



***Innovative methods in clinical hospital placements or clerkships for
nursing and medical students –
a scoping review***

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Introduction

“The times are a’ changing.” The 20th century has seen an explosive development in medical diagnostics, treatment, and care. The incidence of a number of large “lifestyle” associated diseases, such as diabetes and coronary heart disease as well as cancer have increased. Likewise, the diversity, complexity, and subsequent effectiveness of treatments for these diseases are increasing, as well as the population’s expectancy of access to these treatments. These facts, combined with other factors, have increased the life expectancy of the populations of European countries. As the general population is ageing, and surviving, the population of patients with one, two, or more, chronic conditions, requiring medical treatment, follow-up and care are likewise increasing. Unfortunately, so are the costs of treatments. For a number of years, economists, politicians, and healthcare professionals have noted that the increase in allocated resources have been insufficient to cover the increased demand, describing a gap between resources and needs. Invariably, this has led to a continuing process of reform and innovation in the way the healthcare systems are handling patient care. A general shift from admission in hospital wards towards more outpatient service clinics have been present for quite a number of years. More recently, a shift from face-to-face consultation towards increasing online or virtual consultations has begun, with the advent of reliable technological platforms for this method. This development is present both in the primary and secondary healthcare sectors.

The demographics of the healthcare workforce is also changing. Due to expected shortages in the workforce due to retirement and attrition, an increased uptake in healthcare students in schools, colleges and universities has been ongoing for some years. Also new professions have evolved. This increases the need for placements. For some years the demand for and availability of quality placement have been disproportionate. The number of students per clinical educator and institution is increasing. This has led some educators to look for alternative ways of maintaining adequate clinical education of healthcare students.

Generally speaking, the healthcare sector has three pillars of responsibility: The clinical diagnosis, treatment, and care of patients; the research of effective methods for diagnosis, treatment and care of patients; and the effective education of healthcare professionals to meet the needs and demands of the current and the future generations of patients.

This review is focused on the third pillar: the effective education of healthcare professionals. As the hospitals of the future are changing their methods and models of care for patients, this will invariably lead to a need for changing the methods and models of education of healthcare professionals. Healthcare professionals encompass a large number of professions involved in direct patient care, such as physicians, nurses and therapists, as well as a number of allied professions. However, the two primary groups directly involved in the diagnostic workup, the treatment, and the care of patients are the medical doctors and the nurses. Therefore, this review will focus on the hospitals’ involvement in the education of nurses and doctors to meet the future needs and demands of the population.

Generally, the education of nurses and doctors can be divided into three periods: undergraduate; postgraduate; and continuous professional development. The undergraduate education is a combination of

academic theoretical education (college or university) combined with a number of placements or clerkships for practical education. The nomenclature of such placements, as well as the precise composition can change from country to country or between educational institutions. Also, the collaboration between individual academic institutions and clinical hospitals may vary greatly.

In the academic environment, the past 2 decades have seen the introduction of teaching and learning methods based on constructivist and more recently social learning theories, with the advent of problem-based learning and small-group teaching with case-based learning, as well as training the positivist research philosophy, with the increasing focus on evidence-based medicine. Likewise, the assessment for learning has, in some places changed from traditional written and oral examinations to OSCE examinations.

In the clinical hospital environment, the learning is focused on workplace learning theories, like communities of practice (Wenger et al) and socio-cultural learning theories (Vygotsky), as well as skills training and mastery (Halstead; Peyton). However, given the short timeframe these methods may not be well suited to endow learners with more than a token familiarity with the daily clinical routine. A recent focus has been on the lack of real-world experience of newly graduated healthcare students and their risk of “practice shock” and poor integration into the postgraduate work environment. Recently this has led to explorations of new models of internships, like the “Longitudinal Integrated Clerkship” and the “Dedicated Education Units”.

Aims

This review is a part of the “Internships in Future Hospital (HEAL)”-framework. The framework comprises representatives from healthcare professions educational institutions from five different EU countries. The overall aim of the HEAL-project is to develop and test an innovative framework for high quality internships of healthcare professionals for the future. As an initial part of this framework, the HEAL consortium partners formulated several questions for a review of the literature, in order to inform the subsequent development of innovative solutions suited for testing. The questions were as follows:

Question 1: What is already known about innovative learning methods, including current existing solutions?

Question 2: What seems to be important preconditions for successful internships?

Question 3: What innovative methods exist and have been used in health professions education and internships?

Question 4: What are the barriers and promoting factors for these innovative methods?

The scope of these questions was further elaborated on and delineated during a HEAL partnership meeting in May 2022. The partner group also discussed the scope and type of review, as well as potential methods of interest, informing the subsequent research question, review protocol and inclusion/exclusion criteria. Based on these deliberations the review group formulated the following research question:

What innovative methods in undergraduate healthcare professional hospital-based internships have been evaluated in the literature, including preconditions, promoting, and detracting factors?

As we sought to map a broad, emerging field of novel methods for change in medical education with a potential multitude of methods we decided that a traditional systematic review and meta-analysis was inappropriate at present (Munn, 2018). Arksey and O'Malley (2005) described an alternative type of review, the scoping review, suited for examining the extend and range of research and summarizing and disseminating research for policy makers, as well as identifying gaps in the literature ripe for future research. This initial framework has been refined a number of times (JBI Manual) and a reporting method has been developed (PRISMA-Scr). This framework forms the theoretical foundation for the method used in this scoping review.

The literature search, inclusion criteria and exclusion criteria were formulated on the basis of the *Population-Concept-Context* (PCC) Model (JBI Manual). Each item was informed by the initial foundation protocol and the partner workshop as presented below.

Population

There is a multitude of different healthcare professionals. Nurses of various educational levels and specialities, medical doctors, midwives, dieticians, physiotherapists, physician assistants, and pharmacist, to name some professions. Furthermore, the education and professional responsibilities of may differ from country to country. Although most of the healthcare professions have some form of clinical education in hospitals and may have different takes on innovative approaches in relations to their placements, the two major groups involved in clinical education in hospitals are nurses and medical doctors. It is expected that the majority of the available research will be centred around these two professions. Thus, in order to focus the scope of the review we chose to limit the population to undergraduate nursing and medical students.

Concept

Defining innovative approaches can be difficult. Especially when looking at different educational and healthcare traditions. Innovation may be driven by evolving theory, new technologies or the needs of healthcare stakeholders. The method considered innovative or novel in one country, may be considered the norm in another. Therefore, we decided to limit the eligible literature to that produced by countries with similar educational, cultural, and healthcare traditions, namely the EU and Scandinavia, the UK, USA and Canada, and Australia and New Zealand. In the initial protocol for the HEAL framework a number of potential innovative methods were put forth for investigation. These were further elucidated at the partner meeting in May 2022. We also piloted an initial search in Pubmed, to scope what peers around the world considered to be innovative and included these methods in the final search. As the continuous, innovative development is ever evolving, we sought the most recent publications, limiting our search to articles published from 2012 and onwards.

Context

Practical education during workplace placements has a number of different names, across the different professions and countries and may be reported under different names, such as rotations, clerkships, placements, internships and apprenticeships. For this review we will be using the general term of placement. There is also an inconsistent reporting culture, as different authors may use the same name for both undergraduate and graduate education. For this scoping review we investigate the context of clinical,

workplace-based education in the undergraduate population. Thus, we do not consider the literature concerning post-graduate education or continuing professional development. Likewise, the focus of the HEAL framework is hospital placements. Thus, literature focused primarily on primary or community healthcare and placements in the primary sector were not eligible for this review.

Method

Development of the search

Following the partner meeting, the review group performed an initial search of the Open Science Framework (www.osf.io), The Cochrane Database (www.cochranelibrary.com), PROSPERO (www.crd.york.ac.uk), and Best Evidence Medical and Health Professional Education (bemecollaboration.org) for published protocols or completed systematic or scoping reviews of innovation in placements or clerkships in healthcare profession education. We found no scoping reviews were found with this focus for research.

Following this, and on the basis of the initial HEAL protocol, the input from the partnership meeting, and the PCC model, an initial search of Pubmed was performed in order to map potential keywords, Medical subheadings (MeSH terms), and novel methods to inform the final search. A research librarian from library of the University of Southern Denmark was consulted to optimize the final search. A final search was constructed by combining three search strings, each encompassing subheadings and free text search, using Boolean combination AND/OR. The specific keywords varied according to the definitions of the individual database. * and "" were used when relevant.

Search String 1: The education of undergraduate medical or nursing students.

Search String 2: Internships and potential synonyms.

Search String 3: Innovation, novel or methods considered to be innovative.

In August 2022 we queried five databases, Medline (Ovid), Embase (Ovid), Cumulative Index to Nursing and Allied Health Literature (Cinahl Complete, Ebsco), Education Resources Information Center (ERIC, Ebsco), and Scopus using the final combination search string. An example of the combined search for Medline can be seen in Appendix 1. The search was adapted to each database-specific search function. Medline and Embase used the same Medical Subheadings. CINAHL used Major Subheading and Subject terms. ERIC used a Thesaurus and Scopus did not use subheading, but only supported free text searching. The searches were only limited by language (English) and timeframe 2012-2022 (2021 for ERIC, as 2022 was not indexed at the time).

In addition to this database search, each HEAL partner institution separately searched their national and local databases for similar publications to be included in the reference screening process.

We did not search specific databases for grey literature, and we did not perform reference or citation searching.

References were uploaded to a dedicated online review resource, COVIDENCE (covidence.org, Melbourne, Australia), for further screening, review, and extraction of data.

Inclusion Criteria

Included in the review were papers, abstracts, or dissertations in English, presenting primary research of innovative methods involving clinical, hospital placements or clerkships for undergraduate nursing or medical students, from the year 2012 and onwards, within the defined geographical area. As such, quantitative, qualitative, and mixed methods studies were eligible for inclusion, spanning descriptive studies and experimental designs, if they presented evaluative data on novel methods. The geographical area included was EU and Scandinavia, UK, USA and Canada, Australia, and New Zealand.

Exclusion Criteria

The following exclusion criteria were used in each step of the screening process:

Non-English language publication

Outside specified geographical area

Not related to nursing or medical students

Not related to placements or clerkships

Not reporting on undergraduate education

Not hospital setting as a point of interest

Evaluation of current practice

Focus on assessment

Opinion papers, discussion papers, letters, books, or reviews, not presenting primary research

Reference screening, selection, and data extraction

The screening and selection process was conducted by two reviewers (TBC and VD). A total of 13,584 references were identified in the database search by the review team (No. 13,536 papers) and the collaborating partner (No. 48 papers). An automatic duplicate exclusion was performed by the COVIDENCE software, leaving 10,743 papers for screening. The titles and abstracts of these papers were separately screened by both reviewers for eligibility in accordance with the inclusion and exclusion criteria. Following exclusion, this left 179 papers for full text review. Following full-text review 74 papers were included in the scoping review. In all steps of the process, disagreements between the reviewers regarding inclusion and exclusion of references were solved through renewed review and discussion between the reviewers.

The 74 included papers were then reviewed by both authors and divided into three major themes: *Placement or Clerkship Models, Preceptors and Learners, and Didactic Methods*.

A novel data extraction tool was developed for each theme to present data most relevant for each theme and with a focus on what the paper presents, recommends and possible promoters and detractors in accordance with the research question and the original aims of informing the process of innovative creation

in the HEAL-framework. Whenever possible we also included, at which Kirkpatrick level of evaluation (Kirkpatrick & Kirkpatrick, 2016) the data in the papers supported.

Results

A total of 74 papers were included in the scoping review. Their geographical representation and professional focus are displayed in Table 1. There was a stable number of articles per annum, between 4 and 8, with the year of 2021 as an outlier presenting 15 papers. This was probably due to an increased interest in technology enhanced solutions due to the COVID-19 pandemic. Only 20/74 articles originated within the EU and UK area.

Having reviewed the papers, the three major Themes emerged: *Placement or Clerkship Models*; *Didactic Methods*, and *Preceptor and Learner Theme*.

Papers included in the *Placement or Clerkship Models Theme* presented data on different placement models in undergraduate nursing and medical education. A large number of placement models exist around the world, based on tradition, academic-clinical institution partnerships, recommendations from governing bodies, and simple pragmatic reality. What may seem innovative in one setting can be seen as normal routine in another. Generally, the models are related to face-to-face clinical education, simulation clinical education, and virtual clinical education. Papers included in the *Didactic Methods Theme* primarily presented different technological methods for replacing or supplementing individual parts of a placement but did not seek to replace the placement itself. These methods included online lectures, simulations or skills training, virtual simulations, blended learning and more. The papers included in the *Preceptor and Learner Theme* primarily focused on factors within the learner and supervisor, such as method of learning, feedback, and collaboration. A majority of the articles on medical student clerkships were related to technological solutions, as didactic methods or as a clerkship model. The papers on nursing students were more evenly distributed between the three major themes.

Placement or Clerkship Models

Within the field of nursing education, a large number of models have been reported and reviewed. Traditionally, the reported model describes a faculty member as primary supervisor for a variable number of nursing students during their placements. Alternatives to this model may be one or more clinical preceptors supervising the students in different ratios 1:1, 1:2, 1: many. The level of collaboration between academic faculty and clinical preceptors may vary, favouring models of practice-education partnerships or dedicated educational units (DEU), where the students are primarily supervised by clinical preceptors in the wards, with support from academic faculty for the preceptors and students. This type of model has been researched a number of places in Australia, the US, the UK, and EU (Bittner, 2021; Claves, 2015; Crawford, 2018; Hannon, 2012; Hendricks, 2015). Generally, the DEU models appear to receive good evaluations from students and faculty, but the Kirkpatrick level of review is primarily 1 (student feedback), and rarely 2 (change in knowledge, skills, or attitudes). Thus, we are unable to evaluate the model's impact on student behaviour or patient outcome. The DEU fosters the assimilation of students into active learner roles in the community of practice at the clinical wards.

Although the majority of learners prefer the DEU model, some identify more with the learning culture of the traditional models of placement (Claves, 2015). However, the number of learning opportunities and

actually performing procedures are higher in the DEU models (Clayes, 2015), and they seem to support the development of critical thinking better (Bittner, 2021).

Several authors have noted that the frequent rotation of students between blocks may cause anxiety in students, require a significant amount of time to re-orient towards the new environment, as well as a significant effort to align students to new colleagues, preceptors, and patients, as well as IT support systems. Frequent transitions may be unproductive (Mulcock, 2019; Teherani, 2013). Therefore, a number of integrated models and continuity models have been explored (Boardman, 2019; Mulcock, 2019; Hauer, 2012; Shahi, 2015; Simpkins, 2019; Teherani, 2013). For nursing students an integrated model of a combination of part-time placements and part-time academic teaching over a longer placement time may improve work-life balance and better align and integrate theory and practice but may create discontinuous relations with colleagues and patients (Boardman, 2019). This type of model seems best suited for junior students in early placements (Rohatinsky, 2016). Returning to the same placement ward and preceptor seems to lower the anxiety levels of nursing students (Mulcock, 2019). Continuity models have been considered for medical students for many years, primarily in longitudinal integrated clerkships (LIC) in the primary sector, for creating long-term, high value continuous learning relationships with preceptors, patients, and community, across sectors, as well as for recruitment purposes. Variants of LIC have been examined in hospital setting and appear to foster more active learning, responsibility, and the ability to see more patients and perform more procedures, while not be detrimental to overall performance on knowledge assessments (Charak, 2020; Hauer, 2012; Shahi, 2015, Teherani, 2013).

In both professions, it was reported that the traditional models foster more passive learning roles, and the newer models foster more active, participatory learning roles (Hendricks, 2015; Hauer, 2012). Integrating the learners in the workplace team, where clinical experiential learning occurs, in more participatory roles and separating the students from classroom obligations was regarded positively (Costello, 2022) and allowing for student-led activities may increase the number of performed tasks (Sutkin, 2013). Integrating a team of mono-professional, or interprofessional, students into the wards, with responsibilities for a number of patients, fulfilling the normal roles of the workplace, also seems to be well received by some students, leading to increased performance, more collaboration, and better integration into the wards, but also less time for mono-professional task (Clayes, 2015; Brewer, 2013; Morphet, 2014).

The use of simulation, both High-fidelity (HFS), Low-fidelity (LFS), and Virtual (VS) simulations have been considered a potential replacement of parts of the clinical placements for some years. Simulation may serve as an adjunct to traditional clinical placements (reported under *Didactic Methods*), as a partial replacement of some of the placement time or as a full simulated placement in simulated wards or hospitals (Parker, 2018). In nursing education, a Delphi study from the UK found it feasible to replace 11-30% of placement time with simulations instead (Bridge, 2022). A number of studies have found that replacing part of the placement time with simulation time is well received (De Ponti, 2020; Williams, 2022), it may increase perceived or observed knowledge and skills, and meets the learners' needs (Fielder, 2015; Hamra, 2019; Leighton, 2021). Other studies have found no lasting difference in knowledge or skills between simulation placements and traditional placements (Oldenburg, 2013; Pépin, 2022; Veltri, 2014). Student consistently favour face-to-face simulations over virtual simulations, although virtual simulation may meet some learning needs (Leighton, 2021; Pépin, 2022). Another recurring concern was the cost of equipment, design, facilitator training, and maintaining the sites (De Ponti, 2020; Fielder, 2015; Parker, 2018).

Four studies reported on entirely virtual placements, implemented during COVID-19, due to social distancing restrictions. They employed a combination of synchronous and a-synchronous methods, such as

virtual cases, team-based learning, webinars, podcasts, virtual interaction with clinical practitioners, and access to online lectures and material. They found it possible to facilitate theoretical knowledge acquisition, but not practical skills acquisition. Potential detractors were the investment in time, technical difficulties, low attendance, social disturbances and, foremost, no immersive experiential learning (Ingleson, 2022; Redinger, 2020; Topor, 2021; Villa, 2021).

A summary of findings from the reviewed papers is found in Table 1.

Didactic Methods

Access to and use of technology during placements

The current and future learners are increasingly integrating technological resources into their learning strategies and most students currently own a smartphone, with easy access to apps, social media, and online resources. Other electronic devices available include small portable laptops and tablet, which may afford access to electronic health records. However, simply providing access to these resources, does not appear to facilitate their use in the student-patient encounter (Alegria, 2014; Clarke, 2019). A number of methods of providing learning have been employed, from text-messaging clinical pearls (Mandry, 2013), posting clinical pearls on Twitter (Reames, 2015), to designing podcasts (Augustin, 2021; Mookerji, 2020). Although well-liked by some students, these methods were simply not accessed by a large proportion of the students and did not improve the outcome of the placement.

A number of online learning modules has been studied, from simple text monographs to Powerpoint presentations, online video lectures, online digital games, and online virtual patients (Barisone, 2019; Cipriano, 2013; Khasawneh, 2016; Kim, 2018; Lindeman, 2015; Subramanian, 2013; Xiong, 2021). They are generally well received by students and preferred over textbook material and lectures. However, adding these resources does not appear to improve student knowledge when tested (Lindeman, 2015). Furthermore, a large proportion of students did not access the resources, if they were not mandatory (Khasawneh, 2016; Kim, 2018).

Acknowledging students' online connectivity, a number of studies have investigated the use of online solutions for clinical teaching. This was particularly fuelled by the COVID-19 pandemic lockdowns. Live-streamed ward rounds and teleconsultation using Microsoft Teams™ and other solutions were feasible, and acceptable to patients, physicians, and student. However, students uniformly preferred face-to-face learning methods, as this affords greater interaction and opportunity for direct student-patient physical examination (Dykes, 2021; Feeley, 2021; Mill, 2021; Patterson, 2022).

Simulation

From the number of studies published within the last 10 years, it is obvious that *simulation* has the interest of many health educators and researchers. In our work with this scoping review articles on simulation are by far the majority. Simulation comes in several different forms. It may be Low-Fidelity or High-Fidelity,

Face-to-Face or Virtual, Individual or Team-based, Mono-professional or Interprofessional, Simple-task based, or Complex task based, Single-case oriented or Multi-case, Ward or Hospital oriented.

Simulation as a learning tool has been part of educational institutions within health studies for many years, as well as a postgraduate medical training opportunity (Tofil 2013). In recent years there is a growing interest in simulation as part of undergraduate clinical placement (Bridge 2022, Williams 2022) in order to provide training of specific specialities corresponding with students' actual placement. This growing interest only increased during COVID-19 lockdowns around the world.

Handling the COVID-19 pandemic made demands for thinking and acting differently when it came to clinical placements. The changed conditions led to a rise in teaching and learning possibilities that allowed students to stay isolated or only meet a few fellow students, hospital staff and faculty at low incident. To many educators, this had one obvious solution: simulation. Ajab et al. (2022) describe how they constructed a successful high-fidelity alternative to traditional bedside teaching for medical undergraduates during the pandemic in the UK. These alternative sessions proved very prosperous, and students are eager to make it a permanent possibility in connection with more clinical subjects. The main drawback was the resource intensity – financially and staff allocations (Ajab, 2022). Also, in the UK the complete lockdown afforded nurses the opportunity to experience a full-scale simulated placement. Williams et al. (2022) describe, how a blended experiential learning approach to a four-week placement proved:

“..... that this new type of flexible simulated placement has met student nurses' learning needs and prepared them for practice.”

The developers found, that without the COVID-19 restrictions, a ratio of 50% face-to-face may be desirable.

In the US the COVID-19 lock-down restricted usual learning opportunities except but individual work - i.e. screen-based simulation. Badowski et al. (2021) enquire into how nurse students perceive working with screen-based simulation during the lock-down compared to manikin simulation and traditional clinical experiences. They found, that if support and feedback are provided, students gain knowledge, skills, and confidence, and yet 'the clinical environment prevailed the golden standard' (Badowski, 2021).

Integrating simulation into placement

Regardless of current policies of restrictions to face-to-face education, educators and researchers experiment with adding simulation to traditional clinical placement in an attempt to improve learning opportunities to a growing mass of students.

One example is presented by Goolsby et al. (2014). In this study, a full day of hybrid simulation was offered during a four-week clinical placement. Students' confidence with procedural skills increased significantly. Likewise, Tofil et al. (2014) report increase in student learning of knowledge and skills when participating in one-hour high-fidelity sessions four times a week during their placement. In another study, Tofil et al. (2013) also report how competences such as communication and teamwork increase when employing interprofessional simulations in nursing and medical students. Fielder et al. (2015) report how a high ratio of students set off an initiative to integrate simulation-based education into traditional rotation; 19 hours in the clinic and 16 hours simulation. Simulation provided the opportunity to train procedural skills and

situations/patients that students rarely meet in an everyday placement setting. Likewise, Greenstone et al. (2021) present how simulating integrated psychiatry and physical topics for students to learn about the often complex, cases they will meet in e.g., emergency. Students found the high-fidelity simulation realistic and liked the individual feedback. The simulated exercises helped students become aware of and recall the complexities of real patients.

Jauregui et al. (2018) report on another simulation setting. They introduced a low-fidelity case-based peer-assisted learning opportunity for students placed in emergency medicine. Students took turns leading the case-scenarios by use of tablets and experienced a safe learning environment. The method was a low-cost resource. Kwan et al. (2017) also reports on adding high-fidelity simulation to the internship curriculum. Simulation helped build students confidence in performing the tasks trained and was well liked by students. Wise et al. (2016) introduce a web-based simulation of a skill during placement. The resource was well liked, and could be accessed at ones' own time, but was poorly aligned to daily clinical placement learning.

Pros and cons and the ratio between simulation and clinical placement of the different formats are discussed in several articles. Bridge et al. (2022) reported that students find it acceptable if between 11% and 30% of clinical placement time is substituted by high fidelity simulation. Leighton et al (2021) refers to a much-cited article (Hayden, 2014) that if 50% of clinical placement time is substituted by high-fidelity simulation, there is:

“no statistically significant differences in clinical competency, comprehensive nursing knowledge, NCLEX pass rates, or readiness to practice”

Brien et al. (2017) found that when offering two hours of high-fidelity simulation (HFS) as part of clinical placement in a specific specialty:

“Both the HFS activities and the clinical settings were perceived to promote the development of clinical reasoning, to increase confidence, to help link the classroom content to real practice, and to practice clinical skills. However, both environments seemed to favour different aspects of learning related to clinical knowledge, a nurse's role, and personal learning.”

Likewise, Brien (2022) directs our attention to the deficits of placements:

“However, given the shortage of staff, the increased complexity of care, and shortcomings in terms of pedagogical strategies, some preceptors find it hard to provide students with proper guidance, especially in a critical care environment in which patients are unstable and vulnerable”

This as opposed to the planned debriefing sessions following a student targeted simulation session, where students have time to reflect and ask questions and thereby consolidate their learning experiences.

Leighton et al. (2021) compared traditional clinical placement to face-to-face simulation and screen-based simulation and found that screen-based was the less productive regarding nurse students learning. Mollo et al. (2012) account for a high-fidelity simulated ward as an add on for training clerks in a patient safe environment:

“SIMFLO is the first reported in the medical literature to create a hospital ward populated by high-fidelity simulators to teach surgical clerks the basics of inpatient management of surgical patients and communication skills”

Students found simulation improved their understanding of medical management of surgical issues and their documentation skills. It also created wishes for more simulation scenarios.

Likewise, Parker et al. (2018) report, on an on campus simulated hospital to prepare nurses for placement - not as a replacement for clinical experiences but as a preparation. The initiative improved students' readiness for practice.

A general question of importance for students' learning is the question of *transfer* (Parker 2018). Can students apply what they learn in the simulation unit when they are in the clinic? Nash (2017) turns our attention to the fact, that whether transfer is successful or not, partly depends on the similarities of learning- and application contexts; are the simulation conditions and clinical conditions alike. In their research Nash found that nursing students found it hard to use what was trained in simulation, as similar problems did not occur in the clinical setting, they were in. An idea is to do simulations after placement in order to train and refine what was encountered in the clinic.

A summary of findings from the reviewed papers can be found in Table 2.

Preceptor and Learner

The relationship between a student in clinical placement and the preceptor is regarded essential for the quality of placement (Ford 2016, Hart, 2019, Löfmark, 2012, McLeod, 2021). Many attempts to develop the best preceptor model have taken place, as the preceptor is important to help students socialize into workplace culture and develop professional and clinical expertise (Newton; 2012). McLeod (2021) described a model called Clinical School Supervision works (CSS). The purpose of the CSS model was to provide students with the continuity of both theoretical and clinical educational support from both academic staff and clinical preceptors, and the model builds on close collaboration between clinical preceptors and faculty. Theory was taught by faculty, and clinical skills by hospital clinic educational staff in a co-located purpose-built teaching and research precinct adjacent to the hospital.

“Supervision of students was conducted by hospital preceptors and both students and preceptors were supported by a clinical liaison nurse who was also an academic member of faculty.”

Students found that being connected to the same preceptor continuously offers the opportunity of being directed towards appropriate learning opportunities. They felt welcome, encouraged, and supported. Preceptors reported their need to know, what expectations come with the role and, e.g., how to deal with poorly performing students – issues faculty need to address.

Newton et al. (2012) present a model where the same medical teacher follows students in their placements to ensure continuity as the placements take place in different hospital campuses. Also, in attempt of continuity preceptors and students have the same schedules. This allows for a student-centeredness that supports students learning. Experimenting with a consistent clinical tutor is also the theme of Tran et al. (2021). During the pandemic, students had their placement organised in groups with attached junior doctors meeting them every day. The clinical tutor made sure to personalize teaching and replicate clinical experiences through e.g., videos. Involving teaching fellows in students' placements is also reported by Chong et al. (2021). Fellows supervise students on specific specialities with positive outcome.

Biggs et al. (2018) also address the problem with discontinuity in ordinary block rotations where each medical student relates to up to 8 preceptors and the following dissatisfaction with lack of quality of learning. They experiment with sending students to the same location for two blocks and only relate to 1-3 preceptors. This means that relationships evolve, and preceptors can assess students more thoroughly. In this way they adapt one of the benefits of LICs without changing the full educational set-up.

In a study running over two years, Ford et al. (2016) researched what is important to students and supervising nurses. The feeling of being welcome and belonging is vital to the students. They appreciate being recognised as legitimate participants, being encouraged to work independently and the opportunity to combine theory and practice by support from the supervisor. On the other hand, the supervising nurses benefit from the students' questions and experience increased knowledge through their supervising role. However, they need more precise knowledge of student learning goals and needs for assessment. They also pointed out, how they expect students to look for learning opportunities and act as self-directed learners. On the contrary, students expect the supervisor to act as provider of learning possibilities. This may be something to determine, when preparing students for their placement.

*“Meaningful learning occurs within environments
that foster a culture of mutual respect, reciprocity
and transparency of expectation. “*

(Ford, 2016)

To strengthen nurses' placement, collaboration and communication is needed. Hart et al. (2019) piloted a virtual classroom to investigate, if online meetings between student, preceptor and faculty would have a positive influence on collaboration and communication. They used Blackboard Communicate, a learning management system, with features we have all been acquainted with since, due to covid. Students, preceptors, and faculty found several benefits to be pursued; online teaching/supervision is time efficient; travel costs are saved, it is more flexible to arrange meetings when needed, and opposed to telephone calls you have the benefit of the visual modality as well.

A Norwegian study by Löfmark, et al. (2012) inquired into nursing *students'* perceptions of the supervision they received from preceptors and university teachers. Both were rated highly; clinical nurses for their ability to help students apply theory on practice, teachers for assuring learning outcomes were reached. In the Norwegian programme student, preceptor and teacher met three times during the placement period of

eight weeks to ensure goals were met, and as a representative of the educational system, the teacher oversees assessing and grading the student. This model requires close communication between the professionals.

A summary of findings from the reviewed papers is presented in Table 3.

Discussion

The traditional models of organising placements in blocks with changing preceptors and other staff seem to have certain drawbacks regarding learning possibilities. Frequent rotations foster anxiety, lack of coherence and belonging, decreases psychological safety and frequently increases repetitive and unproductive time use on introduction, acclimatization, and assimilation into new learning environments. Students learn more efficiently in an inclusive, safe learning environment, feeling part of the community of practice (Lave and Wenger), afforded the opportunity to actively engage in clinical activities. This feeling of safety and belonging, fostering progressive, experiential, learning takes time and frequent environmental shift break up this stable environment. When students stay in the same place for longer periods of time (LICs) they have the opportunity to become familiar with every-day practices and develop a sense of belonging and identity as a professional. It is possible to progress from being a peripheral participant to a more or less full member of the practice community during the longitudinal placement. On the other hand, students may only be introduced to a limited number of different environments in few wards in single hospitals and are not introduced to the variety of clinical work environments and specialities.

When clinical placement is substituted by on-line and virtual practices students learn theoretical (declarative) knowledge but not procedural skills. It follows, that learning 'how' requires opportunities for hands on-experiences. Therefore, online substitutes should be tailored to teaching clinical knowledge, and, although initially labour-intensive, may in the long run free up time for clinical skills training, hands-on or through simulation, as well as free up time for preceptors and faculty for more bedside teaching. In comparing online and face-to-face experiences, reports indicate that some parts of clinical placements may be replaced by virtual learning methods and simulation without detrimental impact on knowledge on subsequent tests. However, students uniformly prefer face-to-face clinical learning to online or simulation alternatives. Furthermore, the methods have primarily been reported on a proof-of-concept level with feedback from students and staff at Kirkpatrick level 1.

Technology-enhanced learning has received great attention the past decade, with an explosion in methods and sources offered, such as text-messaging, podcasts, access to online libraries and knowledge resources, online videos, as well as games. Most of these are well received by those students who employ them, preferred over traditional lectures, but the offered resources are in reality only employed by a minority of students, especially in the clinical setting. There seems to be a multitude of resources, a lack of generic, relevance or quality control, as well as lack of guidance on what is relevant for each placement type. Furthermore, required resources seem to be accessed, but the utility of non-required resources is low. Online resources, if standardized and endorsed by experts and students, and tailored to the individual learning objective, may have the potential to increase the opportunities for learning during clinical placements, but there remains a significant task of sifting through the number sea of resources and guiding student, and teacher, in what is relevant and what is not.

Though much used, simulation as a supplement to the clinical placement has advantages but is not without its problems. Simulation offers the opportunity to try out new or complex tasks, and employ previously obtained knowledge, in a safe environment, with minimal risk for the patient. Problems may be related to the alignment of the simulation, the actual acquisition of new knowledge and skill, the retaining of said skills, and the transfer of simulated skills to actual clinical patient-involving situations. Finally, simulation may be relatively resource-intensive and expensive in both financial costs as well as labour costs.

Simulation comes in many forms with many different learning objectives. These should be closely aligned with the actual need in the clinical environment. One strategy is to simulate common procedures, such as emergency response teams, resuscitation, and procedural skills. This may seem feasible, but a consideration should be how many repetitions are required for obtaining an acceptable competence, the timing of the simulations and the risk of skill decay. Another strategy is to simulate interesting, or relatively rare medical conditions to increase awareness of these. Since the simulation setting and practice are not identical, it can also be challenging to transfer what is learned in one setting into another. Real life is usually imminently more complex than a controlled simulated environment even when compared to high fidelity simulations.

Simulation may offer the opportunity of active learning. Friedman (Friedman 2017) studied the difference between students doing a traditional placement, where students watched staff perform and students doing simulations at a workplace in connection with the placement. Friedman found a significant impact on students test results, as students who merely watched performed poorer than those who had hands on the simulation station.

Advantages to simulations are the possibilities of repetition, patient safety, and the opportunity to direct the complexity of the simulation to the exact level of the individual student. A simulation can directly address relevant learning objectives and any possible mistakes may be corrected immediately. Debriefing allows students to verbalise what they have experienced and thereby construct knowledge that will be re-accessible and allow new experiences to relate to the established constructs.

Whether simulations are as effective as placement and to what degree placement can be substituted by simulations is a much-discussed topic. Comparing learning outcomes from clinical placement and simulation, Veltri (2014) finds the two modes equally effective. Oldenburg (2013) reports on substituting 1st semester nurse students' clinical placement with high-fidelity simulation and compares with students who do the traditional clinical placement. Initially the students having had the simulation experience feel more confident before entering their 2nd semester placement. This difference between the two groups is equalized after the 2nd placement.

Finally, there is no doubt that the relationship between student and preceptor is of greatest importance. When things work out between them, both parts gain. Being part of a working community of practice where questions and reflections are externalised and shared provides a solid basis for mutual learning. Students' placement also serves as continuous workplace learning for clinical staff - when it is successful. To obtain success it seems necessary, that staff feel well prepared. They need to know the level of the student, the requirements for assessment, and have time allocated. Staff should strive to make students feel as legitimate participants, allowing them to take responsibility according to the students' level. This is facilitated by continuity, when students return to the same preceptor or stay for a longer time. This facilitates an evolving professional relationship and identity formation, and the preceptor finds it much easier to assess the student.

Conclusion and Recommendations

Continuity and integration in placements are important, place in the placement site and in the professional preceptor-student relationship. This ensures a greater integration into the working community of practice, furthers the opportunities of learning during placement and affords higher efficiency when students do not have to start all over in the next placement. It also helps build new professional relations, psychological safety, mutual trust of a fair assessment, and the confidence to ask questions. Opportunities for active learning occur when students are recognised by staff and given independent tasks to perform and reflect upon. However, redesigning placement curriculum may be a significant task, with multiple, sometimes adversarial interests and recommendations and regulatory body requirements.

Awareness of the importance of well-educated/prepared clinical staff with teaching responsibilities, is crucial. Since clinical staff is of such great importance for students' learning experience, they should be well prepared and show interest in welcoming the students into their practises. Explaining and reasoning makes the clinical staff aware of their own knowledge and practises. Opportunities for reflections with others are a highway to awareness of knowledge, skills, and competences needed in a specific setting.

Technology enhanced learning sources, if properly aligned to the learning objectives, with relevant guidance from faculty, and follow-up on the actual usage, may offer the opportunity to free up faculty time for more bedside teaching. However, most studies in this area have solely reported data on feedback from students and faculty and not on actual effect on clinical practice.

Simulation offers a number of opportunities to support clinical learning, if properly aligned to the actual need, properly designed and followed up by actual clinical experience, in order to transfer and retain obtained skills. These solutions may be relatively financially costly, time-consuming, and labour-intensive, setting up and maintaining.

Table 1 Placement and clerkship methods

Reference	Country	Profession	Design	Model	Aim	Outcomes	Kirkpatrick Level	Promoters	Detractors	Recommendations
Bittner, 2021	USA	Nursing students	Quantitative	DEU vs. TCP	To assess whether a DEU improved development of critical thinking	The DEU supports development of critical thinking. TCP does not increase overall critical thinking score.	2	None reported	None Reported	DEU increase critical thinking, which may facilitate a more seamless transition from school to practice
Boardman, 2019	Australia	Nursing students	Qualitative	ICLM	To assess qualitative feedback on the ICLM model	Learners reported the ICLM prepared them for practice, improved work-life balance, felt part of the team, and the protracted period provided time to integrate theory to practice and reflect on learning	1	Better work-life balance Better integration of theory and practice Only one student per preceptor	Continuity with patients and staff. Self-rostering may be problematic	ICLM favourable to mental health clinical education

Clayson, 2015	Belgium	Nursing students	Quantitative	TCP vs. DEU vs. WBL	To assess if there a difference in learning environment or learning performance between the three models.	Learning culture was significantly better in TCP. Learning performance was best in the DEU and worst in the TCP models.	1, 2,	The role of a consistent mentor is vital to learning environment and learning outcome during a placement. The length of the placement is important.	The number of learners per placement and mentor is too high.	To educate more clinical mentors. DEU and WPL should be considered for final-year students.
Crawford, 2018	New Zealand	Nursing students	Mixed methods	DEU	Evaluation by learners and unit and academic staff of a pilot DEU	DEU rated positive by learners and staff.	1,	Supportive and flexible. Inclusive partnership between learners, staff and supervising liaisons	Nor always clarity on roles and responsibilities of different learners and staff.	Include and support learners and staff in the clinical units.
Hannon, 2012	USA	Nursing	Qualitative	DEU	Evaluation of learners	DEU was a positive	1,	Inclusive environ	Teaching of basic skills.	None.

		students			and unit staff of a pilot DEU	experience for learners and Preceptors		ment. Part of the community of practice. Good support from academic faculty.		
Hendricks, 2015	USA	Nursing students	Mixed methods	TCP vs. PEP vs. HLM	Evaluation of three models by students, preceptors and faculty	No difference in learning environment. DEU offered more practical skills opportunities. No difference in test scores.	1, 2	None reported	A large proportion of the learner's time was used as a passive observer.	Understanding the value of observation. Understanding the role of practical skills learning opportunities.
Mulcock, 2019	USA	Nursing students	Quantitative	HBCM	Evaluation of stress levels in three models by students	Significantly lower stress levels in the HBCM model.	1,	Reduced orientation time. Placement spot neutral.	None reported	Recurring placements facilitates inclusion, mentoring, and learner autonomy.
Rohatinsky, 2016	Canada	Nursing students	Qualitative data reported	Block vs. Non-block model	Evaluation of perceived learning in block and non-block models	Qualitative positive feedback for both models.	1,	Non-Block: Concurrent theory and practice, work-life	Student preferences: Non-block preferred by 1 st and 2 nd year students.	Both models have their place. Block model should be preferred for senior students.

								balance , variety of patients, time for formative feedback and reflection. Block: Focus on clinical learning, Frontloading theory, continuity of patient care, clinical judgment.	Block preferred by senior students.	
Charak, 2020	USA	Medical students	Mixed Methods	LIC vs. Block model	To evaluate a LIC	LIC students had greater surgical test scores, but scored the same in clinical skills tests. LIC students had more direct interaction with attendin	2	None reported	None reported	LIC is non-inferior to Block. May increase surgical knowledge and interest in surgical career.

						gs and perioperative contact with patients. LIC students were less likely to rule out a future surgical career.				
Costello, 2022	Ireland	Medical students	Qualitative	Experience based Learning	Post-hoc evaluation of experience based learning model	Positive experience to be part of the team and not just observers.	1	The focus exclusively on clinical work. Simulation and case-based learning as preparatory and supplemental learning methods.	Less opportunity for direct observation by preceptors	Active participation promotes learning. Separation of classroom and clinical time is helpful.
Hauer, 2012	USA	Medical students	Qualitative	LIC vs. Block model	To compare patient care roles and activities of students in LIC and	LIC facilitates workplace learning, a feeling of inclusion in the patient care and authentic	1,	Continuity with patients, preceptors and site promotes authentic doctor-	None reported	LIC model provides better and more patient-centred learning opportunities.

					Block models	c doctor-like roles. Block rotation favors more passive roles.		like roles		
Shahi, 2015	Australia	Medical students	Mixed method	LIC vs. Hybrid vs. Block model	To explore and compare three different models of placement	LIC > Hybrid > Block in number of patient encounters, histories and physical examinations. Hybrid > Block > LIC in number of procedures.	1, 2	Active participation in the LIC and Hybrid models . Opportunities for interaction. Smaller , friendlier environment.	Passive observation in the traditional model. Discontinuity in relationship building in block rotations .	Longer duration, community settings may provide effective alternative placements
Simpkin, 2019	UK	Medical students	Qualitative	Hybrid model	To explore the effect of a new model on students attitudes and experiences	The students felt they developed in the themes of the patient journey, the healthcare system, their learning pathway and their professional	1	Student - centered education in patient - centered healthcare. Self-directed learning. Better prepared to	Concerns about how they will do on exams. Concerns on costs and organizational time due to complex scheduling.	Design curricula that embraces a symbiotic relationship of patient and student needs.

						development		be doctors		
Sutkin, 2013	USA	Medical students	Quantitative	Student-led clinic vs. Resident-led clinic	To compare student's experience in 2 models of outpatient	A student led clinic led to fewer patient encounters, but a higher number of clinical examinations. Preceptors were rated higher in the student-led clinic.	1, 2	No competition between residents and students for procedures in the student-led clinic.	The cost of the time of the attending . The loss of opportunities for the residents to teach students.	Involve students in active learning.
Teherani, 2013	USA	Medical students	Mixed methods	LIC vs. Hybrid vs. Block model	To compare student perspectives and outcome from three models of placements	Continuity models (LIC and Hybrid) had better evaluations than block and scored better for positive role modelling. LIC students were significantly better in data-	1, 2, 3	Continuity facilitates a sense of belonging and increased responsibility, positive role modelling, and affects learning outcomes.	None reported	Continuity increase educational outcomes . Students should be able to choose between models.

						gathering, but there was no difference in marks, clinical knowledge or skills.				
Brewer, 2013	Australia	Medical and nursing students	Mixed method	IPE Training Ward	Evaluation of a pilot IPE ward	Increased collaboration and understanding of the whole patient journey, and the roles of other professions.	1, 3, 4	Understanding for different professional roles. Positive feedback from patients.	Less time with monoprofessional tasks. Longer hours.	Collaboration between key stakeholders are important.
Morphet, 2014	Australia	Medical students	Mixed method	IPE Training Ward	Student evaluation of 2 pilot IPE wards	Positive feedback. Increased autonomy, understanding of other professional roles, facilitated positive communication, collaboration, and belonging to the unit.	1,	Inclusion in the clinical team	Less time with monoprofessional tasks.	IPE to address teamwork education.

Bridge, 2022	UK	Nursing students	Delphi study	Partial placement with simulation	To identify how much of clinical placement time could be replaced by simulation	A consensus of the amount of placement time was presented, as well as promoters and potential problems.	Not applicable.	Training in core skills in patient risk-free environment. Reduced burden of clinical presence in the wards. May increase the number of placements available	Not all placement tasks suitable for simulation. Logistical challenges in designing and facilitating simulation. Not reality. No ways accepted by regulatory authorities.	Between 10-30% of placement time can be replaced by simulation.
De Ponti, 2020	Italy	Medical students	Quantitative	Virtual simulation	To evaluate a complete virtual placement during COVID-19	Positive evaluations with regards to format and realistic presentation.	1,	Preferred over traditional classroom lectures	28% had technical difficulties accessing the platform. Nobody recommended it as a stand-alone instead of traditional placement.	Virtual simulation may be a future add-on to normal clinical education.
Fielder, 2015	USA	Medical students	Quantitative	Partial placement	To evaluate an implement	Simulation improved some	1,	Increases the number of	Initial cost of equipment,	Simulation can ameliorate the high

				with simulation	entation of partial simulation placement	aspects of comfort with medical management, skills and increased knowledge.		student placements.	design and facilitation of simulation	ration of learner to faculty, limited supervision, and variety of presenting patients.
Hamra, 2019	USA	Nursing students	Mixed method.	Simulation placement vs. Traditional placement	To compare the learning experience of student in simulation and traditional clinical placement	Simulation based placement was superior to traditional placements in adult learning tasks, and experiential learning	1, 2	May replace placements, when sites are unavailable	Not always recognized by future employers	Simulation is a valid and effective form of nursing placement.
Leighton, 2021	USA	Nursing students	Quantitative	Traditional placement vs. Face-to-Face simulation vs. Virtual simulation	To evaluate how well students perceived their learning need were met in traditional placements, Face-to-Face simulations and	Traditional clinical education was perceived to be better than Face-to-Face simulations which were better than screen-based simulation.	1,	None reported	Speed of conversion to screen-based simulation due to COVID-19	Screen-based simulation should be well planned, better aligned with student needs and tested before implementation.

					Screen-based simulations.					
Oldenburg, 2013	USA	Nursing students	Quantitative	Traditional vs. Simulation placement	Evaluation of immediate and long-term self-reported clinical competence in traditional and simulated placements	Simulation students reported immediate greater clinical competence which levelled out following a subsequent clinical placement. Both groups improved their confidence from 1. To second placement.	1,	Simulation improves confidence in inexperienced nursing students. May replace placement needs	No long-term difference between groups.	Should be studied further.
Parke, 2018	Australia	Nursing students	Quantitative	Simulated Hospital	Student and stakeholder evaluation of an entire Simulation-based Hospital on Campus	Students felt the simulation hospital offered hands-on realistic experience. Stakeholders were mostly satisfied,	1, 3,	Simulation increases confidence	Costly to establish, to develop authentic simulations and to maintain education of staff.	Simulation may improve the preparedness of students for clinical placements

						that students were ready for clinical work.				
Pépin, 2022	Canada	Nursing students	Quantitative	Simulated vs. Clinical placement	An evaluation of 2 days of simulation vs. 10 days clinical placement	No difference in knowledge acquisition, or satisfaction. Clinical placement students perceived greater self-confidence and support from preceptor.	1, 2	Self-allocated placement type	None reported	Shorter simulation periods may provide the same knowledge acquisition and perceived satisfaction.
Veltri, 2014	USA	Nursing students	Quantitative	Simulated vs. Clinical placement	Comparison of skills in 2 placement groups. Clinical placement in obstetrics and clinical placement in pediatrics with obstetric simulations	No difference in skill assessment by faculty observer.	2	None reported	None reported	Simulation is as effective as clinical placements in skills performance outcome.

Williams, 2022	UK	Nursing students	Mixed method	Simulated virtual placement	Evaluate the creation of a Virtual placement due to COVID-19, including simulation, blended learning and online patient encounter (virtual consults)	Positive evaluation by close to 100% of students.	1	Virtual simulation and blended learning may ameliorate the need for more traditional placements due to increasing number of students.	Very time consuming in administering, tracking student schedules and queries.	Incorporate both virtual and Face-to-Face simulation.
Ingleton, 2022	UK	Nursing students	Qualitative	Virtual placement	Evaluate a pilot blended, virtual placement	Positive evaluation from supervisor. Students did not feel they had the same opportunities as face-to-face placements.	1	None reported	Scheduling and time for self-directed learning were difficult.	Should be planned and reflect the learning need and styles of the learners.
Redinger, 2020	USA	Medical students	Mixed method	Virtual placement	Evaluate a virtual placement, instituted due to COVID-19	No difference in knowledge acquisition scores compare	1, 2	Choosing online methods is well-received, as oppose	No immersive experiential learning. No direct patient contact.	May replace some parts of a placement.

						d to previous placements. Concerns about skills training.		d to self-selected sources.	No skills training. Low participation during live sessions. Family disturbances. No video feed from participants.	
Topor, 2021	USA	Medical students	Quantitative	Virtual placements	To assess the knowledge of students in a virtual placement compared to previous face-to-face placements	Students improved their knowledge. Non-inferior to previous face-to-face placement students.	1, 2	None reported	None reported	Further validation needed
Villa, 2021	USA	Medical students	Mixed method	Virtual placements	Evaluation of program and assessment of student knowledge.	Positive feedback from students. Modest improvement in student knowledge in Emergency medicine	1, 2	Possible to attend over long distances.	Very time-consuming in implementation. Approximately 40 hours/student, not including development and design.	Virtual placement may be valuable as an adjunct to face-to-face placements in the future.

Table 2. Didactic Methods

Reference	Country	Profession	Design	Model	Aim	Outcomes	Kirkpatrick Level	Promoters	Detractors	Recommendations
Ajab, 2022	UK	Medical students	Quantitative	F2F-HFS Pilot	To evaluate students feedback from 2 scenarios instead of bedside teaching during COVID-19	Students had a positive experience and felt confident in their clinical examination skills.	1		High cost in development and Resource intensive up-keep	Simulation may be a useful adjunct, especially when bedside teaching is unavailable.
Badowski, 2021	USA	Nursing students	Quantitative	VS, Manikin-based simulation and TCE	To evaluate students perceptions of how well 3 methods met their learning needs	TCE met all learning needs. VS met 4 domains of learning needs and Manikin-based simulation met 2 learning needs.	1			Simulation may meet some of the nursing students learning need. VS more than Manikin-based. TCE remains the gold standard.
Brien, 2017	Canada	Nursing students	Qualitative	HFS replacing 2 days during clinical placement	To evaluate how HFS and clinical days impacted nursing students learning	HFS and TCE both impacted student learning. HFS provided more opportunity to do but less realistically, less stress. TCE was	1			HFS may supplement TCE and allow for training leadership, collaboration and communication in low stress environment.

						more passive observer, but realistic and more stress.				
Friedman, 2016	USA	Medical students	Quantitative	Virtual simulation cases in radiology as an add-on to normal TCE	To evaluate student perceptions of simulator and knowledge scores	Students had positive feedback of the simulator. Scored better in tests of the covered area, but not on the general tests.	1, 2	May increase the use of additional online resources. Engage students in self-directed learning.	The cost in manpower of establishing the virtual case scenarios	The inclusion of virtual simulation may promote active, self-directed learning.
Goolsby, 2014	USA	Medical students	Quantitative	HFS, LFS and standardized patients	To evaluate the increase in student confidence in procedural skills in emergency medicine by adding 1 day of simulation to placement	Student confidence in procedural skills increased and stayed elevated for 3 weeks.	1			Simulation can increase student procedural confidence
Greestone, 2021	UK	Medical students	Qualitative	HFS	To evaluate feedback from students on 1 day of HFS during placement	Positive feedback.	1		Exam vs. real life	

Jauregui, 2017	USA	Medical students	Qualitative	Peer-assisted virtual cases with LFS	To evaluate student feedback from 5 virtual cases/LFS during emergency medicine placement	High satisfaction. Especially the peer-assisted format was better than normal simulations	1	Peer-assisted learning promotes active learning. Sessions were mandatory.		
Kwan, 2017	USA	Medical students	Quantitative	HFS	To evaluate student reported confidence and feedback on a 2-hour HFS session	Positive feedback on course. Increased student confidence in the procedures.	1		High cost of equipment and maintenance.	
Mollo, 2012	USA	Medical students	Quantitative	Simulated ward using HFS	To evaluate student feedback	Students reported increased understanding of medical management and documentation. Most felt it was not life-like.	1	A simulated ward may accommodate a larger number of students	Requires a significant on-site attendance of faculty, training and equipment investment.	
Nash, 2017	Australia	Nursing students	Qualitative	HFS	To evaluate how previous HFS transferred into placement tasks	Students did not apply the simulation learning during clinical placements. Not relevant for their clinical placement. Low transfer	1			Timing and curriculum during HFS and clinical placements should be better aligned.

						of learning.				
Sanseau, 2020	USA	Medical students	Quantitative	Virtual simulation via teleconferencing.	To evaluate student and faculty use of 21 free virtual simulation cases	Mostly positive feedback. Users found the format feasible and acceptable. Best for communication and knowledge skill. Less so for procedural skills.	1	Low cost	May include too many participants	
Tofil, 2013	USA	Medical students	Quantitative	HFS simulation	To evaluate student perceived effect of adding 4 HFS scenarios during clinical placement	Students perceived improved knowledge and skill, but not attitudes.	1			
Tofil, 2014	USA	Medical and nursing students	Quantitative	HFS simulation	To evaluate student perceived effect of 4 HFS interprofessional scenarios during placement	Students felt the HFS was helpful and increased knowledge. Perceived an increase in self-efficacy communication and interprofessional understanding	1	Compulsory part of the curriculum		

Wise, 2014	USA	Medical student	Quantitative	VS	To assess student usage and evaluation of a voluntary VS during placement	The VS was well liked, and mostly accessed once for between 10-30 minutes. Usually after hours from 5 PM and onwards.	1	Can be accessed at a choosing of one's own time.	Not well aligned to the clinical placement learning	
Dykes, 2021	UK	Medical students	Mixed methods	Online ward rounds via Microsoft Teams™	To evaluate the perceptions of online ward rounds for students, faculty and patients	No concerns raised by patients/family or faculty. Students found the sessions improved approach to history taking, and critical reasoning skills	1,	More students can benefit from a single patient encounter	Some may have technical problems.	
Feeley, 2021	Ireland	Medical students	Mixed method	Online or F2F, bedside teaching in surgical patients	To evaluate the students' acceptance of tele-bedside tutorials	Students in F2F group had significantly greater perceived learning, engagement, satisfaction and involvement. Telesolution may be useful if F2F not possible.	1	Ability to refer to online material and tutorial simultaneously. F2F were prolonged and may result in attention problems.	Technical problems with audio and visual quality and stability of internet coverage.	
Mill, 2021	UK	Medical	Quantitative	Live streamed	To evaluate	Well received	1	Scalability to	Technological	

		students		ward rounds	the students, faculty and patients feedback on tele ward rounds	by students, however lacked interaction and possible technical issues, less well evaluated by faculty with more technical issues. Well received by patients.		larger number of online student participants	limitations regarding ambient audio noise and internet coverage	
Patterson, 2022	UK	Medical students	Mixed	Teleconsultations	Students feedback on teleconsultations	Students preferred F2F consultations, followed by teleconsultations with attending physically present, followed by teleconsultations with attending online, and least preferred were telephone consults. All forms of consults had learning value. No physical examination	1	Learning needs can be met by both F2F and teleconsultations	Technical problems.	Medical students need to be educated in the online consultation techniques.

						on possible in teleconsultations.				
Safdieh, 2021	US	Medical students	Quantitative	Evaluation of several different supportive telehealth roles for students during COVID-19	To evaluate the student experience of several telehealth initiatives	Well received by students. Cannot replace F2F clinical learning.	1, 2			Need to educate students in telehealth methods.
Stenberg, 2015	Sweden	Nursing students	Mixed methods	Peer Learning model	Evaluation of students' perceptions of peer learning during placements	Positive evaluation of peer learning. Created a feeling of safety, increased the learning experience, but also created a sense of competition for preceptor attention. More so in the more junior students	1	Safety in numbers	Risk of competition.	None presented.
Watt, 2016	Australia	Nursing students	Quantitative	Three day introduction program prior to placement	To evaluate the effect on anxiety and self-efficacy of nursing students during their placement	Anxiety decreases following the introduction program and the subsequent placement and self-	2	None reported	None reported	None reported.

						efficacy increases				
Alegria, 2014	USA	Medical students	Qualitative	Supplying a tablet during placement with access to electronic health records, supportive software for learning and more.	To describe how student employ tablets during placement	Students did not use the tablet bedside and did not feel they added to their clinical workflow. Students used it to access reference learning material, often tailored to themselves. Better than smartphones, but pc preferred.	1	Accessibility.	Issues of size, use of virtual keyboards cost, and risk of theft.	May enhance access to self-regulated learning opportunities. Less useful for clinical workflow. May improve with technology.
Clarke, 2019	Ireland	Medical students	Qualitative	Supplying either a MacBook Air or an Ipad for students during placements	To evaluate medical students' preferences and usage of 2 devices.	88% preferred MacBook Air – but did not use it in front of patients. Only half of students with Ipads used them in front of patients, and only 15% found them helpful	1	Students are continuously connected to the web using a variety of devices.	Hesitancy about using the devices in front of patients and staff.	None reported.

						with patients				
Mandry, 2013	USA	Medical Students	Quantitative	Sending emergency medicine pearl via text messaging during placements	To evaluate if the method increases medical students' test scores following placement	There was no difference in test scores immediately following placement compared to group without text messaging	2	Easy to develop and administer.	None reported	None reported
Reames, 2015	USA	Medical Students	Mixed	Posting surgical facts on Twitter account during placement	To evaluate if the use of Twitter enhanced the educational experience.	There was no difference in post placement test scores. Relatively few used it regularly. The students did not feel it increased their engagement.	1, 2	Enhances connectivity and learning on the move	No reciprocal engagement in this study.	None reported
Subramanian, 2013	USA	Medical Students	Mixed	Utilizing digital games based learning modules and additional reading lists during surgery placement	To evaluate if the modules were utilized and affected test scores post placement.	Students found the modules effective. A large proportion did not use the resource or found the options for learning to	1, 2	None reported	Competition from a number of other digital learning sources. A significant proportion of studen	To optimize placement of modules to avoid competition from other sources.

						numerous. There were no difference in test scores of students using the modules.			ts were not cognizant of the modules.	
Augustin, 2021	USA	Medical students	Mixed	Podcast versus online modules on clinical reasoning	To evaluate the perception and impact of podcasts on clinical reasoning	Student liked the podcasts and felt they increased their skills in clinical reasoning. No difference were found on actual clinical reasoning in written assessments	1, 2	None reported	None reported	Podcast seem viable and were well received.
Barison, 2019	Italy	Nursing students	Qualitative	Online videos as add-on to traditional skills learning	To explore the perception and effectiveness of the web-based course	Student felt the videos were effective and could improve healthcare outcomes	1	May make skills application more uniform.	A confusing multitude of videos available online.	Online videos may be a useful add-on to traditional skills lab training.
Cipriano, 2013	USA	Medical students	Quantitative	Online teaching modules as add-on during placement	To assess the impact of online teaching modules during placement	Students felt the modules were worth their time, as good as clinical time, better than textbooks	1, 2	Many short modules, created by a national body.	None reported.	Modules should be easy to access and use, be standardized and be able to be integrated into different settings.

						and lectures.				
Khasawneh, 2016	USA	Medical students	Quantitative	Three different types of online learning resources	To assess the use of, student perception of, and effect of online resources on knowledge test scores	Online modules were only accessed by 67% of students during placements. They did not improve test scores. Students preferred power point to text monograph.	1, 2	None reported	Not all students access non-mandatory educational modules	Modules were satisfactory to student and in some cases increased confidence in subject, but did not improve test scores.
Kim, 2018	USA	Medical students	Mixed methods	Required or self-directed use of virtual patient cases	To explore the use and benefit of virtual patient cases	The group with required virtual patient cases completed more cases, but did not obtain greater scores on knowledge tests.	1, 2	None reported	None reported	Adding virtual patient cases do not increase test scores. Self-directed use of virtual patient cases are sub-optimal.
Lindeman, 2015	USA	Medical students	Quantitative	Lectures or online blended learning during placements	To explore the impact of introducing online blended learning modules to replace F2F lectures during placements on	The group with blended learning modules did not achieve greater test results, but rated the learning experience greater	1, 2	May reduce the human resources involved in lectures.	None reported	Blended learning may be an efficient learning strategy during placements.

					academic test scores	than the lecture group.				
Mooke rji, 2020	Canada	Medical students	Quantitative	Video podcasts during placements	To test the efficacy of video podcasts during surgery placements	The podcasts were well rated by the users and increased scores in a pre-test/post-test design. Podcasts were only used by 54 out of 161 students.	1, 2	None reported	Was only used by a third of the students	Video podcasts are an efficient learning tool and preferred over traditional modalities .
Xiong, 2021	USA	Medical students	Mixed	Introducing a “flipped” placement to ameliorate COVID-19 restrictions	To see if introducing virtual teaching during COVID-19 and shortening the in-patient care activities impacted on knowledge and student ratings.	There was no difference in student ratings of placements or test results between the two models.	1, 2	None reported	None reported	It is possible to convert F2F teaching during placements to virtual “flipped” classes.

Table 3. Preceptors and Learners

Reference	Country	Profession	Design	Model	Aim	Outcome	Kirkpatrick Level	Promoters	Detractors	Recommendations
Biggs, 2018	USA	Medical students	Mixed methods	Students assigned to either 1-3 primary preceptors or 5-8 general preceptors	To investigate if preceptor continuity affected student feedback and outcome during placement	Continuity students received more feedback and preferred the continuity model. There were no difference in test scores.	1, 2	More progressive formative feedback. Relationship building.	May decrease the variety of patient cases and input from preceptor. Logistics are more complex.	The model is recommended by students and faculty.
Chong, 2021	UK	Medical students	Mixed method	Implementation of teaching fellows	To evaluate student perception of a teaching fellow program	The teaching fellow program was rated excellent by the students.	1	None reported	None reported	None reported
Edafe, 2016	UK	Medical students	Qualitative	The feedback, activity, individuality, and relevance (FAIR) model	To examine how the model affected students' experience of learning during clinical placement	Feedback was generally positive or trended towards positive	1	Save environment for feedback	Time intensive for tutors.	The model could improve clinical teaching.
Ford, 2016	Australia	Nursing students	Mixed methods	Survey of nursing program	To evaluate and improve nursing placements with feedback from students and preceptors	Feedback from students and preceptors were generally positive. Three themes were identified as	1	None reported	None reported	None Reported

						important: Welcome and belonging, Competence and confidence, and Support to meet educational needs				
Hart, 2019	UK	Nursing students	Qualitative	Pilot study of 8 students and their preceptors. Focus group evaluation of an online model for higher education institution lecturer support during placement	To obtain qualitative feedback on practical issues related to online support.	The participant found the technology easy to use, time-efficient and afforded flexibility. Could not replace F2F meeting when expressed necessary by student or preceptor.	1	Saves travel time for lecturers. Flexibility in planning sessions.	Technical glitches. Outdated equipment and lack of office space for online meetings.	Online student support may be more time efficient, but cannot always replace F2F meeting.
Lofmark, 2012	Norway	Nursing students	Quantitative	Survey study of supervision from preceptors and teachers following placements	To evaluate students perceptions of the supervision from preceptor and teachers following placement.	Supervision from both teachers and preceptor were rated highly and was related to learning outcomes	1	None reported	None reported	None reported
McLeod, 2021	Australia	Nursing students	Qualitative	Survey of nursing and midwifery students and their preceptors following placements with a clinical school supervision model.	To evaluate students and preceptors' perceptions of the model.	The model enhanced learning opportunities through reflection and students felt they received the best of both academic and clinical worlds.	1	None reported	None reported	Education and academic support for preceptors is important
Newton, 2012	Australia	Nursing students	Mixed methods	Survey of nursing students comparing 3 placement	To evaluate students perception on the	The preceptor partnership model enhanced	1	Consistency vs. frequent shifts	None reported	Consistency and student-centredness is important for

				models (2 traditional and a partnership model)	learning environment	student centredness, but not other themes of the learning environment.				the learning environment.
Tran, 2021	UK	Medical student	Quantitative	Introduction of a near-peer consistent clinical tutor during placement	Pilot evaluation of a junior physician tutor during placement by students and tutors	The clinical tutor program was well received by a majority	1	None reported	May not be practical due to normal clinical duties.	None reported

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