Title

Social media in nursing and midwifery education: a mixed study systematic review

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influence on the design, conduct or reporting of this mixed study systematic review. The views expressed are those of the authors and not necessarily those of STTI or the NLN.

Author Contributions

SOC conceptualised the study. SOC and SJ undertook the literature searching, screening, data extraction and quality assessment with support from RB. SOC undertook the narrative synthesis and framework synthesis with support from LR and RB. SOC wrote the first draft of the review and all authors contributed to the writing of the final manuscript. All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*): 1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content. * http://www.icmje.org/recommendations/

Abstract

Aim: To synthesize evidence on the effectiveness of social media in nursing and midwifery education.

Background: Social media are being explored to see if these online tools can support teaching, learning and assessment.

Design: A mixed study systematic review.

Data sources: A systematic search of PubMed, MEDLINE, CINAHL, Scopus and ERIC was run in January 2016. An updated search was run in June 2017. No date limits were applied.

Methods: Titles, abstracts and full papers were screened against inclusion criteria by two independent reviewers, who extracted and quality assessed data. Synthesis followed a sequential explanatory approach.

Results: Twelve studies were included. Social media seemed to support students to acquire new knowledge and skills. The learning process centred on the interactive nature of the platforms which allow information to be dynamically shared and discussed in near real-time. The characteristics of social media enabled social support and a more student-centred setting, which appeared to enhance collaborative learning, although information quality was sometimes problematic. Learning via social media was underpinned by how well the educational interventions were organized, digital literacy and e-Professionalism of students and faculty, the accessibility of the online applications and personal motivation.

Conclusion: This review provides the first rigorous synthesis of social media in nursing and midwifery education. A new Social Media Learning Model was conceptualized to aid our understanding of learning via this technology. Knowledge gaps are identified

and recommendations on how to capitalize on social media to improve learning in higher and continuing education provided.

IMPACT STATEMENT

Social media are being utilized in nursing and midwifery education. This mixed study systematic review syntheses literature on the impact this technology has on student learning. Findings show these online tools may aid the acquisition of new knowledge and skills, enhance student confidence and help them build professional networks. The dynamic, interactive environments seem to facilitate the learning process by enabling information to be shared and discussed in near real-time between students, faculty and professionals. This student-centred setting could enhance collaborative learning and allow supportive networks to emerge. A new Social Media Learning Model was developed from the review results.

SUMMARY STATEMENT

Why is this research or review needed?

- Social media are relatively new technological platforms which have unique features and are becoming popular ways to communicate and share information online.

- These electronic tools are being utilized to support learning among nursing and midwifery students, but no review and synthesis of their effectiveness currently exists.

What are the key findings?

- Social media may aid learning knowledge and skills among nursing and midwifery students, enhance confidence and facilitate professional and personal networks.

- The characteristics of social media such as its dynamic, interactive, online environments that can affect the learning process in several ways.

- The methodological quality of the included studies was weak and therefore findings should be viewed with caution. More robust studies are required to objectively measure whether social media improves learning.

How should the findings be used to influence policy/practice/research/education?

- The review findings may guide the design and delivery of social media based educational interventions in higher and continuing education.

- The identified gaps in the pedagogical literature on social media in nursing and midwifery education should guide further research.

INTRODUCTION

Information technology is radically changing the face of nursing and midwifery education. It helps to deliver teaching and assessment in academic and clinical settings and is used by students to access educational resources (Moule *et al*. 2010). Computers and mobile devices can facilitate e-learning, enabling faculty and students to interact in new ways to support learning in virtual environments (O'Connor & Andrews, 2015). Button *et al*. (2014) contend that using technology does not ensure learning takes place and emphasizes a sound pedagogical approach to teaching and assessment is required to ensure students achieve successful outcomes.

Social media is an emerging technological phenomenon utilized in nursing and midwifery education worldwide, with Facebook, Twitter and YouTube being popular platforms (Clifton & Mann, 2011; Booth, 2015; Richardson *et al*. 2016). It evolved in the early 2000's when Web 2.0 transformed how the Internet was used. This enabled people to create and share content online instead of viewing webpages in a passive manner, with the number and type of social media platforms growing as new virtual spaces were added. This shift in contemporary communication spawned a new culture of open, collaborative creation and sharing of electronic information, using an array of formats (i.e. text, images, audio, video) that is now pervasive in society (Fraser *et al*. 2015). Social media encompass a huge range of digital applications from social networking sites (SNSs) to blogs, podcasts, webcasts and blended forms of these online tools. However, some types of social media are more sophisticated than others and allow for greater levels of co-production and interaction. In particular, SNSs such as Facebook and Twitter have unique features that differentiate them from other kinds of social media. These include greater levels of personalization through user profiles and

the ability to follow other users. SNSs also facilitate the generation, manipulation and sharing of multimedia content with others in a near real-time fashion, with some content going "viral" or spreading rapidly between users. Notifications of this dynamic engagement can also be pushed to devices and analytics are available that report some of these online interactions.

Reviews have summarized social media use in education previously. However, they examined a range of online platforms, defined social media broadly (Bassell, 2010), had limited studies relevant to nursing and midwifery (Smith & Lambert, 2014) or adopted methodologically weak approaches (Arrigoni *et al*. 2016; Gunberg Ross & Myers, 2017). Therefore, a gap exists in our understanding of how effective social media, especially SNSs, could be in supporting learning among nursing and midwifery students. Given the widespread use of SNSs, a systematic review is needed to support future education, research, practice and policy. Therefore, this review focuses on SNS based applications, as they have more complex functionality that has been suggested to be more sensitive in influencing learning (O'Connor *et al*. 2017).

THE REVIEW

Aims

This review aims to synthesize the literature on social media in nursing and midwifery education, highlight knowledge gaps and provide recommendations for using this technology. The research questions are:

1) What is the effect of social media applications on learning among nursing and midwifery students?

2) What are the perspectives of nursing and midwifery faculty, students and practice staff towards using social media for this purpose?

Design

A sequential explanatory design was used for this mixed study review (Pluye & Hong, 2014). The protocol was registered on PROSPERO (CRD42016039357) and published to describe how the review was undertaken (O'Connor *et al*. 2017).

Search methods

Key terms relevant to social media, nursing and midwifery and education were used to build a preliminary search strategy. This was piloted in PubMed, refined and run across five bibliographic databases; PubMed Central, MEDLINE (Ovid), CINAHL (EBSCOHost), Scopus and ERIC (see Supplementary File S1). The search was conducted in January 2016 and an update run in June 2017. It was not limited by year of publication. Reference and citation tracking were also undertaken.

Search outcome

Eligibility criteria followed the PICO framework (Cullum *et al*. 2013). The population were nurses or midwives at any stage of education. Where mixed groups of students were present, results pertaining to nurses or midwives had to be identifiable. The intervention needed to be an SNS based social media platform used for educational purposes. If a mix of interventions were used, results of the social media component had to be clearly recognizable. No comparison was used. The outcome(s) had to include

a change in students' professional or personal knowledge or skills or the perspectives of students, faculty and practice staff towards learning via social media. All types of study design were included. No date range was imposed and only English language peer-reviewed publications which had undertaken primary research were included. Commentary, editorial or opinion pieces, theses, conference proceedings, grey literature, descriptive and review articles were excluded.

A total of 2,608 citations were retrieved and organized using RefWorks. Two members of the research team (SOC, SJ) individually assessed the relevancy of titles and abstracts. The full text of articles meeting the eligibility criteria were subsequently screened by both reviewers. Another team member (RB) resolved any conflicts that occurred during screening. A PRISMA flow diagram outlines how articles were selected and reasons for exclusion (Figure 1) (Moher *et al*. 2009).

Quality appraisal

Two reviewers (SOC, SJ) critically appraised the included studies independently using the Mixed Methods Appraisal Tool (MMAT) (Pluye *et al*. 2009). Disagreements were resolved through group discussion. One high quality study, five medium and four low quality studies were identified. Two studies received a zero quality rating (see Supplementary File S2). However, none were excluded from the review based on the MMAT score.

Data abstraction

A standardized data extraction template was designed, piloted and applied to the included studies. Bibliographic information, study characteristics, participant and intervention characteristics and the main findings from the results and discussion sections related to the review questions were extracted (see Table 1 and Supplementary information Tables S1 and S2). Two reviewers (SOC, SJ) extracted data independently and disagreements were resolved through group discussion with a team member (RB).

Synthesis

A sequential explanatory approach to synthesize data was used (Pluye & Hong, 2014). To begin with, narrative synthesis was employed due to the heterogeneity of the quantitative and mixed method studies, which were unsuitable for meta-analytic techniques (Centre for Reviews and Dissemination, 2008). A theory of change was not used to inform the design of the review as pedagogical research on social media is an emerging area that could benefit from new conceptual insights. Hence, an inductive approach was taken for the initial phases of narrative synthesis to enable a clearer understanding of how this technology affects learning to evolve. A researcher (SOC) undertook a preliminary synthesis using four techniques: 1) groupings and clusters; 2) tabulation; 3) vote counting; and 4) thematic analysis (Table 2 & Supplementary information Tables S2, S3 and S5) (Popay *et al.* 2006). Relationships both within and between studies were then explored to identify emerging patterns across the quantitative and mixed methods studies. Here four techniques were used; 1) subgroup analysis; 2) conceptual mapping; 3) methodological triangulation; and 4) conceptual triangulation (see Figure 2 and Supplementary File S3). Next, the robustness of the

synthesis was assessed using the Weight of Evidence approach (see Supplementary File S4) and critically reflected on. The analysis was discussed with the review team at intervals to ensure consistency in interpretation. The rationale for the techniques used in the narrative synthesis are provided in Supplementary File S5.

The thematic framework developed in the first phase was then used to inform the analysis of qualitative studies. The framework approach was applied as it allows an a priori framework to be used as a coding tool (Ritchie & Spencer, 1994). Qualitative studies were read multiple times to draw out initial concepts linking them to the predefined themes. The studies were then re-analysed using the updated analytical framework to refine and expand the matrix of themes and subthemes. This iterative, reflective process resulted in a deeper understanding of learning via social media learning (see Table 2). The last step involved revisiting the role of theory in evidence synthesis to ensure the interpretation of results were widely applicable in nursing and midwifery education (Popay *et al.* 2006). Further reflection of phase one and two syntheses was undertaken, conceptualized through the lens of Social Learning Theory (SLT) (Bandura, 1976). This theory acted as a useful heuristic tool to help explain learning via social media from which a preliminary model of this complex process emerged (Figure 2).

Rigour

An international best practice guideline for conducting mixed study reviews was followed (Pluye & Hong, 2014). The PRISMA guidelines (Moher *et al.* 2009) and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research

(ENTREQ) statement (Tong *et al*. 2012) were also used to report the results of the review (see Supplementary File S6 and S7).

RESULTS

Study Characteristics

Twelve studies were included in the review (see Table 1). These were conducted in five countries including Australia (N=5), the United States (N=2), the United Kingdom (N=3), Canada (N=1) and Taiwan (N=1). Participants were primarily undergraduate nursing students as reported in eleven studies and one included both pre-registration and post-registration midwives (Uppal *et al*. 2016). Faculty were included in two cases and practice staff were involved in one study. Few studies reported participant characteristics such as gender, age or socioeconomic status. None described the ethnicity of the nursing or midwifery students, although one study highlighted international students took part (see Supplementary information Table S2). The social media interventions used were Facebook (N=5), Twitter (N=3), YouTube (N=1), Google+ (N=1) and Ning.com (N=1). One study focused on multiple social media platforms (Duke *et al*. 2017). Ten social media interventions were designed and delivered by faculty, whereas two studies explored more student-led initiatives. Few studies reported the frequency, intensity or duration of the social media activities in detail. Those that did varied from one-off interventions, to daily or weekly posts over one week or several weeks or months (see Supplementary information Table S3).

Study outcomes varied widely. No quantitative studies demonstrated sufficient rigour to determine the efficacy of social media applications on student learning. Self-

reported knowledge and skills attainment and satisfaction with this mode of delivery were often used as outcomes measure. No study reported using a psychometrically tested valid and reliable tool to measure outcomes with the exception of Wu (2014). The educational interventions were either clinically-focused, dealt with professional development or university education. Some studies aimed to ascertain the prevalence of social media use among cohorts of students (Duke *et al*. 2017; Jones *et al*. 2016), which provided the largest samples in the papers that were assessed although they suffered from selection bias. There were six quantitative studies that used either surveys or questionnaires and in certain cases analytics data from the social media platform (see Supplementary information Table S4). The four qualitative studies utilized interviews, focus groups and postings from social media activity. Two mixed method studies employed interviews, focus groups, questionnaires and social media analytics data. Only two studies undertook experimental designs and five applied some type of theoretical framework. In all but one paper the social media interventions were used in academic settings, whereas in Wu (2014) the technology was applied in community practice.

Learning Outcomes

The results of the synthesis pointed towards several learning outcomes namely knowledge and skills (see Table 2 and Supplementary information Table S5). However, a minority of students reported learning nothing (Jones *et al*. 2016; Tower *et al*. 2014; Uppal *et al*. 2016), indicating social media may not suit everyone.

Knowledge

Firstly, students reported understanding clinical topics in more depth such as pregnancy and birth (Uppal *et al*. 2016) or disease processes (Thalluri & Penman, 2016) that were the focus of specific social media interventions. Other topics students appeared to grasp more generally included dementia, health promotion, organ donation and sustainability. Secondly, some students gained a better awareness of their profession such as what was expected during practice placement, how to successfully complete a degree qualification, codes of conduct or career opportunities. Thirdly, students learned personal insights such as what caused stressful experiences or found out information that benefited their personal life.

Skills

Some nursing and midwifery students stated they acquired new abilities such as research, communication, digital literacy, stress management and study skills from taking part in a social media intervention. For example, one study focused on using a Facebook group to improve students' confidence when learning clinical skills (Watson *et al*. 2014) while another used YouTube to educate midwifery students about safe birthing practices (Uppal *et al*. 2016).

Other Outcomes

Other outcomes identified from the synthesis included personal and professional networks and confidence (Table 2 & Supplementary information Table S5).

Personal and Professional Networks

A few studies reported that nursing students established personal and professional networks via the social media interventions. This could prove useful for future learning, graduate employability and career development.

Confidence

In two studies, students reported gaining confidence in how much they knew about a subject through their interactions online, as they could check what information faculty and peers had posted and benchmark their understanding or progress against this.

Perspectives of students, faculty and practice staff

Nursing and midwifery students and faculty expressed a range of opinions and experiences of social media in the included studies. These fell into two main themes, the learning process and antecedents to learning. As the views of practice staff in Jones *et al*. (2016) were not clearly identifiable they were excluded from the synthesis.

Learning Process

All twelve studies made some reference to mechanisms in the learning process. These were synthesized into nine subthemes; 1) virtual interaction; 2) social support; 3) speed of exchange; 4) social media users; 5) timeframe; 6) quality of information; 7) role modelling; 8) student-centred setting; and 9) functionality of social media (Table 2 & Supplementary information Table S5).

Virtual interaction

The different ways in which nursing and midwifery students interacted on social media appeared to influence learning. Several students reported passively viewing information posted by others or accessing shared links to educational resources. Others preferred a more dynamic approach and either posted information or questions themselves or responded to peers and faculty on social media, generating interactive discussions. This seemed to enable learning as it provided opportunities for feedback and reflection.

Social support

Several studies mentioned social support networks were formed online as students used features such as emoticons, pictorial representations of user's moods and comments to empathize with others and offer advice. This emotional assistance may have supported learning.

Speed of exchange

The speed at which students received a response to information posted on social media seemed to have an impact on learning. Several students described the positive effect that quick replies to their postings had such as aiding exam preparation, while slower or no responses were demotivating and caused some to disengage from the learning activity.

Social media users

The variety of people and organizations on social media that nursing, and midwifery students could connect with added another layer to how learning progressed. Interacting with different users such as peers, faculty and qualified nurses widened students' perspectives and seemed to help them learn new knowledge and skills. In addition, Ferguson *et al*. (2016) reported that international students may engage with a social media intervention slightly differently if they feel they do not belong to the community of learners.

Timeframe

The frequency and duration of online interactions varied from daily over several weeks to weekly interactions over several months and in many cases this was not reported. Duke *et al*. (2017) was the only study to explicitly report the intensity of virtual interaction, with the majority of nursing students (35.7%, N=120) spending 1-2 hours on social media, most of which was personal use (98%, N=331). One study did state some nursing students felt the excessive amounts of time they spent on Facebook was detrimental (Ferguson *et al*. 2016), which could have an impact on learning.

Quality of information

Both nursing and midwifery students noted that the quality of information on social media tended to vary. Misinformation could easily be shared and there was potential for inaccurate interpretation of information online. Derogatory comments or posting of inappropriate multimedia were also highlighted, which could detract from learning. On

the other hand, midwifery students emphasized that good quality videos posted on YouTube were a useful teaching tool (Uppal *et al*. 2016).

Role modelling

Another aspect of these virtual spaces that may have facilitated the learning process was some used the interactive platforms to model positive behaviours exhibited by diligent students.

Student-centred setting

A further element of the learning process appeared to be the relaxed, open feel of social media environments that students were often familiar with from personal use. Having a level of obscurity online also meant certain students were more comfortable engaging with peers and faculty, as it removed a level of anxiety felt in traditional classrooms.

Functionality of social media

A few studies reported restrictions with interacting virtually such as functional limitations of certain social media platforms and distractions students experienced while being online, which could detract from learning.

Antecedents to Learning

Ten studies reported several aspects required to deliver educational interventions via social media. These were categorized into four subthemes: 1) organization of the social

media intervention; 2) digital literacy and e-Professionalism; 3) personal motivation; and 4) flexible access (Table 2 & Supplementary information Table S5).

Organization of the Social Media Intervention

Whether a social media intervention was organized and explained to students in enough detail before and during its delivery appeared to affect the how much they engaged, which could have had an impact on learning. Jones *et al*. (2016) reported the timing of a Twitter activity was problematic for first-year nursing students as it occurred too early when they were still adjusting to university life. In addition, some students would have preferred social media as an optional extra rather than a mandatory component. On the other hand, Tower *et al*. (2014) reported that 87.5% of participants felt the format and duration of the Facebook activity was useful, demonstrating that a well-designed educational intervention could be successful.

Digital Literacy and e-Professionalism

Several studies highlighted that both students and faculty needed to have good computer skills to utilize social media, which may have affected engagement in teaching and learning. Drake and Leander (2013) suggested that once this initial learning curve is tackled social media can be relatively easy to navigate. e-Professionalism was also seen to be important to reduce risks associated with communicating online such as breaching confidentiality. Jones *et al*. (2016) proposed that digital professionalism become a core nursing skill, which could enable learning via social media.

Personal Motivation

The motivational level of students appeared to have an impact on how much they participated in the social media interventions. Some students were reported as being more motivated that others and a few became disinterested due to a lack of familiarity with the online tools or demanding workloads, especially around examination time.

Flexible access

Some studies reported the value students gained from being able to access the social media intervention at a time and place that suited their needs. This flexibility gave students more choice and control over when and where they accessed information. Some appreciated the ability to continue learning outside of normal classroom hours as they could tailor their education to fit their personal life. However, a few studies hinted that the availability of social media may be problematic (Mistry, 2011), with Drake and Leander (2013) reporting poor Internet services during bad weather reduced access for some students.

Developing a conceptual understanding of learning via social media

The application of Bandura's (1976) Social Learning Theory to the themes identified in the review facilitated the creation of a Social Media Learning Model (see Figure 2). This focuses on three interrelated mechanisms, the person, environment and behaviour, that affect one another as reciprocal determinism is a central tenet of SLT. Firstly, internal factors specific to a person or individual student such as their motivation and level of digital literacy and e-Professionalism can affect how they engage with a social media intervention and interact with others online. Secondly, the behaviour of other

social media users such as peers, faculty and practice staff can influence the type of virtual interaction that occurs and how the student responds to it to learn. By observing this the student can begin to imitate or role model learning behaviours. Thirdly, the wider environment such as the functionality of the social media platform, how accessible it is and whether the educational intervention is well organized can influence how people behave and students learn.

The actions of those on social media can help create an atmosphere of social support, within which learning seems to thrive. In addition, the quality of information on social media can be mediated by those who post it and the environment as offensive or illegal content can be removed. The learner may also be familiar with the platforms from personal use which appears to create a more student-centred setting. Finally, the timeframe reflects the frequency and duration with which students engage with the social media environment and how quickly others respond. As only 12 studies were included in the review, some aspects that affect learning via social media may be absent. Furthermore, Social Learning Theory discusses four mechanisms i.e. attentional, retention, motor reproduction and motivational processes that can affect individual learning. As only two themes, 'Personal motivation' and 'Digital literacy and e-Professionalism' link to motivational and motor reproduction processes respectively, the Social Media Learning Model is preliminary and warrants further development.

DISCUSSION

This is the first mixed study systematic review to identify and critically assess current evidence on social media in nursing and midwifery education. The findings illustrate

that social media interventions appear to have a positive effect on students who learned new knowledge and skills, a finding echoed in other research (Clifton & Mann, 2011; Morley, 2014). The review also indicates social media could improve nurses and midwives' confidence and expand their personal and professional networks, a point emphasised by Garrett & Cutting (2012).

However, the poor quality of many studies in the review and lack of experimental research meant it was difficult to draw decisive conclusions about the effect of social media on learning. Systematic reviews of social media in other educational fields such as medicine (Cheston *et al*. 2013; Sterling *et al*. 2017; Whyte & Hennessy 2017) and general health education (Smith & Lambert 2014) have also reported moderate to poor quality studies. They concluded there was limited evidence of the effectiveness of learning via social media. Therefore, more robust research that uses validated instruments to test and establish causal relationships between social media use and learning is needed to improve our understanding of this pedagogical tool.

Only a handful of studies in the review were theoretically grounded and none proposed a model of how social media might affect learning, a deficit noted in the pedagogical literature (Flynn *et al*. 2015). Hence, a preliminary Social Media Learning Model (SMLM) was developed from the review findings. Many e-learning, blended and other learning theories exist (Wenger, 1998; Kala *et al.* 2015; Flynn *et al*. 2015) but the unique features of social media such as its openness, student centredness and level of interaction warrant the creation of a specific model. Bandura's (1976) Social Learning Theory was used as it bridges behaviourist and cognitive theories and aligns

with the collaborative philosophy and engaging practices of social media, helping explain the complexities of how and why learning occurs via this technology. Future research could develop and expand the SMLM further and test it with nursing and midwifery students in different settings to create a more robust educational framework.

Strengths and limitations

A strength of this review is the systematic, rigorous approach that was taken to identify all relevant literature. A detailed protocol was published to enhance transparency and best practice guidelines such as ENTREQ and PRISMA were used to improve reporting. A robust sequential explanatory synthesis was undertaken to combine quantitative, mixed methods and qualitative results that reflect the current evidence for social media in nursing and midwifery education. A preliminary conceptual model was also developed and knowledge gaps identified to elicit further research that will aid our understanding of how social media interventions work and whether they produce positive learning and other outcomes that can influence professional practice and patient care.

However, several limitations should be noted. Firstly, only English language literature was searched for, which may have reduced the number of potentially relevant studies. Secondly, alternative sources of information such as grey literature, conference proceedings and theses were not included, which means some pertinent studies may have been missed. Thirdly, the geographical spread of primary research was from predominantly Western cultures and low-resource settings are missing. Therefore, some cultural and socio-economic variations in nursing and midwifery education may

be absent from the review findings. Fourthly, the included studies were heterogeneous in nature and employed weak study designs, meaning meta-analysis was not feasible and inadequate descriptions of the social media interventions limited the extent to which learning and other outcomes could be explained. Finally, the review team included studies regardless of their quality score and did not have access to the original pedagogical research and raw data. This may have resulted in the loss of some explanatory context and could have an impact on the quality of the findings, meaning the review results should be interpreted with caution.

Implications for practice and future research

Facebook and Twitter were the most commonly used social media applications in the articles reviewed, a finding reported by others, although blogs have been widely used for learning in the health education literature (Cheston *et al*. 2015; Sterling *et al*. 2017). Social media differs in the range of features and functionality it offers so nurse educators should explore other popular platforms such as Instagram and LinkedIn. This could yield important insights into how nurses and midwives use these digital tools to enhance knowledge, skills and networks throughout their professional careers. Social media interventions also need to be described in detail. Robust descriptions of how these worked were missing from studies in the review, a gap noted elsewhere (Davis *et al*. 2012). Researchers should develop guidelines for describing social media interventions to enhance the quality, replicability and transparency of educational research. The Template for Intervention Description and Replication (TIDieR) (Hoffman *et al*. 2014) is a 12-item checklist that could be used in conjunction with the characteristics of social media presented in this review (see Supplementary information Table S2) to provide more accurate accounts of these online tools. Most social media

applications in this review were designed and led by faculty. Educators could empower nursing and midwifery students to co-design, run and evaluate their own educational activities on social media, which could lead to improvements in learning.

Undergraduate nursing students were the most targeted population, with a dearth of research on postgraduate students, midwives and clinical practitioners. Wu (2014) was the only study to explore social media in a clinical setting, with Google+ being accessed by students in the community via tablet computers. One potential reason for this gap could be the negative perceptions of some nursing staff towards using mobile technology in clinical practice (O'Connor & Andrews, 2015), which might make this type of research more challenging. This issue was not reported in Wu (2014), indicating certain technologies may be more acceptable in some clinical environments (Walton *et al*. 2005). In addition, only a handful of studies stated the characteristics of participants so how students from different age groups, genders, ethnicities or socioeconomic backgrounds learn via social media was difficult to gauge. More research that explores diverse groups of nursing and midwifery students, operating in a range of clinical and academic contexts, is necessary. This would enable a more in-depth understanding of whether learning via social media is feasible and beneficial in higher and continuing education. Learning analytics from social media could also be utilized and combined with Big Data to understand the complexity of factors that affect learning on these electronic platforms (Daniel, 2016; O'Connor, 2017).

Assessing evidence from other professional disciplines could benefit our understanding of social media in nursing and midwifery education, especially as

interprofessional education in healthcare is coming to the fore (Mckay *et al*. 2014; O'Connor 2018). Common themes across the reviews from medical and general health education that are in keeping with the findings of this review include evaluating learning outcomes, understanding e-Professionalism, maximising flexible learning and online communities for social support, managing workload associated with virtual interactions and technical difficulties with some social media platforms (Cheston *et al*. 2013; Smith & Lambert, 2014; Sterling *et al*. 2017; Whyte & Hennessy, 2017). These would benefit from further interdisciplinary research to ensure we can learn lessons and implement pedagogical solutions that work for all types of healthcare students.

This review did not specifically examine or report implementation issues. The cost involved in an educational social media intervention, policies necessary to guide it and cultural implications have been noted in other reviews of social media in higher education (Tess, 2013; Wang & Meiselwitz, 2015). These could affect student's ability to learn and faculty's capability to provide this type of pedagogical tool. Therefore, further implementation research that spans education, practice and policy is needed, the findings of which should be incorporated into future versions of the Social Media Learning Model.

CONCLUSION

This review provides the first rigorous synthesis of social media in nursing and midwifery education, establishing the evidence base for this pedagogical tool. It also created a new conceptual model of learning via social media. This will benefit educators and students as it summarises the types of social media platforms currently being used,

the kinds of teaching and assessment tools employed and the link between this novel technology and learning. Social media has the potential to give students a more interactive experience as it promotes the creation, sharing and consumption of educational content and resources that could improve learning. The findings and recommendations of this review can help inform a future agenda for nursing and midwifery research, practice and policy that could help transform learning in higher and continuing education.

Abbreviations

ENTREQ - Enhancing Transparency in Reporting the Synthesis of Qualitative Research, MMAT - Mixed Methods Appraisal Tool, PICO – Population, Intervention, Comparison, Outcome, PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PROSPERO - International prospective register of systematic reviews, SNS - Social Networking Sites, SLT - Social Learning Theory, SMLM - Social Media Learning Model, TIDieR - Template for Intervention Description and Replication

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Figure 1: PRISMA diagram of the screening process

Identification

Records identified through database searching on CINAHL, EIRC, MEDLINE, PubMed Central & Scopus (n=1,883)

Records identified through additional search strategies i.e. reference and citation tracking (n=725)

Screening

Records after duplicates removed (n=867)

Title and abstract screening (n=867)

Records excluded (n=563)

Eligibility

Full-text screening (n=304)

Full-text excluded (n=296)

Population (n=34)
Intervention (n=124)
Outcomes (n=7)
Discussion piece (n=112)
Conference paper (n=13)
Review article (n=6)

Included studies (n=8)

Included studies from June 2017 search (n=4)

Included

Studies included in the review (n=12)
Quantitative studies (n=6)
Qualitative studies (n=4)
Mixed methods studies (n=2)

Figure 2: Social Media Learning Model (SMLM)

Virtual interaction
(viewing, posting &
responding to information)

Social media users

Speed of exchange

BEHAVIOUR

Quality of
information

Role
modelling

Social
support

Timeframe

Attentional
Processes

PERSON

ENVIRONMENT

Digital literacy &
e-Professionalism

Student
centred
setting

Functionality of
social media

Retention
Processes

Personal
motivation

Motor
Reproduction
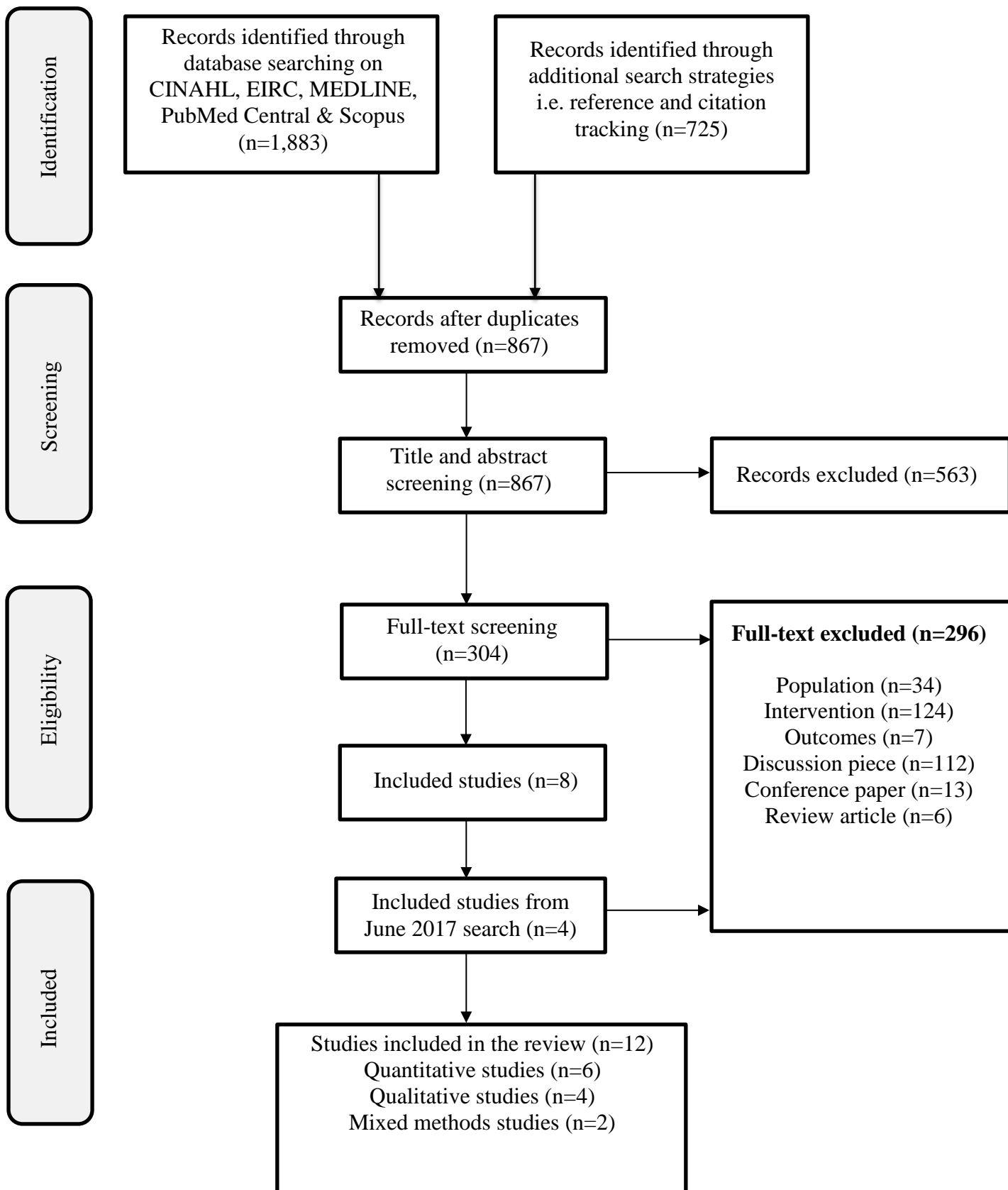Processes

Motivational
Processes

Flexible
access

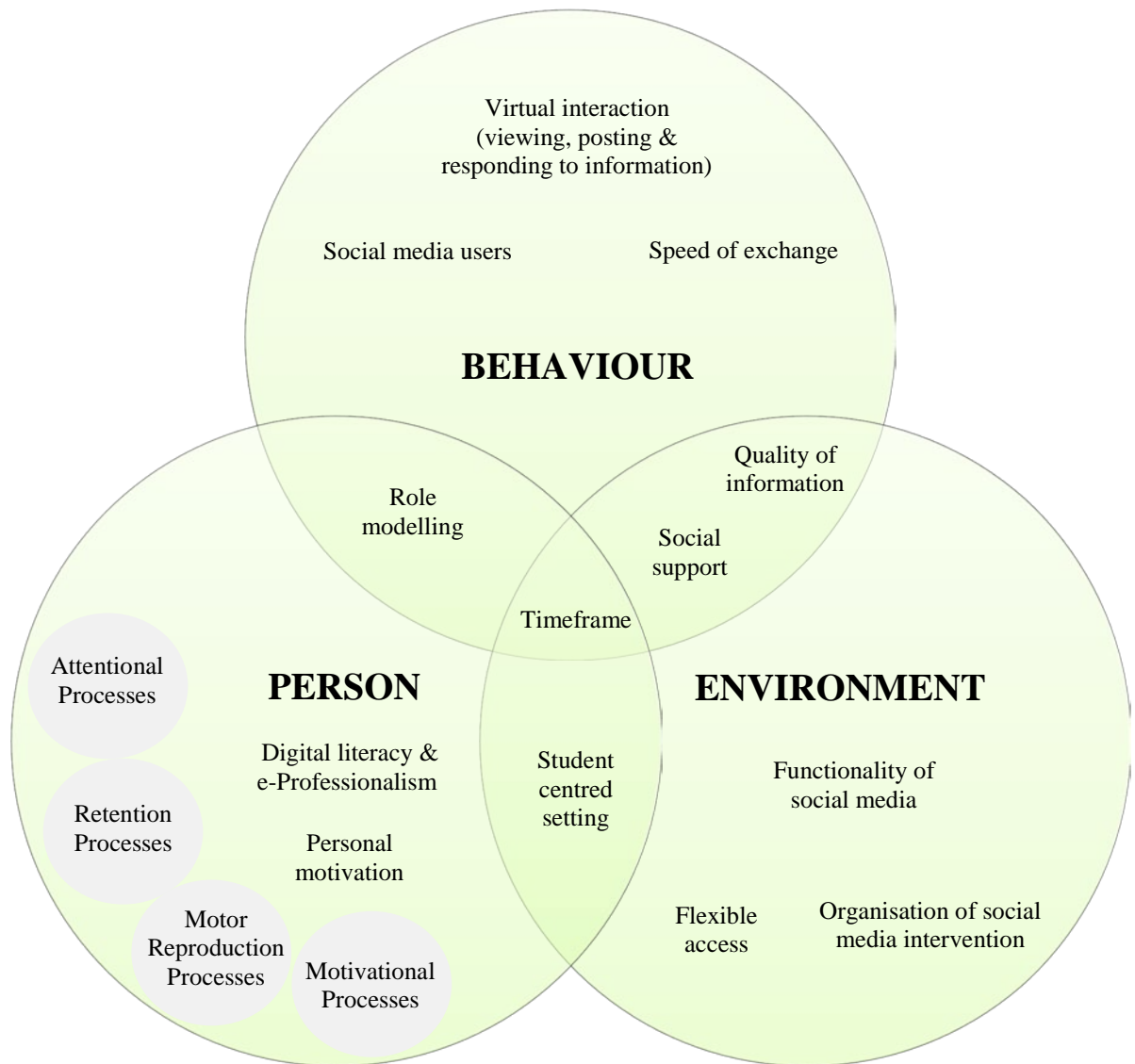Organisation of social
media intervention

Table 1: Overview of studies included in the review

Author(s), Year, Country	Research Aims & Theory / Framework	Methods & Quality	Participants	Social Media Intervention	Outcomes & Results	Setting / Context
Drake & Leander (2013), USA	Evaluate if students would improve their understanding of health inequalities (based on QSEN competencies) through the use of social networking sites.	Ethical considerations not reported. Online evaluation survey. Approach to analysis not described. MMAT = 25%.	Faculty from 11 baccalaureate nursing programs who were teaching community/public health nursing, along with 104 students participated.	SM Content: TV documentary about inequalities in health was viewed followed by an online discussion via a social networking site (Ning.com). SM Duration: 3 weeks. SM Delivered by: faculty.	Over 500 entries were posted on Ning.com. Post evaluation survey (n=7 faculty, n=34 students); Use of Ning added to students' understanding of the material; Faculty interaction on Ning was perceived was helpful; Most faculty & students would recommend the technology to other learners.	Academic setting. Undergraduate nursing education.
Duke et al (2017), Canada	Explore how students and faculty use social media in nursing education and examine e-Professionalism in this environment.	Ethical approval obtained. Descriptive study utilising a pre-existing social media survey (28 items including open ended questions). SPSS (non-parametric tests) used for quantitative data. Descriptive analytic approach to qualitative data. MMAT = 75%.	Convenience sample of Bachelor of Nursing students across four years of study and Practical Nursing students in a 16-month program (n=337) and faculty (n=29).	SM Content: mix of social media interventions e.g. Facebook, Google+, Instagram, text messaging, Twitter, YouTube. SM Duration: not reported. SM Delivered by: not clear, seems to be student led.	More than half the students used social media for formal and informal learning (58.5%) e.g. Facebook, YouTube, text messaging and Google+. Most students reported using social media to discuss academic problems. However, faculty used social media much less for education (27.59%) and mainly for personal use. Both students and faculty were aware of privacy settings and the need for professional behaviour in these environments.	Setting not explicitly stated. Undergraduate & postgraduate nursing education.
Ferguson et al (2016), Australia	Explore first year nursing students' experiences with	Ethical approval obtained. Qualitative approach using focus	Convenience sample of 1st year	SM Content: Facebook for general use e.g. sharing info &	Students interacted on Facebook to work on assignments, share resources, gain advice and support	Academic setting.

	social media to support transition to & engagement at university. Kift's Transition Pedagogy (2009).	groups (n=3). Thematic content analysis. MMAT = 50%.	nursing students (n=10).	discussing with peers. SM Duration: not reported (seems continuous). SM Delivered by: students.	around from peers and exchange clinical placement learning experiences. Some were self-conscious about posting information due to concerns over privacy and unprofessionalism but liked getting instant responses to queries from peers rather than wait for academic staff to return emails.	Bachelor of Nursing programme.
Jones et al (2016), UK	Examine the feasibility of using Twitter for assessment & explore students' opinions of its impact on learning.	Ethical approval obtained, although screenshots of Twitter users & comments included. Comparative case study. Surveys of students and Twitter followers (n=702 out of 4,143) were collected along with Twitter data. Descriptive statistics & general linear modelling done via SPSS & Excel. Open ended survey questions underwent thematic analysis. MMAT = 50%.	Cohort one: 1st years (adult, child & mental health) had lecture, webinar & used Twitter (n=261/450). Cohort 2: 1st years (adult only) had revised lecture, webinar, group work & used Twitter (n=87/97).	SM Content: use Twitter in combination with lectures and webinars to teach and assess the students on digital professionalism. SM Duration: 10 - 12 weeks. SM Delivered by: faculty.	Most student thought the inclusion of Twitter was worthwhile, especially those who had used Twitter previously (p=0.001) & were female (P=0.028). Most students also learned 'a lot 'or 'some things' from using Twitter (especially those that were older). Students learned about nursing & healthcare e.g. organ donation, health promotion, about being a student and personal development through their interactions on Twitter with peers & qualified health professionals. However, students felt they would not have used social media if it was not part of their assessment and some struggled with using it.	Academic setting. Undergraduate nursing education.
Mistry (2011), UK	Explore how useful Twitter is to engage	Ethical considerations reported. Phenomenological	Students on a BSc Critical Care course (n=12) and	SM Content: Four critical care scenarios were filmed in a clinical	Students felt Twitter was a good way to interact with other learners & the tutor as well as access additional	Academic setting.

	students in critical thinking. Salmon's (2004) model of e-moderating underpinned the study.	evaluation using the Content, Interactions, Attitudes and Outcomes (CIAO) framework. Interviews, focus group, questionnaire and Twitter data collected. Approach to analysis not described. MMAT = 25%.	students on a pre-registration nursing course (n=12).	simulation lab & discussed on Twitter. SM Duration: not reported. SM Delivered by: faculty.	resources. The online discussion helped students reflect, which reinforced learning. Students liked the convenience and flexibility of learning via Twitter. Some students thought combining the class with Facebook would be more engaging & felt restricted by the 140-character limit. The timing of the Twitter class coincided with other exams which caused some students to drop out of the online discussion.	Undergraduate nursing education.
Stephens & Gunther (2016), USA	Examine the effectiveness of Twitter in increasing resilience & sense of support and decreasing perceived stress in nursing students. Used Ahern's Model of Adolescent Resilience (2006).	Ethical approval obtained. Experimental design using post-intervention surveys of Twitter use. Content analysis. MMAT = 0%.	Junior level baccalaureate nursing students (n=70) at two universities randomly assigned to an experimental or control group (separate protected accounts on Twitter).	SM Content: Tweets about resilience, support & stress on Twitter. Control group received nursing trivia tweets. SM Duration: 6 weeks. SM Delivered by: faculty.	Twenty-three students completed the survey (experimental n=8; control n=15). Both groups were positive about the social media intervention (87.5% exp and 80% control). Control group reported that tweets helped them remember course content in an easily digestible format which prompted reflection on learning and further study. Some students reported that they were not Twitter users, forgot to check their account on a regular basis or did not participate as no one responded to posts.	Academic setting. Undergraduate nursing education.
Thalluri & Penman (2015), Australia	Explore Facebook as an educational tool for medical and nursing students	Ethical approval obtained. Post-intervention questionnaire of	Second year medical (n=148) and nursing (n=17) students.	SM Content: clinical case studies posted on Facebook for discussion and presentation.	Ten nursing students completed the questionnaire. They agreed Facebook enabled them to direct their own learning (80%), develop life-long	Academic setting.

	and how to develop good practice when using social media in teaching and learning.	Facebook use. Approach to analysis not described. MMAT = 25%.		<u>SM Duration</u>: not reported. <u>SM Delivered by</u>: faculty.	learning skills (80%), helped increase interest in the subject (100%), synthesise knowledge (30%) and improve research skills (60%).	Undergraduate education.
Tower et al (2014), Australia	Examine students' perceptions of using Facebook as a tool to support study.	Ethical approval obtained. Descriptive online survey (quantitative and qualitative questions). Descriptive analysis of quantitative data. Thematic analysis of qualitative data. MMAT = 25%.	Convenience sample of undergraduate year one nursing students (n=373, 70% of cohort) who were enrolled in a Medications and Safe Administration course.	<u>SM Content</u>: Facebook group for exam support for a bioscience assessment. <u>SM Duration</u>: 1 week. <u>SM Delivered by</u>: faculty.	89 students (24% response) completed the survey. Majority of students (88.6%) agreed or strongly agreed that FB supported them to prepare for exams. 88.9% of students felt taking part in the FB group developed their knowledge about the subject content. 92% got help from other students via the group and 87.5% perceived this collaboration as an effective way to learn, although 12.4% did not or were undecided. Most students thought FB was effective in guiding learning by facilitating interaction with peers, although a small minority (17%) did not or were undecided. Academic support received via FB was felt to be helpful and respectful (94.4%).	Academic setting.

Undergraduate nursing education. |
| Tower et al (2015), Australia | Develop and evaluate a Facebook forum to build self-efficacy in student learning. Study underpinned | Ethical approval obtained. Thematic analysis. MMAT = 50%. | Convenience sample of second year undergraduate nursing students (n=189) invited to | <u>SM Content</u>: Facebook group forum related to any aspect of study the students were undertaking. <u>SM Duration</u>: 13 | Students used the FB to gets answers to aspects of their study they found confusing such as how to complete assessments. The FB group was also used by students to manage stress with queries on study load, clinical | Academic setting.

Undergraduate nursing education. |

	by a constructionist epistemology, linked to Bandura's theory of self-efficacy.		join Facebook group.	weeks. SM Delivered by: faculty.	practice and misinformation receiving empathy and support from peers. FB was also used to clarify information and understanding on different areas of study as well as share resources and helpful information. This helped to build a student community.	
Uppal et al (2016), UK	Evaluate the use of YouTube clips of undisturbed births as a learning tool for student midwives.	Ethical considerations not reported. Approach to analysis not described. MMAT = 0%.	Groups of midwifery students (pre and post registration). Sample numbers not provided.	SM Content: Midwifery students viewed Knowles YouTube series of videos and screen shots of women giving birth. SM Duration: not reported. SM Delivered by: faculty.	Midwifery students were concerned about the professional use of social media and the exploitation of women online, especially for sexual titillation. They perceived the content as valuable tools to learn the physiology of undisturbed birth, which they could watch without the responsibility of participating in an actual birth and it encouraged discussion about normal birthing practices.	Academic setting. Undergraduate & postgraduate nursing education.
Watson et al (2016), Australia	Explore the experiences of nursing students using a Facebook group to improve confidence when learning clinical skills. Underpinned by Knowles' six assumptions of	Ethical approval obtained. A qualitative (interviews & field notes), hermeneutic phenomenology approach was used. Interviews were held after the Objective Structured Clinical Examination (OSCE).	First year nursing students (n=10) taking a Clinical Health Assessment course prior to the first clinical placement.	SM Content: a Facebook group to support a Clinical Health Assessment course was setup. SM Duration: 5 weeks. SM Delivered by: faculty.	Students felt FB enhanced social connectedness & made it easier to ask questions and get answers from peers having similar difficulties, which helped improve confidence. Nursing students thought FB provided a good platform to learn clinical skills, integrate theory, share resources and benchmark learning	Academic setting. Undergraduate nursing education.

	adult learning (Knowles, 1973).	Inductive analysis used. MMAT = 50%.			against the wider group. They also found it convenient and quick to use.	
Wu (2014), Taiwan	Examine Google+ as a learning community platform to support project-based learning in a public health education programme.	Ethics not reported. Experiment comparing a social media versus paper intervention. System satisfaction questionnaire, interviews (3 students & 1 nurse educator from intervention group only) and learning portfolio data collected. Lag sequential analysis of portfolio data from intervention group only. Analysis of questionnaire data not described. Qualitative analysis not described. MMAT = 50%.	Fourth year nursing students (n=36) enrolled in a public health education course undertaking home visits with a community health nurse. 18 in experimental group & 18 in control group.	SM Content: using Google+ on tablet computers for collaborative practice learning. SM Duration: 4 weeks. SM Delivered by: faculty.	Students used Google+ to share information, interaction with peers and post information (z scores) as it was quick, easy, fun and convenient to use. The tool also helped relieve stress, provided real-time support, enhanced confidence, help them integrate theory and practice and met their learning needs for the public health education course. Nurse educators could track and monitor student progress better using Google+ and provide immediate feedback. No comparison data between intervention and control groups reported.	Clinical (community) setting. Undergraduate nursing education.

Table 2: Participant quotes linked to themes

Section 2a: Learning and Other Outcomes		
Theme	**Subtheme**	**Participant Quotes or Author(s) Interpretations**
Learning Outcomes - Knowledge	Clinical knowledge	"Shows labour in its natural form makes you realise how nice, calm and natural it can be. Good idea!" (Uppal et al, 2016; Midwifery students; YouTube; Participant quote)
		"students agreed or strongly agreed that: Overall the use of Facebook enhanced my understanding of disease processes (n=8, 80%)" (Thalluri & Penman, 2016; Second year nursing students; Facebook; Author reporting)
		"a dementia trainer who tweets awareness about dementia which I found very useful" (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
	Professional knowledge	"yea very strong identity, on like Facebook with like the older years there's a lot of like PRO NURSING or PROUD TO BE A NURSE posts or kinda stuff and you're in first year and you're like 'what?'" (Ferguson et al, 2017; First year nursing students; Facebook; Participant quote)
		"useful to discuss the importance of a degree with other nurses and health care professionals…helpful to know that what I am doing matters and will make me a better nurse" (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
	Personal knowledge	"They made me take a few minutes to really reflect on who/what makes me happy and helps to relieve my stress" (Stephens & Gunther, 2016; Junior level baccalaureate nursing students; Twitter; Participant quote)
		"My little boy had gastroenteritis, I asked for some advice on getting his appetite back. I had a number of replies which I found very useful" (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
Learning Outcomes – Skills	Research skills	"Students agreed or strongly agreed that: The initiative further honed my research skills (n=6, 60%)" (Thalluri & Penman, 2016; Second year nursing students; Facebook; Author reporting)
	Digital literacy skills	"forcing us to twitter meant we could see how it was used professionally…" (Jones et al, 2016; First year nursing students; Twitter; Participant quote)
	Study skills	"83.2% of student participants felt their study skills related to subject content were guided in a supportive way" (Tower et al, 2014; First year nursing students; Facebook; Author reporting)
	Clinical skills	"Emotional. Realistic. Midwife very hands off. Shows bond between couple. Woman in control. Making verbal noises seems to help woman through pain" (Uppal et al, 2016; Midwifery students; YouTube; Participant quote)
Learning Outcomes – Other	Nothing	"17% of students were either undecided or did not agree that the Facebook group guided their study skills around subject content" (Tower et al, 2014; First year nursing students; Facebook; Author reporting)
Other Outcomes	Personal & Professional Networks	"Furthermore, while the graded group activity was concluded the Facebook group and Facebook 'friends' remained. These peers had the opportunity to further their friendships and professional learning collaborations in the future." (Thalluri & Penman, 2016; Second year nursing students; Facebook; Author interpretation)

Theme	Subtheme	Participant Quotes or Author(s) Interpretations
	Confidence	"the things that are being put up, you're checking you know about all of that and you keep running it through your head, so I guess it … makes you feel more confident I guess that you're on track" (Watson et al, 2016; First-year nursing students; Facebook; Participant quote)

	Section 2b: Learning Process	
Theme	**Subtheme**	**Participant Quotes or Author(s) Interpretations**
Virtual interaction	Passively viewing information	"I noticed that if any students were feeling anxious this site provided clear guidance and support that assisted to alleviate concerns, anxiety about learning and provided clear guidance....or provided explanations that enhanced comprehension. I found that just by reading the content I felt reassured about my comprehension of this subject." (Tower et al, 2014; First year nursing students; Facebook; Participant quote)
	Posting information or queries	"hello guys sorry about this silly question but I'm a bit confused u know about the pamphlet we have to do. Does it have to be about the [patient's] conditions in general or it actually has to be related to the case scenario of a 36 years old with osteoarthritis? Sorry if the question is too silly but I'm a bit confused with that! thanks" (Tower et al, 2015; Second year undergraduate nursing students; Facebook; Participant quote)
	Responding to others	"You notice around exam times that is when most people are actually on fb whether they are procrastinating about study or talking to other people regarding content required" (Tower et al, 2014; First year nursing students; Facebook; Participant quote)
Social support		"support on my nursing degree has been helpful…revision tips...lots of replies from other nursing students" (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
		"Sometimes it was to share information that exam marks or assignment results were available, with comments such as 'good luck all' but students also used the group to share resources such as useful websites or documents for assessment or advice about study. 'Study plan for second years, I did this to motivate me, hope it helps you too'." (Tower et al, 2015; Second year nursing students; Facebook; Author interpretation and participant quote)
Speed of exchange		"I found the Facebook group to be very helpful when preparing for the exam because it provided me with almost instant feedback to questions." (Tower et al, 2014; First year nursing students; Facebook; Participant quote)
		"No one responded so sometimes I didn't see the point." (Stephens & Gunther, 2016; Junior level baccalaureate nursing students; Twitter; Participant quote)
Social media users		"access to a wider community of healthcare professionals across the UK and the world whose valuable insights would be harder to come by otherwise." (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
Timeframe		"It kinda sucks my soul…it's a love hate relationship.…I just don't wanna be on it all the time. I don't use it on my phone" (Ferguson et al, 2017; First year nursing students; Facebook; Participant quote)
Quality of information		"People can be too relaxed and forget that these messages can be read by others or misinterpreted if they are too brief" (Duke et al, 2017; Bachelor of nursing, practical nursing students and faculty; Mix of social media; Participant quote)

Theme	Subtheme	Participant Quotes or Author(s) Interpretations
		"its good to keep up to date on news, but also important not to believe what social media says all the time" (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
Role modelling		"it filled me with confidence when other students also had the same doubts as me …like: 'okay, I'm not alone'. I could see where other students were either going right or wrong and stuff like that and seeing the fact that yeah, they were thinking in the same line that I was and maybe that was a more correct way. I had a lot of the same questions as everybody else on that page" (Watson et al, 2016; First year nursing students; Facebook; Participant quote)
Student-centred setting		"I think it is different asking on Facebook… like, in a lecture you are asking a question, you put your hand up, all eyes turn to you. You don't want to sound like an idiot asking a stupid question. Like on Facebook you know you can kind of like sort of morph the question to make it sound not stupid, but you know that you don't like have the time in class to say it right." (Watson et al, 2016; First year nursing students; Facebook; Participant quote)
		"laid back process and resourceful information obtained" (Stephens & Gunther, 2016; Junior level baccalaureate nursing students; Twitter; Participant quote)
Functionality of social media		"students felt restricted with the 140-character limit" (Mistry, 2011; Pre-registration nursing and critical care students; Twitter; Author interpretation)
		"Facebook is distracting. … I don't like Facebook as a medium for learning." (This student explained how it led to visiting her Facebook account and being distracted from the task at hand.) (Thalluri & Penman, 2016; Second year nursing students; Facebook; Participant quote and author interpretations)

Section 2c: Antecedents to Learning		
Theme	**Subtheme**	**Participant Quotes or Author(s) Interpretations**
Organisation of the social media intervention		"Clarify more fully the use of this program to enhance the communications between students to ensure their understanding and progress." (Thalluri & Penman, 2016; Second year nursing students; Facebook; Participant quote)
		"To be honest I don't think creating a Twitter account should be obligatory for completion of the module. . ." (Jones et al, 2016; Undergraduate nursing students; Twitter; Participant quote)
Digital literacy and e-Professionalism		"The familiarity of Facebook and students' habitual use of it were aspects found to trigger interest in using the learning strategy and thereafter sustained ongoing participation." (Watson et al, 2016; First year nursing students; Facebook; Author interpretation)
		"yeah because now employers can look at Facebook and easily find you and you have to be a lot more cautious" (Ferguson et al, 2017; First year nursing students; Facebook; Participant quote)
Personal motivation		"If this is to succeed we all need to be committed at the start. We all need to be aware that this could really help us support one another. It will work, but it needs everyone's buy in" (Mistry, 2011; Pre-registration nursing and critical care students; Twitter; Participant quote)
Flexible		"It's just ready information that's there when you need it, because people have Facebook on their phones and everything and you can get an answer wherever you might be." (Watson et al, 2016; First year nursing students; Facebook; Author interpretation)

| access | | "I actually enjoyed the issues that were raised over Twitter. [But] I don't think enough people were able to get into it for it to be utilized to its [full] potential" (Mistry, 2011; Pre-registration nursing and critical care students; Twitter; Participant quote) |

Supplementary information Table S1: Participants characteristics from the studies included in the review

Author(s), year, country	Social media intervention	No of participants	Types of participants	Gender	Age (years)	Ethnicity	Socioeconomic status
Drake & Leander (2013), USA	Ning.com	Faculty numbers not reported. 104 students.	Nursing faculty and community or public health nursing students.	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.
Duke et al (2017), Canada	Facebook, Google+, Instagram, text messaging, Twitter, YouTube	337 nursing students and 29 faculty.	Bachelor of Nursing students across four years of study and Practical Nursing students and faculty.	n=333 female, n=31 male	n=141 17-20 years, n=142 21-25 years, n=30 26-30 years, n=26 31-39 years, n=13 40-49 years, n=14 50+ years	Ethnicity not described.	Socioeconomic status not reported.
Ferguson et al (2016), Australia	Facebook	10	1st year nursing students (8 domestic, 2 international)	n=5 female n=5 male	1 mature student	Ethnicity not described.	n=7 high school education
Jones et al (2016), UK	Twitter	547 1st year nursing students.	1st year adult (n=428), child (n=41) & mental health (n=78) nursing students.	n=497 female n=50 male	n=164 under 21 years, n=155 21-25 years, n=139 26-35 years, n=69 over 35 years	Ethnicity not described.	Socioeconomic status not reported.
Mistry (2011), UK	Twitter	24	Students on a BSc Critical Care and pre-registration nursing course.	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.
Stephens & Gunther (2016), USA	Twitter	70	Junior level baccalaureate nursing students.	Gender not described.	19-23 years	Ethnicity not described.	Socioeconomic status not reported.
Thalluri & Penman (2015), Australia	Facebook	148 medical and 17 nursing students.	Second year medical and nursing students.	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.

Tower et al (2014), Australia	Facebook	373	Undergraduate year one nursing students.	Gender not described.	Age not reported.	Ethnicity not described.	40% from lower socioeconomic backgrounds, 35% had Overall Position (OP) greater than 11.
Tower et al (2015), Australia	Facebook	89	Second year undergraduate nursing students.	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.
Uppal et al (2016), UK	YouTube	Sample numbers not provided.	Groups of midwifery students (pre and post registration).	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.
Watson et al (2016), Australia	Facebook	10	First year nursing students (all domestic students).	n=7 female n=3 male	Age not reported.	Ethnicity not described.	n=3 high school graduates, n=4 vocational training, n=2 tertiary education
Wu (2014) , Taiwan	Google+	36	Fourth year nursing students.	Gender not described.	Age not reported.	Ethnicity not described.	Socioeconomic status not reported.

Supplementary information Table S2: Characteristics of social media interventions

Study	Account or profile	Online communication i.e. view, post & respond to information	Displays of emotion (emojis, likes)	Follow & link content (hashtag & tags)	Follow other users or groups	Groups (open or closed) & their size	Moderate (block users, remove content)	Notification feature (push to app or electronic device)	News feature or ads (daily updates, trending)	Privacy settings (open, closed, mixed)	Private chat or message function
Drake & Leander, 2013		X				X					
Duke et al, 2017		X								X	
Ferguson et al, 2017	X	X			X	X	X			X	X
Jones et al, 2016	X	X		X	X					X	
Mistry, 2011	X	X								X	
Stephens & Gunther, 2016	X	X			X	X				X	
Thalluri & Penman, 2016		X			X	X					
Tower et al 2014		X				X					
Tower et al, 2015		X	X			X					
Uppal et al, 2016		X									
Watson et al, 2016		X	X					X	X		
Wu, 2014	X	X				X		X			

Total	5	12	2	1	4	7	1	2	1	5	1

Supplementary information Table S3: Summary table of quantitative studies

Study, Year, Country	Study Design Participants	Outcomes Measured	Intervention group(s)	Control group	Outcome data
Drake & Leander 2013 USA	No explicit study design reported (survey used). Nursing students using Ning.com to learn about health inequalities.	Outcome measures of the survey not explicitly reported. Validity of tool not reported.	1) Nursing students n=104 made at least four discussion posts over 3 weeks 2) Faculty n=11 facilitated online discussions	None	Descriptive statistics summarising single survey variables only. 88% agreed ning.com added to level of knowledge of subject, 82% found faculty helpful & added to the level of discussion.
Duke *et al.* 2017 Canada	Descriptive study. Students and faculty who were using a mix of social media interventions in nursing education.	28-item survey, content validity reported. Use and views on social networking (type, frequency & purpose of social media use, privacy, eProfessionalism, advantages & disadvantages of social media)	1) Nursing students n=337 completed survey 2) Faculty n=29 completed survey	None	96% of students used social media to discuss academic problems compared to 28% faculty (p<0.000). 95% of students used Facebook for informal learning compared to 45% faculty (p<0.000). 67% students used Facebook for formal learning compared to 17% faculty (p<0.000).
Jones *et al.* 2016 UK	Comparative case study using survey & Twitter data.	6-item student survey on digital professionalism and Twitter use. Followers survey but outcome measures not explicitly reported. Survey instruments not validated.	Cohort 1: 1st year nursing students (adult, child & mental health) n=261	None	Most students thought Twitter was (probably or very) worthwhile. Proportion was higher for the 2nd compared to the 1st cohort (88.0% vs. 70.1%; $\chi2 = 31.5$; d.f. = 3; P < 0.001). Most students learned 'a lot'

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	Nursing students using Twitter for learning & assessment.			Cohort 2: 1st year adult nursing students n=87 Twitter followers n=702/4143	or 'some things' from Twitter use, many more than the first cohort (70.8% vs. 44.4%; χ 2 = 23.4; d.f. = 3; P < 0.s001).
Mistry 2011 UK	Mixed method design (questionnaire, social media data, interviews and focus groups). Nursing students using Twitter to engage in critical thinking.	Explicit measures not reported, validity of tool not reported. Learning outcomes (indicative measures of learning), Perceptions and attitudes to social media use.	Nursing students n=12	None	No quantitative data reported.
Stephens & Gunther 2016 USA	Experimental design using post-intervention surveys. Nursing students using Twitter to increase resilience & support and decrease stress.	Online survey about whether Twitter messages were useful or not. Measures not explicitly reported, validity of the tool not reported.	1) Experimental group (n=8) received weekly educational Twitter messages over 6 weeks 2) Control group (n=23) received weekly Twitter messages over 6 weeks		Only one descriptive statistic summarising a single survey variable was reported. 87.5% of the experimental and 80% of the control group responded positively to the social media intervention.
Thalluri & Penman 2016 Australia	No explicit study design reported (post intervention survey used). Nursing students using Facebook as an educational tool.	25-item survey measuring a range of outcomes, validity of tool not reported. Outcomes included opportunities to learn with peers, to direct own learning, develop life-long learning	Nursing students n=17	None	Descriptive statistics summarising single survey variables only. Students agreed Facebook enabled them to direct their own learning (80%), develop life-long learning skills (80%), increase interest in the subject (100%), synthesise

					knowledge (30%) and improve research skills (60%).
		skills, engage with course content, increase interest in subject etc.			
Tower *et al.* 2014 Australia	Descriptive online survey. Nursing students using a Facebook group as a study support tool.	Quantitative and qualitative questions, validity of tool not reported. Outcome measures not explicitly described. Tables 1-4 report some measures e.g. social media as an innovate study support tool, to guide learning for assessment, promote peer learning, engage staff for study support.	Nursing students n=89/373 (Response rate 24%)	None	Descriptive statistics summarising single survey variables only. 88.6% agreed or strongly agreed Facebook supported exam preparation. Students reported the Facebook group helped developed their subject knowledge (90%) and study skills (83%).
Wu 2014 Taiwan	Mixed method experimental design (post intervention questionnaire & interview and learning portfolio data). Nursing students using Google+ in clinical practice (community) to record.	Student satisfaction questionnaire (outcomes not reported). Criteria & construct validity of the tool mentioned. Chronbach's α >0.7 for each dimension. Learning behaviour (S, I, P, E, L, R & V) reported using Google+ analytics of learning portfolio use.	Nursing students n=18 used tablet PCs with Google+ over 3 weeks	Nursing students n=18 used paper-based system over 3 weeks	S - searching for & querying data; I - interacting with peers & educators; P - posting data; E – editing data; L – location positioning, R – reading information; V - recording activities via pictures or video. Significant relationship exists between the following behaviours (based on z score): I->S = 3.23, I->I = 4.69, P->I = 5.97, E->I = 2.85, R-I = 3.72, S->P = 5.23, I->P = 4.37, E->P = 2.16, V->P = 2.02, S->E = 2.08, I->R = 2.23. All $p < .05$ with a 95% level of confidence.

Supplementary information Table S4: Concepts within and between studies

	ANTECEDENTS TO LEARNING				LEARNING AND OTHER OUTCOMES			
Study	Organisation of the social media intervention	Digital literacy & e-Professionalism	Personal motivation	Flexible access	Knowledge	Skills	Establish networks	Confidence
Drake & Leander, 2013	X	X (Dl) + X (eP)		X	X			
Duke et al, 2017		X (Dl) + X (eP)			X			
Ferguson et al, 2017		X (eP)		X	X		X	
Jones et al, 2016	X	X (Dl) + X (eP)	X		X	X	X	
Mistry, 2011			X	X	X			
Stephens & Gunther, 2016		X (Dl)			X	X		
Thalluri & Penman, 2016	X			X	X	X	X	
Tower et al, 2014	X			X	X	X		
Tower et al, 2015					X			X
Uppal et al, 2016		X (eP)			X	X		

Watson et al, 2016	X (Dl)		X	X			X	X
Wu, 2014				X	X			
Total	**4**	**5 (Dl) + 5 (eP)**	**2**	**6**	**12**	**7**	**4**	**2**

LEARNING PROCESS

	Virtual interaction	Social support	Speed of exchange	Social media users	Timeframe	Quality of info	Role modelling	Student-centred setting	Functionality of social media
Drake & Leander, 2013	X			X					
Duke et al, 2017	X	X			X	X			X
Ferguson et al, 2017	X	X	X	X	X	X		X	
Jones et al, 2016	X	X		X	X	X		X	
Mistry, 2011	X		X	X					X
Stephens & Gunther, 2016	X		X		X			X	
Thalluri & Penman, 2016	X		X	X			X		X

Tower et al 2014	X	X	X	X	X			X	
Tower et al, 2015	X	X		X			X		
Uppal et al, 2016	X					X			
Watson et al, 2016	X	X	X				X	X	
Wu, 2014	X								
Total	**12**	**6**	**6**	**7**	**5**	**4**	**3**	**5**	**3**

Supplementary File S1: Search strategy for PubMed

Search	Search terms were modified for use across multiple databases
#1	Search nurs*
#2	Search midwi*
#3	#1 OR #2
#4	Search baccalaureate
#5	Search student*
#6	Search undergraduate
#7	Search postgraduate
#8	Search educat*
#9	Search teach*
#10	Search train*
#11	Search learn*
#12	#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11
#13	Search Social Networking [MeSH term]
#14	Search Academia.edu
#15	Search Bebo
#16	Search Facebook
#17	Search Flickr
#18	Search Google+
#19	Search Instagram
#20	Search LinkedIn
#21	Search Myspace
#22	Search PatientsLikeMe
#23	Search Pinterest
#24	Search Tumblr

#25	Search Twitter
#26	Search YouTube
#27	Search "social media"
#28	Search "social network"
#29	Search "Web 2.0"
#30	Search YouTube
#31	#13 OR #14 OR …. #30
#32	#3 AND #12 AND #31

Supplementary File S2. Mixed Method Appraisal Tool (MMAT) scores of the studies included (n=12)

Study Included, author(s)	Types of mixed methods study components or primary studies	Screening questions and methodological quality criteria	Yes	No	Can't tell	Comments
Drake & Leander (2013)	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?		*		RQ's not explicit in the paper.
		Do the collected data allow address the research question (objective)?			*	RQ's not explicit in the paper.
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?	*			Source of the sample seems reasonable but sampling procedure not explicit.
		Is the sample representative of the population understudy?			*	No inclusion/exclusion criteria stated. Non-participation not discussed.
		Are measurements appropriate?		*		Survey not described in any detail.
		Is there an acceptable response rate (60% or above)?		*		Mixed response rate 64% from faculty (n=7) but only 33% from nursing students (n=104).
	MMAT Score					25%
Duke et al (2017)	Screening questions (not included in score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*			Yes.
		Do the collected data allow address the research question (objective)?	*			Yes.
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?	*			Sampling strategy outlined.
		Is the sample representative of the population understudy?	*			Sample included 4 years of nursing students (range of ages & genders).
		Are measurements appropriate?			*	Content validity of survey only.
		Is there an acceptable response rate (60% or above)?	*			100% response rate as paper-based survey used in class (n=337) & faculty (n=29) emailed survey.
	MMAT Score					75%
Ferguson et	Screening	Are there clear qualitative and quantitative research questions,	*			Yes.

al, 2016	questions (not included in MMAT score)	or a clear mixed methods question?			
		Do the collected data allow address the research question (objective)?	*		Yes.
	Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?		*	Three focus groups lasting 45-60 mins but only 10 nursing students in total.
		Is the process for analyzing qualitative data relevant to address the research question (objective)?	*		Thematic content analysis by two researchers. Software analysis package not described.
		Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	*		Prior use of social media not explored. Facebook use initiated by students not faculty. Context for international & male nursing students discussed but social media use during clinical placement absent. University digital platform mentioned but similarities/differences with other higher education institutions in Australia is missing.
		Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?		*	Researcher who conducted FGs not known to students, but reflexivity not discussed & FG questions not made available.
	MMAT Score				50%
Jones et al (2016)	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*		Yes.
		Do the collected data allow address the research question (objective)?	*		Yes.
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?	*		Sampling strategy not explicit. All first-year nursing students included.
		Is the sample representative of the population understudy?	*		Not clear why only 1st year nursing students sampled but demographics representative of genders & ages in nursing. Non-participation not discussed.
		Are measurements appropriate?		*	Measures clear e.g. survey questions given but validity not known.
		Is there an acceptable response rate (60% or above)?		*	Student response rate 58% (cohort 1, n=261/450) and 89.7% (n=87/97). Professional response rate 16.9%

					(n=702/4143).
	MMAT Score				50%
Mistry, 2011	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*		Yes.
		Do the collected data allow address the research question (objective)?		*	Data collection methods are not very clear. Not sure if they would be able to address all the aims of the project.
	Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	*		Interviews with students and course designers although not well described.
		Is the process for analyzing qualitative data relevant to address the research question (objective)?		*	No analysis method described.
		Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?		*	Some aspects of context are discussed but not well linked to the study's findings.
		Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?		*	No mention of research influence or reflexivity.
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?		*	Quantitative questions not clear, sample is of nursing students.
		Is the sample representative of the population understudy?		*	Only 24 students in the whole sample. No participant characteristics report or what the total population might be.
		Are measurements appropriate?		*	Questionnaire not described in any detail.
		Is there an acceptable response rate (60% or above)?		*	Response rate to questionnaire not reported.
	Mixed	Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?		*	No mention of integrating quantitative and qualitative components of the study.
		Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?		*	No mention of integrating quantitative and qualitative components of the study.
		Is appropriate consideration given to the limitations associated		*	No mention of integrating quantitative and qualitative

Study	Category	Question	Yes	No	Can't tell	Comment
		with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?				components of the study.
	MMAT Score					25%
Stephens & Gunther, 2016	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*			Explore the effectiveness of Twitter to increase resilience/support and decrease stress in nursing students.
		Do the collected data allow address the research question (objective)?		*		Poor description of data collection and analysis procedures.
	Quantitative randomized controlled (trials)	Is there a clear description of the randomization (or an appropriate sequence generation)?		*		Randomization process not described in any detail.
		Is there a clear description of the allocation concealment (or blinding when applicable)?		*		Allocation concealment not discussed although the experimental and control groups had separate Twitter accounts to follow.
		Are there complete outcome data (80% or above)?		*		Response rate to the survey was 34% (n=23).
		Is there low withdrawal/drop-out (below 20%)?			*	Withdrawal / drop-out not reported.
	MMAT Score					0%
Thalluri & Penman, 2015	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*			Yes.
		Do the collected data allow address the research question (objective)?		*		Poor description of data collection and analysis procedures.
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?			*	Sampling strategy not reported. Small sample of nursing students.
		Is the sample representative of the population understudy?			*	Only 10 nursing students responded to the survey. Participant characteristics not reported.
		Are measurements appropriate?	*			Survey questions stated but the validity of questionnaire items was not reported.
		Is there an acceptable response rate (60% or above)?		*		Response rate was 59% from nursing students (n=10).
	MMAT Score					25%
Tower et al, 2014	Screening questions (not included in	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*			Yes.
		Do the collected data allow address the research question	*			Yes.

	MMAT score)	(objective)?			
	Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question?	*		Convenience sample of 1st year BN students (n=373).
		Is the sample representative of the population understudy?		*	Age, gender & branch of nursing not specified. Some aspects of socioeconomic status & education level mentioned. No comparison to 2nd, 3rd or 4th year students.
		Are measurements appropriate?		*	Survey questions not provided. Validity of the items not reported.
		Is there an acceptable response rate (60% or above)?	*		Response rate was 24% (n=89) students.
	MMAT Score				25%
Tower et al, 2015	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*		Yes.
		Do the collected data allow address the research question (objective)?		*	Self-efficacy related to learning is mentioned in the aim of the project, but this isn't measured in any definitive way.
	Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	*		198 2nd year nursing students accepted study invitation to Facebook forum. Non-participation not reported.
		Is the process for analyzing qualitative data relevant to address the research question (objective)?	*		Thematic analytic approach.
		Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	*		Participant characteristics not reported making it difficult to link context with findings. Few contextual issues discussed.
		Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	*		Researcher reflexivity not reported but two researcher coded data.
	MMAT Score				50%
Uppal, 2016	Screening questions (not included in	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?	*		Yes.
		Do the collected data allow address the research question		*	No formal qualitative data collection method was used.

Study	Category	Question				Comments
	MMAT score)	(objective)?				General discussion in class about YouTube videos.
	Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	*			No formal qualitative data collection method was used. General discussion in class about YouTube videos. Number and types of participants not described except we know they are student midwives.
		Is the process for analyzing qualitative data relevant to address the research question (objective)?	*			Approach to analysis not reported.
		Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	*			Contextual issues not discussed.
		Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	*			Researcher reflexivity not reported.
	MMAT Score					0%
Watson et al, 2016	Screening questions (not included in MMAT score)	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?		*		Yes.
		Do the collected data allow address the research question (objective)?			*	Only 10 nursing students interviewed. Not sure if this provides rich enough data.
	Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?			*	Sample not described, only 10 participants & non-participation not reported.
		Is the process for analyzing qualitative data relevant to address the research question (objective)?		*		Yes.
		Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?		*		Some discussion on the use of Facebook to learn clinical knowledge/skills compared to face-to-face. Other contextual factors not discussed in detail.
		Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	*			Researcher reflexivity not discussed.
	MMAT Score					50%
Wu, 2014	Screening questions (not	Are there clear qualitative and quantitative research questions, or a clear mixed methods question?		*		Yes. Found in abstract.

included in MMAT score)	Do the collected data allow address the research question (objective)?		*		Yes.
Qualitative	Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?			*	Interviews conducted with faculty & students, although small in number (n=4).
	Is the process for analyzing qualitative data relevant to address the research question (objective)?	*			Analysis not described.
	Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?			*	Some discussion of context but not strongly linked to the study's findings.
	Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?	*			Research influence or reflexivity not reported.
Quantitative descriptive	Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)?		*		Sampling strategy not explicitly stated, but sample is somewhat relevant to RQ.
	Is the sample representative of the population understudy?			*	Only 36 4th year students participated, 18 of which used the social media intervention. No participant characteristics reported.
	Are measurements appropriate (clear origin, or validity known, or standard instrument)?		*		Previously used questionnaire used & criteria & construct validity performed.
	Is there an acceptable response rate (60% or above)?			*	Response rate not reported.
Mixed methods	Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?	*			No mention of integrating quantitative and qualitative components of the study.
	Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?	*			No mention of integrating quantitative and qualitative components of the study.
	Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?	*			No mention of integrating quantitative and qualitative components of the study.
MMAT Score					50%

Supplementary File S3: Phase 2 of Narrative Synthesis - Methodological and Conceptual Triangulation

Methodological triangulation of included studies*

Study	SM intervention	Data collection	Analysis	Effect of methodology - data collection and analysis - on study results (within studies)	Between studies
Drake & Leander, 2013	Ning.com	Quantitative approach using a survey.	Approach to analysis not described.	A copy of the survey questions was not provided or how they were designed was not described making it difficult to assess how this data collection tool influenced the study's results. How the data was analysed was also not described in the paper, so we are unable to evaluate how this could have influenced the study's findings.	DATA COLLECTION Two mixed studies used qualitative approaches - interviews (n=2) & focus groups (n=1). The qualitative questions used were not reported in both cases, but two concepts appeared across both studies (interactive nature & speed of interaction or information exchange) indicating similar questions may be have been used. Both mixed studies did not generate any unique themes or any more concepts in the preliminary synthesis than the quantitative studies.
Duke et al, 2017	Facebook, Google+, Instagram, text messaging, Twitter, YouTube	Quantitative approach using pre-existing social media survey (28 items both quantitative and qualitative items).	SPSS (non-parametric tests) used for quantitative data. Approach to qualitative data analysis was not described although "participant responses were coded" was mentioned.	The survey was adapted from Hall et al (2013) who reviewed literature on 4 primary research studies to identify concepts for the survey; 1) social networking use, 2) online privacy and profile, 3) professionalism and social networking, and 4) demographic data. Twelve items had attitudinal statements using 5-point Likert scales. Content and face validity along with piloting the survey with pharmacy students was undertaken for the original survey, not the version used in this study. This survey had 4 sections; 1) demographic data, 2) type, frequency and purpose of social media use, 3) online privacy and social media profile, and 4) e-Professionalism. Fifteen were 5-point Likert scales, 11 were limited response and 2 were open ended questions. Definitions of formal and informal learning were provided on the survey. A copy of the survey questions was not provided making comparison against the study's results challenging. Results seem to mirror the sections in the survey, except data related to "social media profile" is not really presented and it is not clear what this means.	
Jones et al, 2016	Twitter	Quantitative approach using a three-phase comparative case study. Surveys of students and	Descriptive statistics & general linear modelling done via SPSS & Excel.	All 6 survey questions on students' opinions of digital professionalism and Twitter were provided, although how they were designed is not described. 5-point Likert scales were used for two questions giving students a range of positive and negative responses to choose from. Only one question specifically mentioned learning and one gave students an opportunity to provide a more detailed response about what aspects of Twitter they found useful. The quantitative results and four main themes reported seem to reflect the questions asked.	

		Twitter followers (n=702 out of 4,143) were collected along with Twitter data.	Open-ended survey questions underwent thematic analysis.	Six of the seven questions from the follower's survey were not provided, with the exception of the last question which was "Do you have any comments about the PUNC project?". How the followers questions were devised was also not explained, making it challenging to understand how this survey affected the comments provided by followers which are presented in Table 6. Twitter data such as the number of tweets, retweets, replies and information on the number and pattern of accounts following and followed by were collected and reported.	Seven studies used quantitative approaches; questionnaires (n=2) and surveys (n=5).
Mistry, 2011	Twitter	Phenomenological evaluation using interviews, focus groups, questionnaires and Twitter data collected.	Approach to analysis not described.	The questionnaire, focus group and interview questions and a description of how they were designed was not provided. This made it challenging to assess how these data collection tools influenced the study's results. In addition, how the data was analysed was not described in the paper, so we are unable to evaluate the impact this may have had on the findings reported.	Open-ended questions were used in four surveys or questionnaires, which generated qualitative data (n=13 concepts). Two concepts (digital literacy & e-Professionalism and quality of information)
Stephens & Gunther, 2016	Twitter	Quantitative approach using an experimental design using post-intervention surveys of Twitter use with a control and experimental group.	Content analysis.	The survey questions or a description of how they were designed was not provided. However, the authors did explain that participants were asked if they considered Twitter messages to be helpful and to explain why or why not. They also asked students what they liked and did not like about the experience. This made it slightly difficult to analyse how this data collection tool influenced the study's results. The results seem to mirror the concepts the authors asked about, although the learning process or learning outcomes did not seem to be explicitly asked about. Only qualitative content analysis was used as no frequencies or other quantitative data is presented, indicating that open-ended questions were used. The two themes identified are quite basic i.e. positive or negative experiences of students and may not reflect the depth of the data gathered.	were unique and common across three and two of the studies with open-ended questions. Both surveys and questionnaires used a range of quantitative questions and measurements e.g.
Thalluri & Penman, 2016	Facebook	Quantitative approach using a post-intervention questionnaire of Facebook use.	Approach to analysis not described.	A description of how the questionnaire was designed was not provided but all 25 questions that were asked were included in the paper. Likert (n=21) and open style (n=4) questions about using Facebook were used. All 21 statements in the Likert scale had positive connotations and 3-points "Strongly agree", "Agree" and "Neither strongly agree or agree" were used. This could have limited students' ability to provide negative feedback on their experiences of using Facebook. A 5-point scale including "Strongly disagree" and "Disagree" could provide more scope for a range of different answers. In addition, some of	Likert-scales. As varying types of quantitative data collection tools were used, no between study factors were

				the open-ended questions such as "The best things about the use of Facebook are:" could be seen as leading participants to give more positive responses. A contrasting question about the negative things about the use of Facebook was not asked. However, students were asked for "Additional Comments" where some gave negative feedback. These limitations in the data collection tools could have influenced the study's results towards being more positive but the results mirror the questions asked. However, some of the results are confusing as the language used does not always correlate with the 3-points used in the Likert scales. How the data was analysed was also not described, so we are unable to assess how this could have influenced the study's findings.	identified as affecting the preliminary synthesis.

DATA ANALYSIS
Three studies did not describe their analytical process at all, and two did not describe how the qualitative data was analysed. Thematic (n=2) and content analysis (n=1) were used in three studies, which are very similar methods. These studies contributed slightly more concepts to the preliminary synthesis than others, which may be attributable to a more robust qualitative analytical process.

Quantitative data were analysed in four studies using a mixture of non-parametric tests (Mann-Whitney, Kruskal-Wallis, Chi- |
| Tower et al 2014 | Facebook | Quantitative approach using an online survey (quantitative and qualitative questions). | Descriptive analysis of quantitative data.

Thematic analysis of qualitative data. | A description of how the online survey was developed was not provided. Nineteen quantitative questions using a 5-point Likert scale (ranging from 'strongly agree' to 'strongly disagree') and 1 open-ended qualitative question was used. None of the specific survey questions were provided but the survey themes are discernible from the tables of results provided i.e. innovation (3 items), guiding learning (7 items), peer learning (3 items), engaging with staff (6 items). The results mirror the survey themes and are clearly reported but not understanding how the questions were designed and not having access to the specific survey questions that were asked limits the ability to assess their impact on the study's results fully. | |
| Wu, 2014 | Google+ | Mixed methods approach using a system satisfaction questionnaire, interviews (3 students & 1 nurse educator) and learning portfolio data were collected from | Lag sequential analysis.

Approach to qualitative analysis not described. | The system satisfaction questionnaire was based on Chen et al (2007) who used a 24-item feedback form, covering 5 areas, to evaluate learner's satisfaction with a personalised e-learning system to learn mathematics. How this tool was developed was not described and no reliability testing of the questionnaire was reported in Chen et al (2007). The Wu (2014) questionnaire consisted of 6 aspects: 1) hardware and software services, 2) learning interest, 3) learning module, 4) teacher–student interaction, 5) learning attitude, and 6) learning effectiveness. It was reviewed for criteria and construct validity and used a 5-point Likert scale. The specific questions were not provided and it is not clear how some aspects map to the Chen et al (2007) tool. In addition, some of the statistical results e.g. analysis of satisfaction are not reported, the authors just summarise the findings although they do appear related to the aspects of the questionnaire. The interview questions that were asked were also not provided. How the qualitative data was analysed was not described and no | |

experimental and control groups.	participant quotes were provided in the paper, making it difficult to assess how these could have influenced the study's findings.		Square) (n=1), descriptive statistics and general linear modelling (n=1), descriptive analysis (n=1) and lag sequential analysis (n=1). As varying types of quantitative analysis were used no between study factors were identified as affecting the preliminary synthesis.

*Above studies are mixed and quantitative studies only

References
- Hall, M., Hanna, L., Huey, G. (2013). Use and views on social networking sites of pharmacy students in the United Kingdom. American Journal of Pharmaceutical Education, 77 (1), 9. doi: 10.5688/ajpe7719
- Chen, C.M., Hsieh, Y.L., Hsu, S.H. (2007). Mining learner profile based on association rule for web-based learning diagnosis. Expert Systems with Applications, 33(1), 6–22. doi: 10.1016/j.eswa.2006.04.025

Conceptual triangulation of included studies*

Study	SM Intervention	Underpinning Theory or Conceptual Framework	Description of Theory or Conceptual Framework	Effect of conceptual framework / theory on study results (within studies)	Between studies
Drake & Leander, 2013	Ning.com	NA	NA	NA	
Duke et al, 2017	Facebook, Google+, Instagram, text messaging, Twitter, YouTube	NA	NA	NA	Of the two studies that incorporated a conceptual framework or theory in some way, there seemed to be no apparent overlap or influence between studies on the themes identified during the preliminary synthesis. The frameworks or models were all used in different ways, with only one influencing the preliminary themes (n=18 codes) and the initial conceptual model that was developed (n=4 themes / concepts) (Mistry, 2011).
Jones et al, 2016	Twitter	NA	NA	NA	
Mistry, 2011	Twitter	Salmon's (2004) model of e-moderating	The five stages: 1) access and motivation, 2) online socialisation, 3) information exchange, 4) knowledge construction, and 5) development. This aids in understanding how learning (needs of students) is supported and facilitated by educators in online environments.	This study has organised its qualitative results based on the 5 stages of the e-moderating framework, which seems appropriate to use. Although the type of analysis conducted is not described a deductive approach seems apparent. Stage 1 access & motivation results seem appropriate and relevant to the framework. The paper uses a different heading "Forming relationships" for stage 2 which is called "Online socialisation" in the framework. How students actually formed relationships via Twitter is not really presented in this results section bar a suggestion of integrating it with Facebook. Some of Stage 3 of the results seem more relevant to stage 2 in terms of online socialisation and stage 4 in terms of knowledge construction than stage 3 information exchange. Stage 4 knowledge construction reports mainly on learners who dropped out of the Twitter activity that how students learned about critical care through social media interactions. Stage 5 Development seems to focus more on the use of Twitter than building	

				knowledge and a deeper understanding around critical care. Negative/deviant data that falls outside the framework is not discussed and no critique of Salmon's framework is provided.
Stephens & Gunther, 2016	Twitter	Ahern's Model of Adolescent Resilience (2006) as adapted from Rew and Horner's (2003) youth resilience framework was used.	Ahern's model consists of three main concepts in resilience; 1) Risk (internal and external factors), 2) Protection (individual and sociocultural), and 3) Interventions, each of which have several sub-sections.	There seems to be no link made between Ahern's model of resilience and the results presented in the paper. None of the concepts in Ahern's model are mentioned in the results or discussion section. Presumably the model underpinned the educational material that was developed and posted on Twitter and it was not used to analyse and understand student learning on this subject. The paper does state at the beginning that a detailed account of the study will be provided in a future publication and this article focuses on the experience of using Twitter, which may go some way to explaining this how the model was applied. Negative/deviant data that falls outside the Ahern's model was not discussed and no critique of the model is provided.
Thalluri & Penman, 2016	Facebook	NA	NA	NA
Tower et al 2014	Facebook	NA	NA	NA
Wu, 2014	Google+	NA	NA	NA

*Above studies are mixed and quantitative studies only

References

- Ahern, N.R. (2006). Adolescent resilience: An evolutionary concept analysis. Journal of Pediatric Nursing, 21(3), 175-185.
- Rew, L., Horner, S.D. (2003). Youth resilience framework for reducing health-risk behaviours in adolescents. Journal of Pediatric Nursing, 18(6), 379-388.
- Salmon, G. (2004). *E*-Moderating: the Key to Teaching and Learning Online (2nd Ed). London: Routledge Falmer.

Supplementary File S4: Weight of Evidence*

Study	A: Soundness of methodology	B: Appropriateness of research design for answering the review questions	C: Relevance of the particular focus of the study for answering the review questions	D: Overall weight that can be given to the evidence in relation to the review focus
Drake & Leander, 2013	Low	Medium	Low	Low
Duke et al, 2017	Medium	Low	Low	Low
Jones et al, 2016	Medium	Medium	Medium	Medium
Mistry, 2011	Low	Medium	Low	Low
Stephens & Gunther, 2016	Low	Medium	Low	Low
Thalluri & Penman, 2016	Low	Medium	Medium	Medium
Tower et al 2014	Low - Medium	Medium	Medium	Medium
Wu, 2014	Low - Medium	Medium	Low	Low

Supplementary File S5: Narrative Synthesis Phases 2, 3 and 4

Phase 2: Developing a Preliminary Synthesis of Findings of Included Studies

The tools and techniques for developing the preliminary synthesis of findings of included studies are outlined below.

No	Technique	Description of Technique	Researchers Comments	Apply technique?
1	Textual descriptions	A descriptive paragraph on each included study. These descriptions should be produced in a systematic way, including the same type of information for all studies if possible and in the same order. It may be useful for recording purposes to do this for all excluded studies as well.	This technique was deemed unnecessary for the review due to the use of detailed data extraction and quality assessment tools and the tabulation of included studies, which was felt summarised each individual study succinctly and enabled some initial comparisons to be made.	No
2	Groupings and clusters	The included studies might be grouped at an early stage of the review, though it may be necessary to refine these initial groups as the synthesis develops. This can also be a useful way of aiding the process of description and analysis and looking for patterns within and across groups. It is important to use the review question(s) to inform decisions about how to group the included studies.	The studies were organised by the intervention (type of social media application) and target population (type of learner e.g. undergraduate, postgraduate) as the 'primary cluster' and then the context (academic or clinical setting) as the 'secondary cluster' within these. Outcome was unsuitable as a grouping due to the diversity of measured used.	Yes
3	Tabulation	A common approach, used to represent data visually. The way in which data are tabulated may affect readers' impressions of the relationships between studies, emphasising the importance of a narrative interpretation to supplement the tabulated data.	Tabulation was used (based on the groupings outlined above) to represent the study data visually under the following headings; 1) Authors, Year, Country, 2) Research Aims, 3) Study Design and Type of Social Media Intervention, 4) Sample and Setting, 4) Analysis, 5) Findings, 6) Quality. This technique aided the preliminary synthesis.	Yes
4	Transforming data into a common measure	In both narrative and quantitative synthesis, it is important to ensure that data are presented in a common measure to allow an accurate description of the range of effects.	This technique was deemed unsuitable for the review due to the different types of interventions, populations, contexts and outcomes used, making this type of quantitative synthesis unfeasible.	No
5	Vote-counting as a descriptive tool	Simple vote-counting might involve the tabulation of findings according to direct of effect. More complex approaches can be developed both in terms of the categories used and by assigning different weights or scores to different categories. However, vote-counting can disregard sample size and be misleading. So, the interpretation of the results must be approached with caution and subjected to further scrutiny.	Vote counting was used to calculate how often initial concepts (from the thematic analysis) appeared in the main themes, so the frequency of these could be determined to inform the preliminary synthesis.	Yes

No	Technique	Description of Technique	Researchers Comments	Apply technique?
6	Translating data: thematic analysis	A technique used in the analysis of qualitative data in primary research can be used to systematically identify the main, recurrent and/or most important (based on the review question) themes and/or concepts across multiple studies.	Thematic analysis was used to identify the main concepts across the quantitative and mixed methods studies by drawing on primary data (e.g. qualitative comments from surveys or questionnaires) and the author's interpretation of the data reported in the results and discussion section of each study.	Yes
7	Translating data: content analysis	A technique for compressing many words of text into fewer content categories based on explicit rules of coding. Unlike thematic analysis, it is essentially a quantitative method, since all the data are eventually converted into frequencies.	This technique was deemed unnecessary for the review due to the use of thematic analysis and vote counting to identify concepts and record their frequency.	No

Phase 3: Exploring relationships within and between studies

The tools and techniques for exploring relationships within and between studies are outlined below.

No	Technique	Description of Technique	Researchers Comments	Apply technique?
1	Graphs, frequency distributions, funnel plots, forest plots and L'Abbe plots	There are several visual or graphical tools that can help reviewers explore relationships within and between studies. These include presenting results in graphical form; plotting findings (e.g. effect size) against study quality; plotting confidence intervals; and/or plotting outcome measures.	This technique was deemed inappropriate for the review given the predominantly qualitative data present in the quantitative and mixed methods studies and the heterogeneity of quantitative outcome measured used.	No
2	Moderator variables and subgroup analyses	This refers to the analysis of variables which can be expected to moderate the main effects being examined in the review. This can be done at the study level, by examining characteristics that vary between studies (such as study quality, study design or study setting) or by analysing characteristics of the sample (such as subgroups of participants).	This technique was impractical to carry out using some participant characteristics e.g. age, gender, ethnicity as they were not reported in most studies. However, some population level aspects (nursing discipline, educational level) were explored as were the social media interventions (components), learning outcomes and types of educational settings to identify differences within and between studies, where possible.	Yes
3	Idea webbing and conceptual mapping	Involves using visual methods to help to construct groupings and relationships. The basic idea underpinning these approaches is (i) to	Concept mapping was undertaken based on the results of the tabulation, thematic analysis, vote counting and	Yes

		group findings that are empirically and/or conceptually similar and (ii) to identify (again on the basis of empirical evidence and/or conceptual/theoretical arguments) relationships between these groupings.	subgroup analysis to develop an initial model of the key concepts and where possible their relationships. In addition, an average of the MMAT scores based on the data from the studies in each theme was calculated to gauge the quality of concepts that were identified.	
4	Translation as an approach to exploring relationships	Translation focuses on seeking a common rubric for salient categories of meaning, rather than the literal translation of words or phrases. There are two types; 1) reciprocal translation (accounts are directly comparable), and 2) refutational translation (the accounts are oppositional).	Meta-ethnographic techniques were not used as the review team did not have this specialist expertise and the other techniques used were deemed appropriate for a robust preliminary synthesis.	No
5	Qualitative case descriptions	Any process in which descriptive data from studies included in the systematic review are used to try to explain differences in statistical findings. For example, why one intervention outperforms another apparently similar intervention or why some studies are statistical outliers.	This technique was not feasible due to the variation in outcome measures used and statistical results reported in the included studies.	No
6	Investigator / methodological triangulation	Triangulation makes use of a combination of different perspectives and/or assessment methods to study a particular phenomenon. This could apply to the methodological and theoretical approaches adopted by the researchers undertaking primary studies included in a systematic review, e.g. investigator triangulation explores the extent to which heterogeneity in study results may be attributable to the diverse approaches taken by different researchers. Triangulation involves analysing the data in relation to the context in which they were produced, notably the disciplinary perspectives and expertise of the researchers producing the data.	Investigator triangulation was not practical to undertake due to the lack of data in the included studies on the disciplinary perspective or expertise of the study authors. Methodological triangulation was carried out and data collection tools examined both within and between studies in relation to the quality and rigour of the evidence collected and how this may have influenced the findings studies.	No Yes
7	Conceptual triangulation		When reported, the theories or frameworks underlying the included studies were reviewed to determine their influence on the study's results. The concepts from the theories were compared and contrasted with the themes identified in the preliminary synthesis to further enhance the process.	Yes

Phase 4: Assessing the robustness of the synthesis

The tools and techniques for assessing the robustness of the synthesis are outlined below.

No	Technique	Description of Technique	Researchers Comments	Apply technique?
1	Weight of Evidence e.g. the EPPI approach	In the EPPI approach relevance criteria are set for a particular review and studies are then assessed for relevance using these. Those that are judged to be relevant are then assessed for methodological quality.	This technique was used to judge the soundness of methodology, appropriateness of the research design for answering the review questions, relevance of the particular focus of the study for answering the review questions and overall weigh that can be given to the evidence in relation to the review focus.	Yes
2	Best Evidence Synthesis	BES deals with the robustness in terms of the methodological quality of included studies though the application of inclusion criteria. Only studies that meet minimal standards of methodological adequacy and relevance to the review are included, and information is extracted in a common standard format from each study, with a systematic approach to the assessment of study quality and study relevance.	This technique was not used as it is primarily focused on the selection of studies and not determining the quality of the synthesis.	No
3	Use of validity assessment – Centre for Disease Control (CDC) approach	Use of specific rules to define weak, moderate or good evidence. An example is the approach used by the US Centre's for Disease Control and Prevention although there are many other evidence-grading systems available. Decisions about the strength of evidence are explicit although the criteria used are often debated.	This technique was not used as the review team felt the Weight of Evidence (EPPI approach) in combination with critical reflection was sufficient to assess the robustness of the preliminary synthesis.	No
4	Reflecting critically on the synthesis process	Use of a critical discussion to address methodology of the synthesis used (especially focusing on its limitations and their potential influence on the results); evidence used (quality, validity, generalisability) – with emphasis on the possible sources of bias and their potential influence on results of the synthesis; assumptions made; discrepancies and uncertainties identified; expected changes in technology or evidence (e.g. identified ongoing studies); aspects that may have an influence on implementation and effectiveness in real settings. Such a discussion would provide information on both the robustness and generalisability of the synthesis.	This technique was used and the review team met to discuss the independent preliminary synthesis that was conducted, which was finalised after discussing these issues.	Yes
5	Checking the synthesis with authors of primary studies	It is possible to consult with the authors of included primary authors of primary studies in order to test the validity of the interpretations developed during the synthesis and the extent to which they are supported by the primary data.133 The authors of the primary studies may have useful insights into the possible accuracy and generalisability of the synthesis; this is most likely to be useful	This technique was not possible given the time and resources available for the synthesis and review.	No

when the number of primary studies is small. This is a technique that has been
used with qualitative evidence.

Supplementary File S6: Preferred Reporting of Items for Systematic Reviews and Meta-Analysis - The PRISMA Statement

Section	#	Checklist Item	Reported on Page #
Title			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
Abstract			
Abstract	2	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.	1 & 2
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4 & 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5 & 6
Methods			
Protocol and registration	5	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.	6
Eligibility criteria	6	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	6 & 7
Information sources	7	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.	6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	File S1

Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	7 & 8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	7 & 8
Risk of bias in individual studies	12	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.	NA
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Table 1 & Table S3
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	8 & 9
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	NA
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	NA
Results			
Study selection	17	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.	7
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations	9 - 11 Table 1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	NA
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	Table S3
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	11 - 18
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	NA
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	NA
Discussion			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).	18 & 23
Limitations	25	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).	20 & 21
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	23
Funding			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	24

Supplementary File S7: Enhancing transparency in reporting the synthesis of qualitative research - the ENTREQ statement

No	Item	Guide & Description	Review (qualitative studies only)
1	Aim	State the research question(s) the synthesis addresses.	1) What is the effect of social media applications on learning among nursing and midwifery students? 2) What are the perspectives of nursing and midwifery faculty, students and practice staff towards using social media for this purpose?
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis and describe the rationale for choice of methodology (e.g. meta-ethnography, thematic synthesis, critical interpretive synthesis, grounded theory synthesis, realist synthesis, meta-aggregation, meta-study, framework synthesis).	A sequential explanatory approach was used to synthesise data as this is a mixed study review. Narrative synthesis was employed during the first phase due to the heterogeneity of included studies. The initial thematic framework developed was used in the second phase and the framework approach (Ritchie & Spencer, 1994) applied to code qualitative data to the set of themes. The third phase involved reflection and reinterpretation of the synthesis process and outputs to build a conceptual model of learning via social media.
3	Approach to searching	Indicate whether the search was pre-planned (comprehensive search strategies to seek all available studies) or iterative (to seek all available concepts until they theoretical saturation is achieved).	A systematic search using predefined terminology relevant to the review topic was undertaken.
4	Inclusion criteria	Specify the inclusion/exclusion criteria (e.g. in terms of population, language, year limits, type of publication, study type).	Population - nurses or midwives at any stage of education Intervention - social media platform (SNS based) used for educational purposes Control – None Outcome - change in students' professional or personal knowledge or skills or the perspectives of students, faculty and practice staff towards learning via social media Language – English language only Year – no limitations Study type – all study designs; only peer reviewed primary research studies were included

5	Data sources	Describe the information sources used (e.g. electronic databases (MEDLINE, EMBASE, CINAHL, psycINFO, Econlit), grey literature databases (digital thesis, policy reports), relevant organisational websites, experts, information specialists, generic web searches (Google Scholar) hand searching, reference lists) and when the searches conducted; provide the rationale for using the data sources.	Five electronic databases were used - PubMed Central, MEDLINE, CINAHL, Scopus and ERIC. Reference and citation tracking of the included studies was also undertaken. No date limitations were employed. Searches were undertaken in January 2016 and an update ran in June 2017.
6	Electronic Search strategy	Describe the literature search (e.g. provide electronic search strategies with population terms, clinical or health topic terms, experiential or social phenomena related terms, filters for qualitative research, and search limits).	Please see Supplementary File S1 for a detailed search strategy.
7	Study screening methods	Describe the process of study screening and sifting (e.g. title, abstract and full text review, number of independent reviewers who screened studies).	Titles and then abstracts were screened by two independent reviewers, who then undertook full paper screening (also done independently). A third reviewer helped resolve disagreements, where necessary.
8	Study characteristics	Present the characteristics of the included studies (e.g. year of publication, country, population, number of participants, data collection, methodology, analysis, research questions).	Please see Table 1 in the paper.
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion (e.g. for comprehensive searching, provide numbers of studies screened and reasons for exclusion indicated in a figure/flowchart; for iterative searching describe reasons for study exclusion and inclusion based on modifications t the research question and/or contribution to theory development).	Please see Figure 1 the PRISMA diagram in the paper.
10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings (e.g. assessment of conduct (validity and robustness), assessment of reporting (transparency), assessment of content and utility of the findings).	The Mixed Methods Appraisal Tool (MMAT) by Pluye *et al*. (2009) was use to appraise included studies. Please see Supplementary File S2 for MMAT scores of the included studies.
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings (e.g. Existing tools: CASP, QARI, COREQ, Mays and Pope [25]; reviewer developed tools; describe the domains assessed: research team, study design, data analysis and interpretations, reporting).	MMAT measures a number of quality indicators including the suitability of the research question to the study's design, the robustness of the methods used, the quality of reporting and applicability of results. The robustness of the synthesis was assessed using the Weight of Evidence approach (EPPI-Centre, 2002). Please see Supplementary File S2 and S4 of the review paper
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.	Two reviewers undertook the MMAT quality assessment separately.

13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.	Please see Supplementary File S2 of the review paper. No studies were excluded based on the results of the quality appraisal as weak studies can yield relevant results.
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies? (e.g. all text under the headings "results /conclusions" were extracted electronically and entered into a computer software).	Data were extracted by two independent reviewers. Data were analysed from the results and discussion sections of the included studies. Both participant quotes and author interpretations were extracted and analysed.
15	Software	State the computer software used, if any.	RefWorks was used to download search results and facilitate management of research data. Microsoft Excel and N-Vivo were used during the three stages of the synthesis process to code data, develop themes and create the conceptual model.
16	Number of reviewers	Identify who was involved in coding and analysis.	The two independent reviewers were SOC and SJ, with RB used as a third independent reviewer to resolve any disagreements. The primary author, SOC, undertook the synthesis process and corresponded with the research team to discuss the analysis.
17	Coding	Describe the process for coding of data (e.g. line by line coding to search for concepts).	Qualitative analysis was undertaken line by line to identify initial codes or concepts in the data.
18	Study comparison	Describe how were comparisons made within and across studies (e.g. subsequent studies were coded into pre-existing concepts, and new concepts were created when deemed necessary).	Multiple techniques from narrative synthesis e.g. groupings and clusters, tabulation, vote counting, translating data through thematic analysis, subgroup analysis (qualitative), and methodological and conceptual triangulation were used to make comparison within and across studies. Please see Table 1, Supplementary information Tables S1, S2, S3 and S4 and Supplementary File S3 and S5 in the review paper.
19	Derivation of themes	Explain whether the process of deriving the themes or constructs was inductive or deductive.	Themes were derived via an inductive process as they emerged through iterative rounds of qualitative coding and analysis.
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs and identify whether the quotations were participant quotations or the author's interpretation.	Please see Table 2 in the review paper which provides quotations from primary studies and identifies their source.
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies (e.g. new interpretation, models of evidence, conceptual models, analytical framework, development of a new theory or construct).	Please see Figure 2 in the review paper for a detailed conceptual model of how students learn via social media. Supplementary information Table S2 also provides useful insights into the characteristics of social media interventions.