Candidate Statement:

I have considered the ethical dimensions of the above named research project, and have successfully obtained the necessary ethical approval(s).

Ethical review number(s) from Faculty Ethics Committee (or from NRES/SCREC): SFEC 2019-081B

If you have not submitted your work for ethical review, and/or you have answered ‘No’ to one or more of questions a) to e), please explain below why this is so:

Signed (PGRS): A.M.T Date: 15/11/2021

UPR16 – April 2018