Technovation 120 (2023) 102549

Contents lists available at ScienceDirect

Technovation

journal homepage: www.elsevier.com/locate/technovation

Steering resilience in nursing practice: Examining the impact of digital innovations and enhanced emotional training on nurse competencies

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ARTICLE INFO

Keywords:
Resilience
Clinical confidence
Comprehensive nursing education
Technological innovation

ABSTRACT

The phenomenal development of healthcare practice in the past few decades has reinforced the view that technology could potentially be the third healing triad element. This study, using data from Australia and the United Kingdom, explores resilience in nursing education through the lens of emerging digital technologies and enhanced emotional training. The study employed a mixed-method approach. A pretest-posttest was used to collect data from 54 nursing students during the lectures and tutorials, whilst the qualitative consisted of interviews with 20 health professionals, including nurse teachers and doctors. We found that students' confidence in mental health nursing practice improved substantially after mental health placement. Besides, the effectiveness of the training offered was not compromised by variances in the demographic groups (e.g. age and gender) amongst the participants. The interview findings revealed that nurses could develop more outstanding modern capabilities with exposure to increasingly used technologies in the healthcare sector; thus, AI and digital technology and health-related engineering equipment can help reduce stress in the profession as machines become critical aid. Technology is, thus, not a threat but a necessary complement that can upskill nurses for contemporary practice.

1. Introduction

The nursing profession demands that registered nurses think critically and make confident decisions to deliver nursing care with competence (Edward et al., 2015; Lundberg, 2008). The Australian comprehensive nursing education programs were designed to prepare student nurses to be competent and confident practitioners in various health settings (Edward et al., 2015; Happell and McAllister, 2015). It is, therefore, important that undergraduate nursing students spend sufficient time undergoing clinical experience (Hemingway et al., 2016). We deploy Timmermans and Berg's (2003) technology-in-practice theory as the theoretical foundation for this study. The paper examines the interplay between technology and the dynamics of medical practice (particularly in nursing) in contemporary societies. Given the complexification of healing and technological advances amidst a growing interest by both scholars and practitioners in electronic or E-health (Biancone et al., 2021) and the urge for the continuous integration, implementation, and management of the acquired knowledge and new technologies in healthcare organisations (Shaygan and Daim, 2021), it is significant that research is now attempting to explicate emerging dialectic relationships between technological innovation and users in the medical field. We address the factors that enhance or hinder clinical confidence among student nurses— a critical component in their ability to carry out their responsibilities in the clinical setting (Panduragan et al., 2011).

The literature on the clinical experience of trainee nurses is limited

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https://doi.org/10.1016/j.technovation.2022.102549
Received 14 September 2021; Received in revised form 27 April 2022; Accepted 8 May 2022
Available online 23 May 2022

despite criticisms of health education programs, particularly in nursing (Fawaz et al., 2018). This paper makes a significant contribution to the Special Issue by studying the mechanism underpinning training, which results not just in clinical competence but also confidence and mental resilience (Bonsall, 2020; Laskowski-Jones, 2019), particularly in a time of covid-19 pandemic when many communities worldwide have been deemed unprepared for the unanticipated turmoil resulting from such a possibly *black swan* event (Cobianchi, Dal Mas, Peloso, Pugliese, Massaro, Bagnoli and Angelos, 2020a; Taleb, 2008) and nurses have been hailed as *heroes*. This could be by addressing the following research question: What is the effect of clinical experience on the clinical confidence of undergraduate nursing students? Using data collected in the Australian and United Kingdom contexts, the study aimed to investigate the effect of mental health clinical experience on the clinical confidence of undergraduate nursing students.

The article is organised as follows. First, we synthesise relevant literature to offer theoretical premises for the study and its aim and objectives. Second, we discuss the methodological approaches employed to perform this study. The third section presents the research findings, followed by a discussion positioning the study's contribution to both theory and practice and addressing the research limitations, thus, offering directions for future research. Finally, we offer a conclusion that summarises the key findings and elements of this investigation.

2. Literature review and theoretical framework

2.1. Perspectives on contemporary nursing education

Most contemporary nurse education aims to develop in the nurses a sense of certainty and self-reliance (Hack-Polay, 2020; Porter et al., 2013). Clinicians define confidence as a certainty of a professional approach that brings a valuable outcome (Bonsall, 2020). The attributes of confidence include terms such as self-efficacy, self-belief, credence, assurance, courage, firmness, nerve, self-regulation and self-possession (Waite and Hawker, 2009). In this study, the concept of clinical confidence is based on the understanding that undergraduate nursing students' confidence in clinical settings depends on traits exhibited in specific situations (Owens and Keller, 2018). In addition, the term confidence is grounded in the principles of self-efficacy, and hence, these two terms, confidence and self-efficacy, have often been used interchangeably (Bandura, 1977).

The literature highlights the importance of clinical confidence in nursing practice, and it is clearly stated that individuals with confidence experience a sense of assurance that contributes to competent or outstanding performance in their duties (Hemingway et al., 2016; Owens and Keller, 2018). For example, Thackrey (1987) discussed how confidence is particularly important in managing patients/clients with mental illness, as it allows nurses in the mental health setting to deal with their patients/clients effectively and comfortably. Similarly, Liew (1996) reported that clinical confidence allows nurses to competently deal with aggression or other challenging behaviours displayed by patients in the mental health setting.

Most global nursing educational frameworks posit that integrating theory and practice is a critical tandem in preparing efficacious nurses for the job market. The notion of practice no longer refers to the emotional attention to the patients but also the articulation of modern developments that allow the patients to feel a sense of connection with society and 'normality' despite being hospitalised or receiving outpatient care. Although *theory* is an important component of nursing, clinical experience is generally viewed as an integral component of nurse education. It is the clinical experience that provides student nurses with the framework to develop clinical confidence to practice in clinical settings (Bell et al., 1998). The technology-in-practice theory is a suitable theory for examining the use of technology innovation in nursing education as it can help to appreciate how the nursing field and the nursing student engages with non-psychological dimensions of patient care, which at the same time can enhance the healing process, considering Booth, Strudwick, McBride, O'Connor and Solano López's (2021) findings.

Timmermans and Berg (2003) contend that while the technology-in-practice orientation means allowing social scientists to critique the high promises and grim cautions encoded in medical technologies, it can be argued that the obvious next step of this viewpoint is to influence the invention and deployment of medical technologies. Such an endeavour is a determinant of self-confidence among professionals but also healthcare users [patients and families]. As reported by several authors (e.g. Achterbosch et al., 2015; Bonsall, 2020; Hack-Polay, 2020), confidence emerges from the interaction of environmental, experiential and behavioural factors influencing a person. Similarly, student nurses require theoretical knowledge, exposure to the clinical environment, interaction with clinical educators, nurses and patients so that they can develop clinical confidence. In addition, clinical experience in the mental health setting provides students with the opportunity to develop cognitive and psychomotor skills in key areas of mental health nursing such as assessment, communication, patient/-client education, medication knowledge, self-management and teamwork (Happell and McAllister, 2015; Owens and Keller, 2018).

In social cognitive theory, modelling influences learning and attitude development. This capacity to learn by observation enables the learner to acquire rules for generating and regulating behavioural patterns, reducing the chances of them forming these through trial and error (Kurian and Mekoth, 2021; Tenenberg, 2016). Bandura postulated that some complex procedures could only be mastered through the aid of modelling. Similarly, student nurses in clinical practice learn clinical procedures by observing registered nurses provide patient care. It exemplifies the effectiveness of mentorship advocated by DeForge et al. (2019). Hence, clinical educators and mental health nurses with expert knowledge should be professional role models to students on mental health clinical placements.

Technology-in-practice theory sees technological learning as part of a social transmission in which institutional practices are taught to new members by selective reinforcement. Nursing is, therefore, a practice-based profession that requires student nurses to learn in clinical settings (Mthiyane and Habedi, 2018). Furthermore, Mthiyane and Habedi (2018) argue that nursing is an applied science that cannot be fully developed in the classroom or clinical laboratory skills. Therefore, student nurses on clinical placements learn high-quality nursing skills with the help of reinforcements such as clinical supervision, post-clinical conferences and clinical tutorials. We have used Technology-in-practice theory because it supports the two dimensions of our research (the technological and the psychosocial dimensions).

A significant additional perspective of modern nursing education is forethought ability. It is thought that an individual's behaviour is purposive and regulated by thinking ahead (Kurian and Mekoth, 2021). Individuals anticipate the likely consequences of their actions; they set goals, plan, weigh evidence from different sources and recognise actual success and failures, which influence later performance. Similarly, student nurses on mental health clinical placements assist patients in resolving problems by formulating care plans. This requires skills of assessment, problem identification, care planning, implementing and evaluating health-related problems (Happell and McAllister, 2015). The implementation of care using nursing care plans assists students to monitor patients/clients' progress and ultimately helps them self-regulate their nursing activities.

However, it is thought that with increasing technological changes in society at a large and medical practice, in particular, nursing education requires some re-engineering in order to increase resilience in nursing practice. The next section of the literature review examines some of these key changes and their impact on healthcare.

2.2. Technological innovations and healthcare practice

The continued application of technological innovations is crucial for the development of most organisations (Berghoff, 2001; Kahn, 2018), including those in healthcare (Massaro, 2021; Soenksen and Yazdi, 2017) during the COVID-19 pandemic and future health crises (Basile et al., 2022; Drago et al., 2021) during which healthcare service providers are urged to identify and implement clinically necessary changes within healthcare systems in order to enable antibody testing and medical interventions (Madhavan et al., 2021). Activities that contribute to the research, development, and design of new goods, services, or processes or improve current ones are categorised as technological innovation whose activities also produce new technological knowledge (Inna Sousa and Isabel Costa, 2015). That involves *digitisation*, a disruptive innovation that offers new social and business opportunities, whilst at the same time challenging the conventional way of inventing 'work' in a way that would require both individuals and organisations to adjust, and ultimately leads to *digitalisation*, improvements in the business processes as a result of digitisation (Elia et al., 2020; Mahmoud, 2021). This has been the theme for Industry 4.0, where, as expected in earlier research (e.g. Thimbleby, 2013), the healthcare sector has its processes disrupted by the employment of the internet of things (IoT) alongside artificial intelligence (AI) (Abdel-Basset et al., 2021; Mahmoud, 2021; Massaro, 2021; Sousa et al., 2019) under the umbrella of technological innovation and with a mission, according to WHO (2016), to enhance the health of all individuals, particularly vulnerable groups; thus, offering healthcare institutions and organisations a wealth of new innovation possibilities (Biancone et al., 2021; Cohen et al., 2017; Nambisan, 2017; Tortorella et al., 2021; Yoo et al., 2010), as in the context of place and time, IoT allows every artefact to become a more intelligent device for sensing and communications, storage, processing, and display (Ramaswamy and Ozcan, 2018).

As a result of technological innovation in the healthcare sector, robotic medical devices have been widely implemented to provide many sorts of medical services, including monitoring patients, performing surgeries, and managing vital functions such as nursing (Guntur et al., 2019). For instance, IoT offers the potential to transform the look of robotics by presenting a new level of intelligent robotics dubbed the "Internet of Robotic Things (IoRT)" in conjunction with artificial intelligence in the near future, where the fundamental component in designing and developing IoRT is "cloud robotics" (Batth et al., 2018; Masuda et al., 2020). Therefore, the Internet of Medical Robotics Things (IoMRT) plays an essential role in improving medical equipment's efficacy, speed, and operational accuracy (Guntur et al., 2019). In addition, the IoMRT may collect health data from patients using sensors and equipment linked to Internet-powered health tracking systems (Guntur et al., 2019). Furthermore, they integrate clinical, diagnostic, and therapeutic services into IoMRT, which will result in the addition of surgical operation services, such as nursing and laboratory test analysis (Guntur et al., 2019; Masuda et al., 2020). Robotic systems combined with IoT allows physicians and other healthcare workers to manage the functioning of robots and execute particular tasks in real-time using a smartphone or a wearable device (Masuda et al., 2020) that offer personalised (or smart) healthcare (Pérez-Roman et al., 2020) through mobile applications (Chakraborty and Paul, 2022).

However, as clinicians, nurses are not often trained in the aspects of innovation. For instance, the challenges nurses encounter, and the usage of workarounds as quick remedies for problems lead them to acquire specific skill sets similar to those of most clinicians. Moreover, nurses observe patient needs through the prism of their nursing education and experience (Eccleston and Richardson, 2019). As a result, innovation in nursing has taken on a greater significance in nursing literature (Kaya et al., 2015). Further, we argue that technological innovation training is inevitable in the case of nursing education and practice. That is, on the one hand, given the attempts and endeavours of the governments and policymakers to enhance the equality and availability of healthcare services to their populations, healthcare service providers are developing a growing demand for skilled clinicians and healthcare workers amidst a shortage in these resources—making this quite challenging, especially in the case of nurses (Rice, 2019). Moreover, on the other hand, recent health crises like the COVID-19 pandemic have shown that traditional ways of offering healthcare services can be dysfunctional and obsolete during such turbulent times (Cobianchi et al., 2020a). Healthcare systems around the world have been forced to rethink their global strategies following the COVID crisis (Cobianchi, Pugliese, Peloso, Dal Mas and Angelos, 2020b).

3. Methodology

The study employed a mixed-method approach with a quantitative survey with nursing students and qualitative semi-structured interviews with health professionals. Combining qualitative and quantitative data may enhance an assessment by balancing the strengths and limitations of each form of data. This will boost knowledge by combining diverse methods of knowing. Qualitative methods may be able to provide light on correlations between variables that emerge via quantitative methods (e.g. quantitative). A study's generalisability or relative relevance may be improved by using a combination of approaches. The credibility of research is enhanced as a result, as does our knowledge base. Despite the fact that the findings may be affected by the method used, it is impossible to determine the nature of the effect if only one method is used. This "method effect" may be countered by using a variety of ways. As a result, scholars might have more faith in their judgments (Bryman, 2006; Greene, 2007; Molina-Azorín, 2010; Saunders et al., 2019). A pre-test and post-test survey design involving a quantitative research approach was used. The use of a survey was suitable because it focused on obtaining information regarding the status of the situation or persons by means of direct questioning of participants (Polit and Beck, 2017). The participants were surveyed using demographic profiles and the Mental Health Nursing Clinical Confidence Scale (MHNCCS) self-report questionnaire before and after their clinical experience in mental health settings.

The chosen design is flexible, broad in scope and economical. Surveys using a questionnaire can cover a wide range of geographical areas, reach a range of participants, ensure respondents' anonymity and require less skill to administer (Ellis, 2016). Hence, nurse researchers have used the survey research approach to study a wide range of research topics (Polit and Beck, 2017).

3.1. Sample

Convenience sampling method was used for both quantitative and qualitative aspects of the research and was found suitable given the human and financial resource constraints (Saunders et al., 2019). The students were invited to take part in the study if they were enrolled in the Bachelor of Science (BSc) Nursing program, and were third-year nursing students in the fifth semester, and were undertaking a mental health unit. Students who did not meet the above criteria were excluded.

The participants of the study were recruited from a convenience sample of third-year undergraduate nursing students. Participants had mental health theoretical input of the nursing curriculum throughout the semester. The students were invited to participate in the study following an address by researchers in which the aims, significance and benefits of the study were explained. Out of 80 students, 77 students responded and agreed to participate in the study.

The Mental Health Nursing Clinical Confidence Scale developed by Bell et al. (1998) was used to elicit students' clinical confidence in relation to skills and knowledge in key areas of mental health nursing practice relevant to beginning practitioners. The MHNCCS is a 20-item scale incorporating essential areas of mental health nursing practices such as assessment, communication, patient education, self-management, medication therapy and teamwork. The responses

from this scale were measured on a four-point Likert scale that was rated as 1 = Not at all Confident, 2 = A Little Confident, 3 = Quite Confident, 4 = Completely Confident. Permission to use the MHNCCS was granted by Bell, and the tool was provided to the authors. The items of the questionnaire are reproduced in the results section below. The reliability of the MHNCCS for the current study was established using Cronbach's Alpha and revealed excellent psychometric properties. The overall pre-confidence scores of the 20 items calculated together resulted in Cronbach's Alpha of 0.90, demonstrating satisfactory reliability (Hair et al., 2010). Finally, we applied Harman's single factor test to check for common method bias (Podsakoff et al., 2003). Using "principal axis factoring" as an extraction method, the common factor produced 32.14 per cent of variance, which is markedly less than 50 per cent; hence there was no concern related to CMB (Podsakoff et al., 2003).

3.2. Data collection and analysis procedures

The study was done in two parts. The first part consisted of survey data collected from nursing students during the lectures and tutorials. The second part consisted of interviews with ten health professionals, including nurse teachers and doctors. For the survey, two days prior to the commencement of their clinical placement, the researchers collected the pre-test data. Participation in the study was voluntary, and that they were free to withdraw from the study at any time and that participation in the study would not influence their assessment in their course. The students who volunteered to participate were given an information sheet and a consent form to sign. Participants completed the first self-report demographic profile and the MHNCCS questionnaire in a classroom setting, taking 10–15 min to complete. The participants then commenced a two-week clinical experience at different mental health settings in the Perth metropolitan area. The clinical placements aim to integrate theory into practice and help student nurses to acquire clinical confidence in clinical skills (Cashin et al., 2017). The clinical educators met with students every day for case study group discussions related to their clinical experiences. The students on clinical placements were also buddied with Registered Nurses (RNs) who acted as role models. Both clinical educators and RNs helped students to gain clinical confidence in mental health nursing skills. One week after their clinical experience, students were administered the same demographic questionnaire and the MHNCCS self-report questionnaire under the same conditions as the pre-test. Only 54 students responded to the post-test. Therefore, a total sample comprising 54 participants completed both the pre-test and post-test self-report survey questionnaires.

For the interview part, the research followed three key steps. We first conducted the semi-structured interviews and transcribed them. Secondly, we examined the transcripts through thematic analysis to derive the main topics from the discussions (Guest et al., 2012). The third step involved the interviews being coded manually given the small number of interviews. The researchers used axial coding to re-organise the data by establishing possible connections between the earlier identified themes. Finally, the qualitative data analysis was done on a case-by-case basis to bring to light the common aspects of the participants' technological knowledge and advantages for nursing practice. To ensure confidentiality, we blanked the participants' identities. Table 1 shows details of the participants.

Table 1
Interview participants.

Participants	Gender	Age	Length of service
1	Female	45	20
2	Female	40	18
3	Female	35	10
4	Male	50	23
5	Female	39	11
6	Female	26	5
7	Male	32	10
8	Male	26	4
9	Female	32	10
10	Male	23	2

The statistical analysis was performed using SPSS. The MHNCCS scores were compared in relation to demographic variables (age, gender), enrolled nurse status and work experience in healthcare facilities. Paired-samples *t*-test was used to compare pre-test and post-test variables within groups, and an independent *t*-test was used to compare the variables between groups. In addition, we used One-way Analysis of Variance (ANOVA) to compare pre-test and post-test confidence scores between different age groups and work experience.

3.3. Ethical approval

Curtin University's Human Research Ethics Committee granted approval to conduct this study before the commencement of data collection (Permission HR16499). All eligible participants gave written consent after explaining the aim, benefits and significance of the study. The participants were assured of confidentiality and were informed that only aggregate data was used in the final report.

4. Findings

4.1. Quantitative analysis

Of the 77 participants, 18 did not respond to the post-test questionnaire resulting in 54 pre and post-test matched cases responding to demographics and the MHNCCS. Data from 54 participants who completed the pre-test and post-test self-report questionnaires were subjected to component analysis. The pre and post confidence scores were generated using the mean of the 20 items, with the mean based only on items that had a response. This standardised the result for pre-test and post-test confidence scores.

Most students were females (87%) of the sample. The average age of participants in the study was 25 years (SD = 7), with an age range of 19–46 years. Thus, four distinctive age groups were established for the analysis of data in the study. The demographic data revealed that students who participated in the study were employed as casual or part-time workers in various healthcare settings (Fig. 1). Fifteen per cent (15%) of the students were registered as enrolled nurses, 37% in nursing homes and 35% in other healthcare facilities. In addition, 6% of the students were currently employed in mental health while 17% had previously worked in mental health.

A paired-samples *t*-test was used to analyse the mean of sum pre-test and post-test confidence scores. Table 2 shows the mean pre-test score

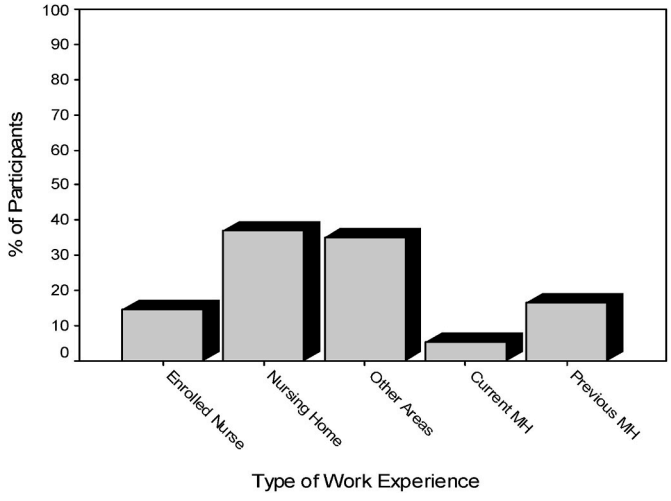

Fig. 1. Participants' Work experience.

Table 2
Mean pre and post-test scores for MHNCC Scale items.

	Item	n	Pre-test Mean	SD	Post-test Mean	SD	*t*	*df*	P	Cohen's *d*
1	Can communicate effectively with clients	54	1.31	0.75	3.13	0.52	−6.71	53	<.0001	>.8
2	Can carry out psychological assessments	54	1.91	0.68	2.78	0.63	−6.22	53	<.0001	>.8
3	Can conduct a mental state examination	54	1.71	0.69	2.57	0.74	−6.58	53	<.0001	>.8
4	Can develop a nursing care plan based on assessment	54	2.09	0.71	2.69	0.67	−4.72	53	<.0001	>.5
5	Can assist client to clarify treatment goals	54	1.87	0.65	2.77	0.64	−8.09	53	<.0001	>.8
6	Able to provide basic counselling	54	1.91	0.73	2.81	0.73	−8.78	53	<.0001	>.8
7	Able to be empathetic	54	2.67	0.80	3.39	0.66	−5.60	53	<.0001	>.5
8	Can provide information regarding diagnosis	54	1.96	0.75	2.78	0.72	−7.94	53	<.0001	>.8
9	Able to assist clients develop living skills	54	2.33	0.61	2.93	0.64	−6.10	53	<.0001	>.8
10	Basic knowledge of antipsychotic medications	54	1.32	0.67	2.96	0.78	−5.85	53	<.0001	>.5
11	Basic knowledge antidepressants	54	1.35	0.68	2.94	0.81	−5.69	53	<.0001	>.5
12	Basic knowledge ant-anxiety	54	1.31	0.70	2.89	0.82	−5.33	53	<.0001	>.5
13	Basic knowledge mood stabilisers	54	1.30	0.72	2.89	0.84	−5.07	53	<.0001	>.5
14	Provide education regarding effects of medication	54	1.20	0.68	2.83	0.80	−5.73	53	<.0001	>.5
15	Can fit with the nursing team on mental health placement	54	1.72	0.63	3.44	0.66	−6.37	53	<.0001	>.8
16	Can contribute at multidisciplinary meeting	54	1.89	0.74	2.96	0.80	−7.99	53	<.0001	>.8
17	Can handle verbally aggressive clients	54	1.96	0.75	2.67	0.67	−6.53	53	<.0001	>.8
18	Can handle physically aggressive clients	54	1.67	0.73	2.22	0.72	−5.49	53	<.0001	>.5
19	Can establish own personal boundaries	54	1.48	0.82	3.26	0.62	−7.68	53	<.0001	>.8
20	Can seek support from other team members	54	3.00	0.77	3.65	0.52	−5.92	53	<.0001	>.8

On a scale of 1–4 (1 = Not at all confident and 4 = Completely confident).

($M = 44.0$, $SD = 82.2$) and the mean post-test score for the MHNCCS Scale ($M = 58.5$, $SD = 8.2$). The pre-test score was significantly and largely lower than the post-test score for MHNCC Scale (t = −11.4, df = 53, $P < 0.001$, Cohen's $d > 0.8$). Further, a comparison of pre and post-test confidence scores for each item on the MHNCC scale showed that the mean post-test scores were significantly higher than the pre-test scores ($p < 0.0001$ for each item). These findings indicate that the students were more confident after their mental health nursing practice.

4.2. Does the effectiveness of the technological innovation training work invariantly across demographics' different groups?

The findings in this section answer this question by showing the relationship between the pre and post confidence scores and the demographic data such as age, gender, enrolled nurse status, and work experience in mental health, nursing homes and other care facilities.

A One-Way Analysis of Variance (ANOVA) was used to compare pre-test and post-test confidence scores between the different age groups and work experience. The relationship between the four age groups (19–20 years, 21–25 years, 26–35 years, and 36+ years) and mean sum of pre-test/post-test confidence scores are shown in Table 3. There were no significant differences in the pre-test confidence scores ($F = 1.01$, df = 3, $p = 0.395$) or post-test confidence scores ($F = 0.66$, df = 3, $p = 0.580$) between the age groups. This implies that the participant's age was not shown to have any influence on students' confidence either before or after their clinical experience.

4.3. Gender and MHNCCS scores

The relationship between pre-test/post-test confidence scores and gender is shown in Table 4. There was no significant difference in the mean confidence scores between males and females, either at pre-test ($t = .18$, df = 52, $p = 0.857$) or post-test ($t = 0.26$, df = 52, $p = 0.799$).

Table 3
Age groups and MHNCCS scores.

Variable	Age Group	n	Mean	SD	*F* Statistic	df	*p*
Pre-Test	19–20	18	42.6	9.2	1.01	3	0.395
	21–25	20	44.0	6.8			
	26–35	11	47.4	8.5			
	36+	85	44.0	10.0			
Post-Test	19–20	18	59.9	5.7	0.66	3	0.580
	21–25	20	58.0	9.2			
	26–35	11	58.8	8.6			
	36+	5	54.2	11.3			

4.4. Enrolled nurse status and MHNCCS scores

The relationship between enrolled nurse status and pre-test/post-test confidence scores is shown in Table 5. There was no significant difference in the pre-test confidence scores between students with an enrolled nurse qualification and other students without a qualification ($t = 1.51$, df = 52, $p = 0.136$). Similarly, there was no apparent difference in the post-test confidence scores between the two types of students ($t = -0.54$, df = 52, $p = 0.590$).

4.5. Work experience in nursing home and MHNCCS scores

There was no significant difference in confidence scores of those students who worked in nursing homes and those who did not work in nursing homes either at the pre-test ($t = 1.08$, df = 52, $p = 0.248$) or post-test ($t = 1.59$, df = 52, $p = 0.117$), as indicated in Table 6.

4.6. Work experience in other care facilities and MHNCCS scores

Analysis of work experience in other care facilities in relation to pre-test/post-test confidence scores is shown in Table 7. There was no significant difference in the pre-test/post-test confidence scores ($t = 1.95$, df = 52, $p = 0.847$) between those students who worked in other care facilities and those who had no such experience ($t = 0.04$, df = 52, $p = 0.967$).

4.7. Current mental health work and MHNCCS scores

Table 8 shows the relationship between current work experience in the mental health setting and MHNCCS scores. There was no significant difference in pre-test confidence scores ($t = 0.29$, df = 520, $p = 0.771$) or

Table 4
Gender and MHNCCS scores.

Variable	Gender	n	Mean	SD	*t*	df	*p*
Pre-Test	Female	47	44.0	8.3	0.18	52	0.857
	Male	7	43.4	8.5			
Post-Test	Female	47	58.6	8.4	0.26	52	0.799
	Male	7	57.7	6.8			

Table 5
Enrolled Nurse Status and MHNCCS scores.

Variable	Enrolled Nurse	n	Mean	SD	*t*	df	*p*
Pre-Test	Yes	8	48.0	8.26	1.51	52	0.136
	No	46	43.3	8.17			
Post-Test	Yes	8	57.0	7.75	−0.54	52	0.590
	No	46	58.7	8.34			

Table 6
Work Experience in Nursing Home and MHNCCS scores.

Variable	Work Experience in Nursing Home	n	Mean	SD	*t*	df	*p*
Pre-Test	Yes	20	45.5	8.5	1.08	52	0.284
	No	34	43.0	8.1			
Post-Test	Yes	20	60.7	7.4	1.59	52	0.117
	No	34	57.1	8.5			

Table 7
Work Experience in other care facilities and MHNCCS scores.

Variable	Work Experience in Other Care Facilities	n	Mean	SD	*t*	df	*p*
Pre-Test	Yes	19	44.3	8.5	1.95	52	0.847
	No	35	43.8	8.3			
Post-Test	Yes	19	58.5	7.6	0.04	52	0.967
	No	35	58.4	8.6			

Table 8
Current Mental Health Work and MHNCCS scores.

Variable	Current Mental Health Work Experience	n	Mean	SD	*t*	df	*p*
Pre-Test	Yes	3	45.3	9.3	0.29	52	0.771
	No	51	43.9	8.3			
Post-Test	Yes	3	60.3	6.7	0.40	52	0.689
	No	51	58.4	8.3			

post-test confidence scores ($t = 0.40$, df $= 52$, $p = 0.689$) between those students who currently worked in mental health settings and those who had no current mental health experience.

4.8. Previous mental health work and MHNCCS scores

Table 9 shows the relationship between previous work experience in the mental health setting and MHNCCS scores. There was no significant difference in pre-test ($t = 0.10$, df $= 52$, $p = 0.919$) or post-test ($t = -1.40$, df $= 52$, $p = 0.168$) confidence scores between those students who had worked previously in mental health settings and those who had no prior experience.

Based on the above, we find that the effectiveness of the training offered was not compromised by variances in the demographic groups amongst the participants.

Table 9
Previous Mental Health Work and MHNCCS scores.

Variable	Previous Mental Health Work Experience	n	Mean	SD	*t*	df	*p*
Pre-Test	Yes	9	44.2	6.0	0.10	52	0.919
	No	45	43.9	8.7			
Post-Test	Yes	9	55.0	4.3	−1.40	52	0.168
	No	45	59.2	8.6			

4.9. Qualitative analysis

The interviews were held with ten nursing professionals who are involved in nursing education and practice. Table 1 shows the characteristics of the participants.

Two major analytical themes were derived from examining the data collected following coding and the thematic analysis. These two overriding themes are knowledge of digital technologies and digital technologies in nursing education.

4.10. Knowledge of digital technologies

Most of the participants showed very good knowledge and understanding of current digital technologies used in healthcare practice, particularly in nursing. This expert understanding is illustrated in the statements of some participants.

> "So far as my knowledge goes, the key digital technologies which are popular in nursing practice are electronic point-of-care wound documentation for residential long-term care, noise-sensor light alarms for the intensive care unit (ICU), companion robots for elderly care or multi-municipal support networks for informal carers. This also includes both formal and informal care settings. In addition, some of these technologies are employed in nursing education. Big Data Analytics (BDA) are increasingly adopted with different interactive apps to improve patient care."
>
> — Participant 1

> "There are many devices, software and applications from the digital technologies. It is difficult to think of nursing practices without digital technologies. Some of the technologies are more specialised for this sector. One thing is very archaic but still very common which a pager is. Many doctors and nurses use a pager to communicate at hospital as they are used to with this."
>
> — Participant 4

This confidence exemplifies the degree to which technologies are becoming a familiar feature of a sector that traditionally relied upon human relations and physical contacts.

The knowledge of digital technologies goes beyond physical and more visible apparatuses to include some good understanding of software and data analytics. Though not all participants were totally conversant with these, some professionals interviewed were in a position to articulate the strategic importance of technological developments such as big data and data analytics.

> "AI will shape the emergency patient management with very high level efficiency in future. In of accident and emergency, AI will be able to suggest required preparation before the arrival of ambulances. AI will also be able to fill data by observing the patient."
>
> — Participant 3

> "AI can confer approximate conclusions based on data generated from healthcare settings, patient information and disease progression etc. using computer algorithms. AI has been used in prevention or treatment of diseases and improve patient outcomes by analysing and making conclusions from complex and dynamic medical and healthcare data with the use of technologies that can mimic human cognition."
>
> — Participant 7

> "Analytics are giving very significant information and data that can help in healthcare services in many ways. It could be very difficult to face Covid-19 patients without the help of analytics."

— Participant 10

The participants explained well how dynamic technologies could help society deal with evolving healthcare issues and the complexification of patient care. Reference to how AI and Analytics helped deal with the ongoing covid-19 pandemic is a significant statement about the strategic aspects of healthcare technological development.

4.11. Digital technologies in nursing education and practice

4.11.1. Benefits of digital technologies to nursing practice

The use of digital technologies in the nursing practice is increasing due to the critical role they play in patient care. The participants overall acknowledge the significant benefits that such technologies have for nurses, patients and their families. These range from timely assessment information to patients monitoring, family information to nurses' workload and working conditions. The following excerpts attest to the recognition of these benefits.

"Digital technologies can offer opportunities to overcome existing problems and challenges in the healthcare sector. Many healthcare systems face challenges due to shortage of skilled workers and increasing demand for long-term care."

— Participant 1

"Digital technologies assist people in need of care to maintain their independence and improve their quality of life and health and support formal and informal caregivers. It can, therefore, revolutionise improved delivery of healthcare alongside reduce the financial strain on government."

— Participant 2

"There are many benefits, such as, online scheduling and quick access to the report. It can also enhance the level of efficiency and accuracy. They can also reach out team instantly to consult during critical treatment including live video session. At the same time, they can support doctors by ensuring a quick access to the patient history."

— Participant 5

"The great benefits I see include: avoiding medication errors and errors in dosing, precise dilution of IV/infusions medications, patient records documentation systems."

— Participant 9

Despite the acclaimed benefits of digital technologies, their introduction to nursing education is slow. This means that many trainee nurses graduate without the necessary competence in the use of these valuable modern tools, which can enhance the quality of care of their future patients as well as lessen the burden of themselves as nurses. The following section presents participants' views and concerns about the slow introduction of digital technologies in nursing training.

4.11.2. Slow implementation of digital technologies in nursing education

Our participants largely agree that it is high time that digital technologies became fully integrated into the nursing curriculum. This is because there appear to be inconsistencies and patchiness across nursing training programmes and institutions. The following excerpts support the need for development in this area.

"The field is emerging and these have been gradually embedding in nursing education in developed country but hardly it happens in LMICs."

— Participant 1

"Some of the applications are already embedded in nursing education to give them proper orientation of benefits of these technologies in delivery of improved patient care."

— Participant 6

"Currently we can see very limited applications in nursing education despite growing awareness of the opportunities that AI for example offers."

— Participant 7

"There is growing awareness of the capability of digital technologies in the sector. That's good development. But the actual adoption of new technologies in nursing education is slow."

— Participant 10

4.12. Economy and resistance as causes of slow adoption of digital technologies

Many factors explain the slow adoption of digital technologies in nursing education and practice. In our participants' eyes, these mainly centre on economic issues and resistance due to fear of machines potentially 'taking over jobs'. As some participants put it:

"Many training institutes and hospitals do not have the funds to buy digital technologies. Some of the traditional machines are still rudimentary, so digital technologies could seem like a fantasy."

— Participant 4

"In developing countries, the governments don't have the resources. This means that nursing training is still very basic and traditional. I further training in country Z but when I came here I had to learn to use different machines. Getting to know about artificial intelligence use in nursing is very new for me."

— Participant 5

"Many nurses feel that machines will replace human and there will be no need for nurses in the healthcare settings. They prefer to work hard than be unemployed or have their roles undervalued."

— Participant 6

"The experienced nurses who have been working in the nursing field for long time might find it hard to adopt new technology as they don't have the basic knowledge about technology; they are more comfortable to serve the patient old way. Some nursing educators are from the old school and don't want to embrace technology."

— Participant 10

The next section discusses the findings from the quantitative data and the qualitative interviews.

5. Discussion

The findings indicate that students had little confidence in mental health nursing practice prior to the mental health placement. In addition, the interview findings show that with exposure to increasingly used technologies in the healthcare sector, nurses can develop more outstanding modern capabilities. The results of individual items of the MHNCCS indicate that students had little confidence in handling physically aggressive patients and little confidence in conducting the mental status examination. These findings suggest that students require clinical experience to develop clinical confidence to practice. Our study demonstrates that the effectiveness of the training offered was not compromised by variances in the demographic groups (e.g. age and gender) amongst the participants. This is congruent with other studies (e.g. Fawaz et al., 2018; Liew, 1996).

The results indicate that students were more confident in mental health nursing practice after their mental health clinical experience. The post-test scores for the individual 20 items of the MHNCCS show that student confidence had significantly increased. Specifically, the results show that the students were more confident in their ability to seek support from other members of the team. In addition, they were even more confident in their ability to communicate effectively with patients in the setting. This supports Owens and Keller's (2018) and Porter et al.'s (2013) findings, which found that students valued experience in the mental health setting because it allowed them to learn to communicate effectively with patients in mental health settings.

However, because enrolled nurses work under the supervision of registered nurses (NMBA, 2020), it would be expected that they would be more confident than other students who have less clinical experience. These findings are supported by Mitchell (1997), who stated that the role of enrolled nurses was mainly one of being task-orientated and hence, they may not have been as effective in a mental health setting as this is a different area of nursing, requiring a greater problem-solving approach (see also Owens and Keller, 2018; Porter et al., 2013).

Our findings are consistent with studies demonstrating that clinical experience is an important determinant in nurses' clinical confidence (Bell et al., 1998; Fawaz et al., 2018; Liew, 1996). Bell et al. (1998) uncovered similar results and concluded that clinical experience helped students develop clinical confidence to perform in various settings.

5.1. Fostering nurse resilience

Our findings indicate that student nurses were more confident after their clinical experience in the mental health setting. Clinical confidence is gained by learning through reinforcement, forethought capability, self-regulation functions and self-reflective capacity.

This study shows that student nurses needed mental health clinical experience and technological competence in addition to their theoretical knowledge attained before clinical placements. This supports Bell et al. (1998), who established that undergraduate nursing students require theoretical knowledge, exposure to the clinical environment, interaction with clinical educators, nurses and patients to develop clinical confidence. SCT conceptualises human behaviour as requiring continuous interaction between behavioural, cognitive and environmental factors.

The results indicate that student nurses learn clinical skills and technology skills from clinical educators and registered nurses acting as professional role models. This is consistent with Bandura's SCT, which shows that modelling influences learning and attitude development. However, as new technologies used in the sector are recent, some educators themselves are not so familiar with those, which makes passing on knowledge in that area difficult—learning results from direct experience where the learner observes other people's behaviour and its consequences and has hands-on practice. In addition, complex procedures and new technologies can only be mastered through positive/confident role models and peer support (Bandura, 1986; Walker et al., 2014).

Even with theoretical knowledge, students still needed reinforcement of knowledge through clinical experience. These findings align with Severinsson's (1994) study, which showed that student nurses learn through reinforcement; thus, nursing is an applied science that cannot be fully developed in the classroom only. It is presumed that students' learning is reinforced through extensive clinical placements. These findings align with SCT, which views learning as part of the social transmission in which institutional practices are taught to new members by selective reinforcements.

Student nurses on clinical placements must demonstrate foresight, empathy, medical skills but also technology competencies in order to develop readily accessible care plans for their patients/clients. Developing care plans requires assessment, problem identification, planning, implementation and evaluation (Kapoor and Nambisan, 2020). This supports SCT's core perspective that individual behaviour is purposive and regulated by forethought. Individuals anticipate the likely consequences of their actions, set goals, plan, weigh evidence from different sources and recognise actual success and failure in influencing later performance.

This study indicates that self-reflective practice is an important learning tool in nursing education. Students on clinical placements had case study group discussions which included critical thinking, clinical reasoning, clinical judgement and problem-solving to reflect on their clinical experience. This shows that students used self-reflective practice to meet registered nurse standards for practice (Cashin et al., 2017) while on clinical placement. In addition, they gained an understanding of their patients' problems in more depth if exposed to technological use, e.g. AI, digital technologies and analytics. Self-reflection in SCT enables individuals to analyse their experiences and develop their thought about how technology can enhance healthcare processes to derive knowledge about themselves and their patients. This is in line with Rippa and Secundo's (2019) findings concerning the substantial role of digital technologies in shaping academic entrepreneurship through which universities employ a variety of actions relying upon the collaboration of diverse stakeholders (Secundo et al., 2019; Simeone et al., 2017) to accomplish their entrepreneurial goals (Rippa and Secundo, 2019), including cooperation agreements with industry and research ambidexterity (Chang et al., 2016; Rasmussen et al., 2011), patent registrations (Llopis, D'Este, McKelvey and Yegros, 2021), concept spinoffs into new enterprises, entrepreneurial teaching of highly trained personnel, and business incubators (D'Este et al., 2012; Muscio and Ramaciotti, 2019; Ndonzuau et al., 2002; Pauwels et al., 2016).

5.2. Greater nursing confidence and responsiveness in changing epidemiology

The interview results show that technology can help respond faster in a healthcare setting and save lives. In fact, it can help deliver quality and accuracy in diagnosis. Some nurses resist technology because they fear technology taking over their jobs, thus diminishing their influence. Previous research (e.g. Biancone et al., 2021) has identified technology anxiety as a key determinant of technology adoption in healthcare. For instance, whilst Spanò et al. (2021) highlight the ways blockchain technology can contribute to value creation in the healthcare sector, Massaro (2021), however, found that practitioners tend to be sceptical about its potential. However, our findings show that AI and digital technology as well as health-related engineering equipment can help reduce stress in the profession as machines become critical aid. Technology is, thus, not a threat but a necessary complement that can upskill nurses for contemporary practice.

5.3. Study contribution to theory and practice

The first part of the data (quantitative) shows that traditional aspects of healthcare training are still valid (the human warmth, compassion and psychology). However, with the increasing number of patients changing epidemiology and care needs, AI and digital technologies can be vital. Thus, good healthcare in the 21st century and beyond is both human and technological. The effect of mental health clinical experience on undergraduate nursing students and the paper's conceptual contribution is delineated in Fig. 2.

Our findings suggest that nursing students had little confidence in performing mental health nursing assessments, e.g. therapeutic communication, medication knowledge, psycho-education, self-management and teamwork. Within the SCT, a blended approach, encapsulating sufficient technological dimensions, is important to highlight interest, intentions, activity and expectations to improve expected outcomes. Our findings highlight the importance of confidence development for a better learning experience through the application of self-efficacy enhancement. By combining the findings (effects of mental health experience), assumptions of SCT and technological embeddedness of the training programmes, this study showed that self-possession,

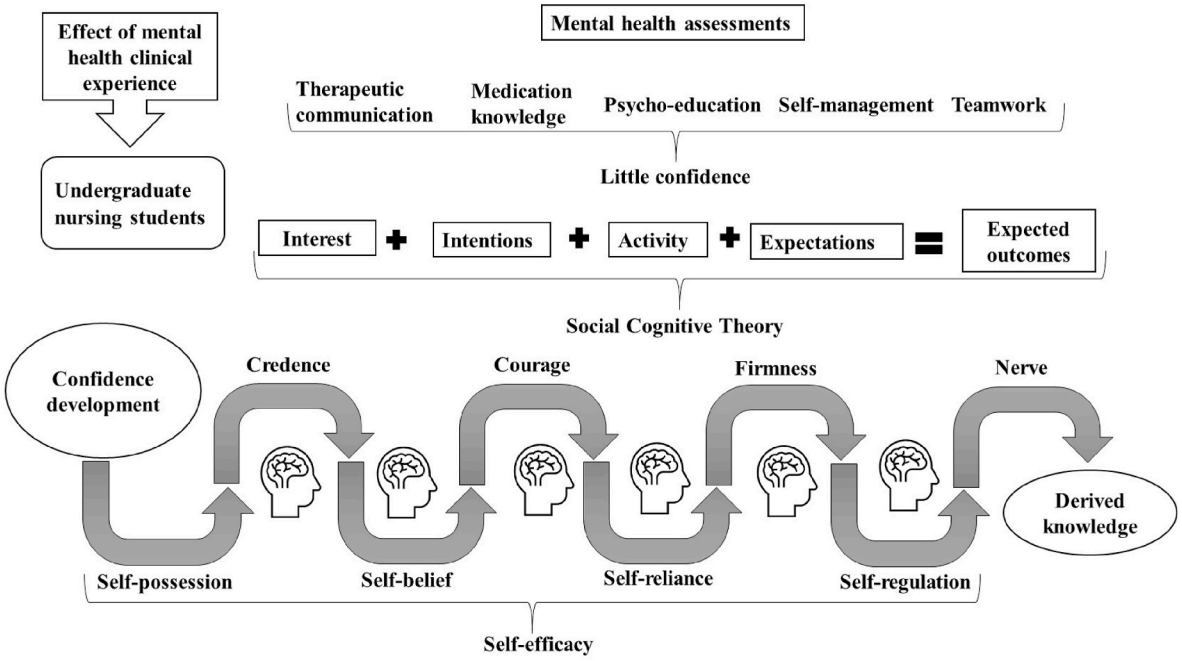

Fig. 2. Effect of clinical experience on undergraduate nursing students.

self-belief, self-reliance and self-regulation boost credence, courage, firmness and nerve. Developing self-efficacy ultimately supports greater knowledge development when lack of confidence is an issue in practice.

Building on the above, the findings from this inquiry make several additions to the current literature. First, the investigation has gone some way towards enhancing our understanding of nursing practice in mental healthcare by lending support to the validity of the traditional facets of healthcare education. For example, nurses' compassion exhibited as a sense of warmth and empathy towards patients, followed by a desire to help relieve their emotional pain, can be instrumental for successful nursing practice even through the phases of the inevitable digital transformation. This implies that healthcare in the twenty-first century and even beyond is thus a combination of human and robotic elements. Second, the present study has highlighted the lack of confidence as the main impediment for nursing students to embrace the new technology and agilely adapt to the resulting disruption in nursing practice. Clinical confidence in mental health nursing practice allows nurses to deal with mental health patients effectively and comfortably. Nurses can assess patients' problems more accurately, intervene appropriately when necessary, and provide quality care to patients with the aid of technology. For instance, the analysis of the digital phenotype like pitch, loudness, jitter, and other aspects of the human voice has been shown to precisely predict marital problems and whether or not at-risk young adults would develop a mental disease, outperforming clinical diagnosis, with results of 100% accuracy (Basu, 2021). The study provides nurse educators with a clear understanding of clinical confidence issues, thereby enabling them to provide more effective student support during clinical placements. In addition, the study can inform the development of a curriculum that promotes positive mental health clinical outcomes and soft skills and competencies such as teamwork, mental strengths, innovation, decision-making and resilience, which have proved to be critical competencies for working in a crisis situation such as the COVID-19 pandemic (Mahmoud et al., 2021; Mahmoud et al., 2021). Recent literature (e.g. Cobianchi et al., 2020a) suggests that healthcare organisations need to develop *antifragile* strategies (see Taleb, 2012), which means that they must become stronger, following a black swan event such as COVID-19, by addressing all challenges presented by the coerced circumstances for successful transition management while on guard against another pandemic (Cobianchi et al., 2020b). Such black swan events can apply to war zones. For example, military forces led or supported by Russia have targeted health facilities during its wars on other countries, like Syria's ongoing civil war and its recent invasion of Ukraine (Cole, 2022). In this regard, confidence-building as a matter of self-efficacy improvement is suggested to be essential for a better learning experience in which self-possession, self-belief, self-reliance and self-regulation enhance credence, courage, firmness and nerve—leading to steady knowledge attainment.

Moreover, our sample consisted of young generations (i.e., millennials and Generation Z). Previous research (e.g. Mahmoud et al., 2021) has depicted the millennials and Generation Z people as *tech-native*; thus, it was no wonder that the qualitative results showed them to have a good command of and favourable attitudes towards digital technologies and their adoption. Such favourability expands to viewing AI-powered technologies as highly beneficial to individuals and healthcare organisations as well as an integral part of the current and future practice of nursing. There is, therefore, a definite need for more serious steps towards a more profound embedment of digital technologies in nursing education. For instance, artificial intelligence and digital technologies could be used to more explicitly guide facets of the trainee nurse curriculum to promote clinical confidence and quality of care. The integrated nursing curriculum should continue to incorporate a well-supervised and supportive clinical experience program but also make the teaching of modern technologies part of the core nursing curriculum since healing in the 21st century is no longer just medical or psychological but also technological. In general, therefore, it seems that introducing AI-enabled technologies in nursing education and practice are not expected to jeopardise employment despite the concerns about machines taking over humans' jobs. Nevertheless, recent technological advances, such as quantum computing, may stimulate the evolution of artificial general intelligence (AGI), a level at which machine intelligence will outperform humans' and become uncontrollable (i.e. singularity); thus, governments and policymakers are urged to monitor such developments, and proper legislation should be enacted to control the AGI growth and protect the human race from the threats posed by 'evolving' robotic systems (Cao et al., 2021; Mahmoud et al., 2020). Finally, the study revealed that the Mental Health Clinical Confidence Scale (MHNCCS) is an effective tool to measure the clinical confidence of undergraduate nursing students, which is increasingly

multidimensional. Therefore, we encourage both scholars and practitioners to use MHNCCS to evaluate the clinical confidence of undergraduate nursing students during clinical placements.

5.4. Research limitations and future directions

The study findings have some limitations that restrict their external validity. For instance, using a convenience sample limits wider generalisability. In addition, a larger sample could have included all third-year undergraduate student nurses, but due to time and financial constraints, the study had to be confined to volunteers from one-semester intake. The study relied on self-report close-ended questionnaires. However, open-ended questions and interviews could provide more insight into the nursing students' world. We feel that the sample for both quantitative and qualitative data could be widened to more healthcare professionals who interact with nurses to prove the degree of confidence and expertise as well as the effectiveness of technology in healing.

The findings suggest a need for further research into the role of technology in clinical confidence among undergraduate student nurses as many issues remain unexplored. More investigation is required into how, in often under-resourced health systems, placements could be rotated in a way that each student nurse could be attached to a setting equipped with sufficient technology, at least during part of their placement. Finally, the study could be replicated on students in other clinical settings, such as medical/surgical nursing.

The findings provide nurse educators, clinical educators/facilitators, and key external stakeholders who influence practice in nursing and workforce developments with more information that will help redesign a curriculum promoting positive digital technologies and emotional resilience to increase healthcare outcomes in all areas of clinical practice. That could examine alternative theoretical models for an integrated nurse education that contributes to increase digital technology competencies, and steer resilience in nursing practice.

The study could be replicated on different levels of undergraduate and postgraduate nursing programs in other clinical settings such as in emergency department, medical/surgical, oncology, and community health services. A comparative study among local and international undergraduate nursing students would be a viable alternative to future research directions.

6. Conclusion

The findings revealed that the students could develop more confidence after their clinical experience if exposed to adequate technologies that are increasingly prevalent in their future work as nurses. Furthermore, the study indicates that the traditional psychological and medical based nursing training alone does not promote clinical confidence of students to practice in mental health settings. The study provides evidence that clinical experience is important in nursing education, but what defines it is shifting and drawing on technological development, particularly in computing and engineering. Other studies show that clinical experience facilitates student nurses' clinical learning and self-efficacy (Fawaz et al., 2018). Hence, undergraduate nursing students must be allocated sufficient clinical experience where they can be included in contact with their teacher and the significant new datum of technology. Adequate clinical experience in mental health settings may assist students in acquiring knowledge and skills in assessment, communication, patient education, medication knowledge, self-management and teamwork. This could then apply to other clinical nursing practice fields.

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