Effectiveness of peer learning on diagnostic reasoning skills, decision making skills and knowledge of nursing students: a pilot study

Efficacia del peer learning sulla capacità di ragionamento diagnostico, sulle capacità decisionali e sulla conoscenza degli studenti di infermieristica: uno studio pilota

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RIASSUNTO

INTRODUZIONE: L'apprendimento tra pari è una strategia didattica importante, insieme a quelle tradizionali, nello sviluppo di competenze di ragionamento diagnostico e pensiero critico, di leadership, di insegnamento e tutorship degli studenti infermieri.
OBIETTIVO: valutare l'efficacia dell'apprendimento tra pari nello sviluppo delle competenze di ragionamento diagnostico, di capacità decisionale e conoscenza degli studenti infermieri.
DISEGNO: Studio randomizzato controllato monocentrico di tipo pilota.
SETTING: Sede di un Corso di Laurea in Infermieristica di Torino, nel mese di giugno 2019. Partecipanti: 113 studenti infermieri (gruppo di intervento: n=68, gruppo di controllo: n= 45).
INTERVENTO: Applicazione dell'apprendimento tra pari in sessioni in cui erano presenti contemporaneamente studenti del primo, secondo e terzo anno. Questi studenti hanno condotto una discussione di un caso clinico senza la supervisione dei docenti.
RISULTATI: Gli studenti del gruppo di intervento (GI) hanno risposto meglio rispetto al controllo (GC); sono state rilevate differenze statisticamente significative rispetto alle percentuali di correttezza delle risposte ai quesiti di ragionamento diagnostico e capacità decisionale (p=0,001; p=0,008). Rispetto alla diagnosi infermieristica, due studenti del gruppo di intervento hanno dimostrato di possedere questo tipo di competenza.
CONCLUSIONI: Gli studenti del GI hanno dimostrato competenze di ragionamento diagnostico più elevate. Sono pochi però gli items nei quali sono emerse differenze statisticamente significative a favore degli studenti del GI. Ciò potrebbe essere attribuito al poco tempo a disposizione della sperimentazione e al numero esiguo di studenti coinvolti nello studio. Una valutazione certificativa, e non solo formativa all'esperienza, potrebbe potenziare ulteriormente l'efficacia dell'apprendimento tra pari.
KEYWORDS: "peer learning", "nursing students", "competence", "diagnostic reasoning", "pedagogic strategies

ABSTRACT

BACKGROUND: Peer learning is an important teaching strategy for nursing students, alongside more tradi-tional approaches, in the development of diagnostic reasoning and critical thinking, leadership, teaching and tutorship skills.
OBJECTIVE: to evaluate the effectiveness of peer learning for nursing students in developing knowledge, diagnostic reasoning and decision making skills.
DESIGN: Randomized controlled single-centre pilot study.
SETTING: Degree Course in nursing in Turin, in June 2019.
PARTICIPANTS: Nursing students were 113 (intervention group = 68, control group = 45) .
Intervention: The peer learning method was used in sessions attended by 1st, 2nd and 3rd year students simultaneously. These students conducted a clinical case study without teacher supervision.
RESULTS: The intervention group students (IG) responded better than those of the control group (CG). Statistically significant differences were found in the percentages of correct answers given to questions requiring diagnostic reasoning (p=0.001; p=0.008). Two students of the intervention group were shown to have competence with regard to nursing diagnosis and to be at a higher level in terms of diagnostic rea-soning skills.
CONCLUSION: Better diagnostic reasoning skills were demonstrated by students in the intervention group. There were, however, few items with statistically significant differences in favour of these students. This could be attributed to the limited available time for the experimentation and to the small num-ber of students on the degree course.. A formal assessment with certification could also enhance the peer learning experience more than a simple training exercise. The fear of teacher's vote could lead students to a better performance.
KEYWORDS: peer learning, studenti infermieristici, competenza, ragionamento diagnostico, strategie pedagogiche.

INTRODUCTION

Learning is the intellectual process which, either spontaneously or through an external impulse, results in a stable and lasting change in behaviour over time. People acquire knowledge about the world through the attribution of a specific meaning to some experience. The concept of " learning " is strongly correlated to that of "training". To train means to face open problems, different from each other, for which there is no single predetermined solution (Nelwati et al., 2018; Brown Tyo et al., 2019).

The discipline of nursing requires the student to contextualize their skills and theoretical knowledge in practice, not proceeding from one situation to another by analogy but through the use of the "clinical judgment", closely related to diagnostic reasoning (Andersen et al., 2018; Westerdahl et al., 2020; Tayce et al., 2021). The latter is defined as a recursive process in which observation, analysis, synthesis, infer-ence, hypothesis generation, their verification and investigative attitude are interconnected (Burgess et al., 2020). Bachelor trainers actively seek teaching strategies that foster student involvement in a meaningful learning process, which facilitates development of knowledge, critical thinking and problem-solving skills (Irvine et al., 2019; Underwood et al., 2019; Stenberg et al., 2020).

Traditional training models previously adopted by the university system for the evaluation of diagnostic reasoning skills of nursing students were not always clear, unambiguous and satisfactory (Bright et al., 2019). Assessment tests were useful for evaluating individual knowledge, but were likely to be partial and inadequate for evaluating competence. Many authors (Bright et al., 2019; Putri et al., 2021) have tried to conceptualize this challenge to the traditional evaluation system used in the past training context. The literature makes reference to dynamic assessment, an assessment aimed at enhancing complex skills, such as analysis and synthesis, critical reflection, creative and original solutions to open problems. This also reflects a learning idea congruent with the paradigm of socio-cultural constructivism, focused on active knowledge construction, anchoring to specific contexts and group collaboration (Bright et al., 2019; Putri et al., 2021).

BACKGROUND

With reference to dynamic assessment, in recent years many attempts have been made to implement nurs-ing education through the introduction of pedagogical strategies favouring diagnostic reasoning, reflection and critical thinking: problem-based learning (PBL), clinical cases studies, concept maps and collaborative strategies (Yue et al., 2017; Andersen et al., 2018) . Clinical cases studies and collaborative strategies are considered the most effective way of encouraging the development of diagnostic reasoning in nursing students (Collins et al., 2020). A case study is the description of a real or imaginary situation, character-ized by a large amount of information and a solution that is often not unique. It requires the participants to project themselves into the situation, but at the same time to bring their own wealth of knowledge. In this sense, "cases studies" constitute a transition from the academic to the active approach, where the pedagog-ical relationship between teacher and learner favors comparison and discussion, both in real and simulated clinical contexts (Lorio et al., 2016; Wosinski et al., 2018).

On the other hand, over the last ten years, the use of collaborative strategies has spread considerably in degree courses for the health care professions, to the extent that they are as popular as traditional ones (Rance et al., 2016; Peñuela-Epalza et al., 2019). Collaborative training strategies reflect this concept: members of a team all contribute to the project together, to achieve common goals. They can comment, ask questions, and give immediate feedback. By bringing different ideas and skills together, a job can be done in a more interactive way. Different people approach challenges from unique angles, and it's those differences in approach that help create new and original ways of understanding something. Some authors describe two stages of collaboration: dialogue, which requires group members to suspend their individual assumptions and engage in free and creative exploration of issues, and discussion, which involves reach-ing consensus and formulating group decisions. Problem solving and critical thinking skills are fostered during the group discussions where students develop an understanding of the material not possible if they were to learn on their own (Granheim et al., 2018).

Among collaborative strategies, peer learning is currently one of the most widespread innovative training model (Granheim et al., 2018; Peñuela-Epalza et al., 2019). The concept of peer learning consists of "a two-way mutual learning activity" which involves sharing knowledge, ideas and experiences in a way that is advantageous for both teachers and learners (George et al., 2020) . It can occur between more experi-enced and less experienced students or between students with the same knowledge, and is based on the assumption that experience, understanding and knowledge are forms of social interaction (Tai et al., 2016; Lawrence et al., 2018; Irvine et al., 2018; Carey et al., 2018; Markowski et al., 2021). Each student there-fore becomes the "author" of their own training path, as well as a "point of reference" for the others (Lee et al., 2016; Jacobs et al., 2017; Pålsson et al., 2017; Tornwall et al., 2018;).

The effectiveness of peer learning has been demonstrated in some studies. It would appear to have led to the improvement of clinical judgment, critical thinking skills of nursing students, as well as enhanced di-agnostic reasoning skills. Senior students direct and coordinate less experienced students during patient care in clinical internship, during the delivery of nursing care: identification of health needs and care inter-ventions (Lee et al., 2016; Alizadeh et al., 2018; Pålsson et al., 2021). Less experienced students can be mentored by more experienced students in conducting discussions about patient care that may be con-

ducted using different care complexity assessment tools (Jacobs et al., 2017; Lawrence et al., 2018; Mar-kowski et al., 2021). In the Italian context, from 1994 to 2015 different methods of classification of care complexity have been developed. These include: Index of Care Complexity, Assessment of Hospitalized Patient General Status, Information System of Performance Nursing, Professionalising Assistance Meth-od, Corridor Triage, Persiceto's Score, Care intensity and clinical complexity, and Nursing assessment pathway of care complexity (Rossetti et al., 2016).

According to some authors, the use of peer learning it would appear to have led also to an increase in or-ganizational and leadership competence and identification of priorities (Lee et al., 2016; Alizadeh et al., 2018; Granheim et al., 2018). It has also seems to prove effective in developing students' technical skills during faculty laboratories (blood sampling, urinary and vascular catheter insertion) and abilities to find and use evidence-based practice in theoretical lessons: many times students collaborate with each other in research work, both during theoretical lessons and clinical internship. More experienced students assist less experienced students, methodologically, in finding informations in databases and attributing clinical significance to data. That process helps students develop better reasoning skills and the ability to contex-tualize theoretical knowledge in practice (Lee et al., 2016; Rossetti et al., 2016; Granheim et al.,2018; Alizadeh et al., 2018). Another important result concerns the improvement of management skills of work groups, of communication and coaching skills. Students have also shown better involvement and partici-pation in their clinical learning path (Curtis et al., 2016).

Since peer learning, as an innovative strategy, currently needs further experimentation, it is difficult to confirm its advantage over traditional strategies. That is why this study aims to evaluate through a clinical case study the effectiveness of peer learning for students of a Nursing Degree Course in Turin. The pri-mary outcome is the development of diagnostic reasoning skills. There are other two second ones: the de-velopment of decision making skills and knowledge. The hypothesis of the study is that peer learning may prove to be more effective than traditional instructional strategies that rely on the presence of the fac-ulty member to achieve the learning goals of nursing students.

METHODS

Design and partecipants

A randomized, controlled single-centre pilot study was conducted in June 2019 in a degree course in nursing in the city of Turin, Italy. 1st, 2nd and 3rd year students undertaking their internship period.

Setting

In the context of Turin degree course in nursing, nursing students must complete three one-month clinical placements: one in December, one in March and one in June. The students are divided into groups of no more than two or three people by the university lecturers and then assigned to various wards of Turin hospitals. During their internship students also participate in sessions at the university in order to carry out clinical cases study drawn from various hospital contexts. Students are divided by course year and assigned to a teacher who leads the clinical case analysis. The aim of the students is to produce a clinical case study applying the Professionalising Assistance Method.

This a method consisting of two tools: the assessment of complexity of patients' care and an estimate of the relative human resource require-ments. It involves four factors:

- clinical stability (the degree and number of altered physiological parameters);
- responsiveness (the ability of patients to define their own needs and to choose the most suitable behaviour in given circumstances);
- independence (the possibility of the patient to act autonomously and effectively).
- context: medical-surgical aids (drainage, oxygen, etc.), family caregivers. This can be a facilitator or barrier in the health project of the patient or in the quality of care provision (Rossetti et al., 2016).

Intervention

Peer learning was applied through a clinical case study, this time provided by the university lecturers and not produced by the students. The clinical case study was carried out in two sessions in which students of all course years participated . In the intervention groups, 1st year students took part in the discussion of a complex clinical case in which 2nd and 3rd year students took on the role of tutor. Teachers were present at the meetings, but did not participate in the discussion, except to refocus it in the event that the discussion deviated from the objective. Control group students (CG) also participated in sessions during which the same clinical case as that assigned to the intervention groups (IG) was analysed and discussed. In this case, however, the students were divided by course year and the teachers led the students to clinical reasoning, supervising them throughout the whole discussion.

Randomization

Students were divided, using the stratified sampling method, into six IGs and six CGs made up of approximately the same number of participants. To ensure the greatest homogeneity in terms of knowledge and skills, the IGs were composed so as to have proportionally the same number of students as the total in the 1st, 2nd and 3rd course years. CGs were divided into six sub-groups in the following way: two groups of 1st year students, two groups of 2nd year students and two groups of 3rd year stu-dents. This allocation was kept hidden from the principal investi-gator to avoid detection bias. At the be-ginning, the samples consisted of an equal number of students. In a

second phase, the number was re-duced as some students were unable to participate in the study as they did not pass a preparatory and compulsory examination.

INSTRUMENTS

Socio-demographic data

This tool was used to collect data on samples characteristics. Socio-demographic data sheets for each par-ticipant containing: age, gender, course year, marital status, number of children, work in progress, sur-gery exam scores , location of internships carried out, previous work experience, previous university courses undertaken).

Evaluation tool

A questionnaire was constructed from scratch for data collection, as a review of the literature showed that there were no validated instruments available at the time to assess nursing students' diagnostic reasoning skills and other study outcomes. Moreover, in this case an instrument was created that would assess this competence in a comprehensive manner, simultaneously considering two other variables closely related to that of diagnostic reasoning: decision-making skills and knowledge. In this way, an all-round assessment of the students' competences could have given greater clinical relevance to the study.

In the literature studies, few assessment instruments were found that could be reused in this research work, as the existing ones aimed more at assessing the technical skills of nursing students. As the nursing profession has been defined as "intellectual", nurses have to possess not only technical skills but also more complex skills. Taking the Dublin descriptors as a reference, although not restricted to the discipline of nursing but applicable in other academic contexts, the following factors are referred to: knowledge and understanding; applied knowledge and understanding; autonomy of judgement; communication skills; ability to learn. Another pillar in terms of training and educational attainment is Bloom's taxonomy. This covers the intellectual and logical activities of the individual and is divided into the following educational objectives, in order from simplest to most complex: knowledge; understanding; application; analysis; syn-thesis; evaluation34. The instrument created for the assessment of diagnostic reasoning skills in this study, included higher skills like that ones of Dublin descriptors and Bloom's taxonomy (Spence et al., 2019). It consisted of 23 clinical-assistance questions (22 multiple choice and 1 open answer) representing the min-imum standard of knowledge expected of all students. The questions were divided into three sections, corresponding to the following processes: knowledge (6 questions), diagnostic reasoning (8 ques-tions) and decision-making skills (8 questions). The knowledge questions aimed at assessing this out-come as they concerned the correct definition of pathologies or the meaning of signs and symptoms, or the correct defini-tion of assessment scales, operational protocols (e.g. prepa-ration of the patient for sur-gery).

The diagnostic reasoning questions were aimed at assessing the students' abilities to identify the severity of symptoms, the consequences of certain clinical conditions, the meaning of clinical data and the possible causes of their occurrence. The decision-making ability questions were structured with the aim of as-sessing the students' ability to establish suitable care interventions according to the clinical condition of the patient (e.g. educational care interventions for a patient with alcohol dependency). There was also an open question, formulated in order to give the students the opportunity to comment on their elaboration of the nursing diagnosis, which was formed according to the Professionalising Assistance Method. Multiple choice questions presented three possible answers, of which only one was correct. The score was as-signed in the following way: one point for each correct answer, no point for a wrong or missing answer.

To assess the effectiveness peer learning on students' diagnostic skills, the following cut-off scores were set: 6/23 for 1st year students, 13/23 for 2nd year students and 18/23 for 3rd year students. This cut-off scores was decided on the basis of the structure of the few question-naires in the literature that were con-structed and tested in a similar manner. At the end of the questionnaire, students could express freely in writing their perception of the effec-tiveness of the two teaching methods. The clinical case reading, in a first phase, put the student in the condition of having to know all the theoretical concepts and therefore to find the missing knowledge. In a second phase, filling in the questionnaire, the questions structured in this way demanded students an ability to correlate clinical symptoms and signs with each other and to at-tribute a value to them, subsequently identifying care interventions to be implemented. In the third phase, during the answer to the open question, the student had the opportunity to elaborate a real nursing diagno-sis with reference to the model of care complexity analysis used in this faculty (Professionalising Assis-tance Method).

Data collection procedure

Study feasibility was assessed in advance with univer-sity nursing trainers (the objective, intervention, method of application, data collection tools and structural resources being explained). Before undertaking the experi-ment, the researcher met the students at the university to illustrate the rationale, objective and operating methods of the study. The case was delivered during the first session, while the questions were distributed at the end of the last one.

Data analysis

Data analysis was performed with SPSS for Windows software, version 22. Descriptive statistics were analysed: continuous variables were described using mean and stan-dard deviation (SD), while the discrete variables were expressed as absolute and percentage frequencies. As regard the inferential analysis of variables, appropriate hypothesis tests were conducted (chi square test). A p value of $p < 0.05$

was con-sidered to represent significant difference between observations.

Ethical considerations

All students were enrolled on a voluntary basis and requested to give written informed consent which could be revoked at any time. The design of the evaluation questionnaires ensured students' anonymi-ty. The data collected was used exclusively for study and research purposes in compliance with cur-rent privacy regulations (Legislative Decree 101/2018).

RESULTS

Table 1 compares the characteristics of the population in order to show that the groups being compared are homogeneous and therefore no differences between their characteristics influence the results of the study. IG and CG students had similar socio-demographic characteri-stics. 113 nursing students were re-cruited to the study. The students enrolled were predominantly women (85.8%), with an average age of 23.8 years (SD 6.2; min-max 19-51). The population consisted of a similar percen-tage of 1st (36.3%), 2nd (33.6%) and 3rd year students (24.8%) with a similar number of students who were behind with their ex-ams (6%) and those repeating a year (5.3%).

Around half the populations (51.3%) had passed the surgery exam with an average score of 22.9 (sd 2.3; min-max 19-28). Almost all participants had no children (92.9%) and the vast majority were not working at the same time as their studies (84.1%). More than half of the population had previous work experience (70.8%), but only 20% of these in the care sector (medicine, educational sciences, obstetrics, psychology, biomedical laboratory technicians). Most of the population (80.5%) reported that they had undertaken previous university courses, some similar to the health sector (OSS, obstetrics, assi-stance to disabled per-sons, psychiatric service educators, laboratory technicians or psychologists) .

Diagnostic reasoning 3

Table 2 shows the data relative to the comparison between IG and CG, with respect to the correctness of the answers to the diagnostic reasoning questions. The chi-square test was used for the inferential analy-sis and, as can be seen from the table, in all the questions the percentage of correctness to the questions is always greater in the IG. Considering this, it can be said that the results of the study are certainly of clini-cal relevance. Furthermore, in two cases statistically significant differences emerged, which were high-lighted in the comparison of questions 1 and 8 (question 1 p-value 0.001; question 8 p-value 0.008), and in one case the results are at the limits of statistical signifi-cance (question 4 p-value 0.60).

Decision making 2

Table 3 shows the results of the comparison between the IG and the CG with respect to the percentages of correctness of the answers to the decision-making ability questions. The statistical test for the inferen-tial analysis is always the chi-square one and also in this case the same conclusions can be drawn: the IG showed better perfor-mance in the answers to the questions related to this outcome. All the percentages are in favour of the IG so the results are clinically relevant; in this case there are no stati-stically significant differences, but they are at the limit of statistical significance (question 17 p-value 0.064; question 21 p-value 0.092).

Table 1. Characterist of population

		GI (n = 68)	GC (n = 45)	Chi square (X2)
		n (%)		
GENDER	Female	61 (89.7)	36 (80)	0.092
	Male	6 (8.8)	9 (20)	
AGE	Mean (± ds)	23.9 (± 6.166) 19-46	23.7 (± 6.531) 19-46	0.883
MARITAL STATUS	Unmarried	58 (87.9)	41 (91.1)	0.311
	Married	5 (7.6)	3 (6.7)	
	Cohabitant	3 (4.5)	0 (0)	
	Separate	0 (0)	1 (2.2)	
COURSE YEAR	1styear	21 (30.9)	20 (44.4)	0,290
	2ndyear	22 (32.4)	16 (35.6)	
	3rdyear	20 (29.4)	8 (17.8)	
	Behind in exams	3 (4.4)	0 (0)	
	Repeating a year	2 (2.9)	1 (2.2)	
SURGERY EXAM	Passed	39 (57.4)	19 (42.2)	0.103
	Failed	2 (2.9)	1 (2.2)	
	Nottaken	27 (39.7)	25 (55.6)	
EXAM SCORE Min-Max		23.0 ± 2.465 19-28	22.9 ± 2.093 20-26	0.927
WORKING	No	59 (86.6)	36 (80)	0.244
	Yes	8 (11.8)	9 (20)	
CHILDREN NUMBER	0	63 (92.6)	42 (93.3)	0.838
	1	3 (4.4)	2 (4.4)	
	2	1 (1.5)	/	
	3	/	1 (2.2)	
	4	1 (1.5)	/	

Table 2. Percentage of correct answers to diagnostic reasoning questions

Diagnostic reasoning questions - percentages of correct answers	IG (%)	CG (%)	CHI SQUARE
Question 1 "What do you assess at the entrance of the patient with these symptoms?"	81,8	18,2	0,001
Question 4 "What variables do you assess in this patient with vomiting?"	64,9	35,1	0,060
Question 7 "In a patient taking metformin and having vomiting, what do you expect the glycemic values to be like?"	85,0	15,0	0,008
Question 8 "What information are you lacking to attribute meaning and relevance to this patient's glycaemic values?"	58,3	41,7	0,735
Question 13 "What parameters do you assess in a patient with alcohol dependence?	60,2	39,8	0,542
Question 16 "What meaning do you attribute to the following parameters of the patient? Haemoglobin 11.1 mg/dl, blood pressure 90/70 mmhg, heart rate 110 bpm, saturation 96%, temperature 37.5°, blood glucose 430 mg/dl"	62,3	45,5	0,481
Question 19 "What do you ascertain in a patient suffering from alcohol dependence?"	56,5	43,5	0,220
Question 22 " what could be the cause of the patient's fall?"	59,4	40,6	0,567

Table 3 - Percentage of correct answers to decision making questions

Decision making questions - percentages of correct answers	IG (%)	CG (%)	CHI SQUARE
Question 3 "What are care interventions for this patient's pain symptoms?"	57,8	42,2	0,682
Question 9 "what interventions do you put in place to address the health problem and symptoms that this patient presents on first access to the emergency department?"	53,8	46,2	0,304
Question 10 "What interventions do you implement with a patient with diabetic neuropathy?"	50,0	50,0	0,507
Question 12 "What do you assess and how do you treat a patient with ascites?"	63,3	36,7	0,397
Question 15 "in this case, in your opinion, was the placement of the nasogastric tube correct?"	60,0	40,0	0,580
Question 17 "what interventions do you plan for this patient?"	66,7	33,3	0,064
Question 20 " what interventions are indispensable after the resolution of the pancreatitis so that the person does not present recurrences?"	59,6	40,4	0,362
Question 21 " What are the most suitable educational interventions for a patient with alcohol dependence?"	66,1	33,9	0,092

Table 4 - Percentage of correct answers to knowledge questions

Knowledge questions - percentages of correctanswers	IG (%)	CG (%)	CHI SQUARE
Question 2 "How do you assess this patient's pain?"	60.9	40	0.746
Question 5 "The patien thas pain referable to the upper quadrants of the abdomen. To which organs could pain in this anatomical location be related?"	55.4	44.6	0.073
Question 6 "What is the difference between fever and hyperthermia?"	55	45	0.16
Question 11 "What are the objectives of the requested diagnostic investigations and why were they requested in that order?"	54.7	45.3	0.175
Question 14 "What educational interventions do you implement with a patient suffering from acute pancreatitis?"	55.4	44.6	0.438
Question 18 "How do you prepare this patient for surgery?"	66.1	33.9	0.092

Knowledge 1

Also in the last table the results were compared using the chi-square test and were in favour of the IG. As in table 2, the results are clinically relevant and in 2 out of 6 cases at the limits of statistical significance (question 5 p-value 0.073; question 18 p value 0.092).

Students' perception of the study

The analysis of the students' perceptions of this training experience was carried out with the aim of understanding the strengths and weaknesses of this study in relation to peer learning. The strengths would help to support the usefulness of this training strategy and the weaknesses would provide insights for possible future studies. The technique of phenomenological analysis was used: the data were transformed into conceptual categories, compared with each other to identify similarities and differences and to discover what the true meaning of this training experience was.

Most of the 1st and 2nd year students in both groups felt that the comparison and sharing of knowledge and experience was a strength of the study (IG 62% vs CG 66%). Specifically, in the IG, the strengths most highlighted were greater participation without fear of judgement (21%), greater ability to reflect on information received (9%) and better teaching and tutorship skills (17%). As regards the weaknesses, some 1st and 2nd year students from the IG and also the CG identified the lack of a reference point and fear of making mistakes (IG 25% vs CG 17%) and the limited time available (IG 7% vs CG 10%). Furthermore, the low participation of less experienced students (36%) and lack of clarity in the way in which they were expected to conduct the discussion (18%) were noted in the IG. In the CG, on the other hand, the students felt that their knowledge was insufficient to deal with the case (60 %) and had difficulty in finding information (7%). The last weakness of the study was identified by the 3rd year students of the GI in the difficulty of identifying themselves as leaders (10%) .

DISCUSSION

The objective of this study was to assess the effectiveness of "peer learning" as a pedagogical strategy in relation to the development of diagnostic reasoning skills, decision making skills and knowledge in nurs-ing students. Diagnostic reasoning, especially, is unequivocally a key skill for nurses and for this reason enjoys particular attention in the university environment, where a great deal is currently being invested in identifying the most effective training strategies (Andersen et al., 2018; Westerdahl et al., 2020; Stenberg et al., 2020) . In this study peer lear-ning was demonstrated to be an effective strategy with several particu-lar benefits.

In the present study, the training led to better overall results (in terms of the correct questionnaire re-sponses) in the IG although there were few statistically significant

differences compared to the CG. Areas in which the grea-test differences were found, not only in terms of pedago-gical relevance but also of statis-tical significance, were "diagnostic reasoning skills". This is an important finding as it confirms the initial research hypothesis. In fact, the performance of the IG students in answering questions more correctly, revealed a better ability to reflect and attri-bute meaning to information through critical thinking. Peer learn-ing facilitated the systematic collection of patient data to understand how the patient responds and reacts, or may respond and react, to health problems and to evaluate possible solutions to meet their needs. The students organised the information and grouped related information into categories to identify care prob-lems, risk factors and resources of the patient through clinical judge-ment. In their learning process the es-sential elements of knowledge, experience and reflective skills interacted. The aim of the work given to them was the interpretation and linking of data, the formulation and verification of diagno-stic hypotheses and the definition of the nursing problem and diagnosis. Furthermore, following the phases of the nursing process and using their decision-making skills, they planned the care by defining the patient's priority problems, the expected results and the selection of inter-ventions. With regard to the latter, students devel-oped the ability to prioritise and critically evaluate the results of care, as well as the ability to collaborate with each other. Good communication skills and pro-active involvement allow a greater chance of success at all stages of the care process. As can be seen, diagnostic reasoning is a complex concept that encom-passes many competencies, which is why in this study we did not define just one outcome but several outcomes.

In the literature, the application of peer learning has led to similar results in some respects and slightly dif-ferent results in others. Many experiments have been carried out in laboratories (Rance et al., 2016; Gran-heim et al., 2018; Tornwall et all., 2018) ; others in the context of inter-nships (Lee et al., 2016; Alizadeh et al., 2018; Peñuela-Epalza et al., 2019; Pålsson et al., 2021;). In this study, the clinical internships setting was chosen because it was more conducive to the development of the chosen outcomes. Among the as-pects in common with this article, many studies in the literature (Rossetti et al., 2016; Gray et al., 2016; Curtis et al., 2016; Trotter et al., 2021) have shown an increase in these competencies: problem solving, clinical judgement and thus the ability to make nursing diagnoses, collaboration and mentoring ability.

In addition to the aspects in common with the study, the literature points to other results to which peer learning has led. An aspect on which the present study and the lite-rature hold different positions re-gards leadership skills: while the literature (Lee et al., 2016; Alizadeh et al., 2018; Granheim et al., 2018; Spence et al., 2019) reports an increase in this type of ability after experimenting with peer learning, the students in the present study declared a fragility in this particular area. This could be related to the short time available for the trial (one month). Almost all studies identified in the literature were carried out over a

period of time from two to six months (Granheim et al., 2018; George et al., 2020; Tornwall et al., 2018; Hegg et al., 2020). Another example concerns technical skills, such as performing blood tests, and skills in using evidence-based practice (Lee et al., 2016; Rossetti et al., 2016; Granheim et al.,2018). In the present research work they are not mentioned, this might be due to the chosen setting. Each setting is more conducive to the development of a given competence: evidence-based practice skills are perhaps best explored in more theoretical settings such as lectures, while technical skills in laboratories.

It is difficult to say on the basis of these data alone if the peer learning approach in this experiment could be considered more effective than the training strategy traditionally used by the university. This again could be a consequence of the time factor, for the reasons already discussed, but may not be the only rea-son. The principle of peer learning depends on students' self-management of their learning, but this can be sometimes a value and sometimes a limit. The absence of the teacher in the classroom leads to a feeling of greater involvement and less fear of making mistakes on the part of the student. This can be regarded as the most notable result of the teacher's absence in the classroom. One of the main goals of a student at university is to learn to retrieve information independently, without necessarily needing the presence of the lecturer to impart content. The importance of knowledge of theoretical sources is evident, so that the learning student can develop a good proactive attitude towards new learning experiences. The role of the learner is not reduced to collecting knowledge but to producing knowledge, establishing good self-esteem and a sense of confidence in themselves and their abilities. The absence of a teacher to guide and super-vise the group in achieving the goal could sometimes give the experience excessive informality and little sense of duty. A strategy that could be used to overcome this limit and stimulate better perfor-mance by students, while still safeguarding fundamental characteristics of peer learning, could be to intro-duce a formal certification of their peda-gogical experience. Indeed, many studies that have emerged in the literature on this topic have included a final evaluation by the teacher in order to improve the perfor-mance of students (Pålsson et al., 2017).

CONCLUSIONS

Diagnostic reasoning is a core competence for the nursing profession. Although it often represents a weak point, the recent adoption of new pedagogical strategies stimulating this type of competence demon-strates how much universities are investing in this issue. Peer learning is recognized as an effective peda-gogical strategy both by trainers, in increasing diagnostic reasoning and decision-making skills, and by nursing students as it favors a setting with less tension and greater participation.

Despite time and context limits, the present study confirmed the importance of peer learning in the training of university students, highlighting the need to devote far

more time and space to this teaching strategy. With a view to further future experimentation, it would be advisable to devote more time to preparing the students for the study, explaining the theoretical aspects and the methods to be applied. Furthermore, in order to assess whether different or similar results can be achieved, it might be useful to test the impact of peer learning with other methods of care complexity assessment. In this way they could achieve more shareable and clinically relevant results. (4765 words)

REFERENCES

Alizadeh, M., Mirzazadeh, A., Parmelee, D. X., Peyton, E., Mehrdad, N., Janani, L., & Shahsava-ri, H. (2018). Leadership Identity Development Through Reflection and Feedback in Team-Based Learning Medical Student Teams. Teaching and learning in medicine, 30, 76–83.

Andersen, T., & Watkins, K. (2018). The Value of Peer Mentorship as an Educational Strategy in Nursing. The Journal of nursing education, 57, 217–224.

Brown Tyo, M., & McCurry, M. K. (2019). An Integrative Review of Clinical Reasoning Teach-ing Strategies and Outcome Evaluation in Nursing Education. Nursing education perspectives, 40, 11–17.

Bright A. L. (2019). Practicing Leadership Skills through Peer Mentoring and Teaching: the Lived Experience of BSN Students. International journal of nursing education scholarship, 16, 10.1515/ijnes-2019-0022.

Burgess, A., van Diggele, C., Roberts, C., & Mellis, C. (2020). Key tips for teaching in the clini-cal setting. BMC medical education, 20, 463.

Carey, M. C., Kent, B., & Latour, J. M. (2018). Experiences of undergraduate nursing students in peer assisted learning in clinical practice: a qualitative systematic review. JBI database of systema-tic reviews and implementation reports, 16, 1190–1219.

Collins, T., Perry, F., & Chandler, V. (2021). Using Peer Discussion to Create a SOAP Note in Graduate Clinical Nursing Education. Nursing education perspectives, 42, E66–E67.

Curtis, E., Ryan, C., Roy, S., Simes, T., Lapkin, S., O'Neill, B., & Faithfull-Byrne, A. (2016). In-corporating peer-to-peer facilitation with a mid-level fidelity student led simulation experience for undergraduate nurses. Nurse education in practice, 20, 80–84.

Granheim, B. M., Shaw, J. M., & Mansah, M. (2018). The use of interprofessional learning and simulation in undergraduate nursing programs to address interprofessional communication and collaboration: An integrative review of the literature. Nurse education today, 62, 118–127.

George, T. P., Gainey, K. L., Kershner, S. H., Weaver, D. L., & Hucks, J. M. (2020). Junior and Senior Nursing Students: A Near-Peer Simulation Experience. The Journal of nursing education, 59, 54–56.

Gray, S., Wheat, M., Christensen, M., & Craft, J. (2019). Snaps+: Peer-to-peer and academic support in developing clinical skills excellence in under-graduate nursing students: An exploratory study. Nurse education today, 73, 7–12.

Hegg, R. M., Ivan, K. F., Tone, J., & Morten, A. (2020). Comparison of peer assessment and faculty assessment in an interprofessional simulation-based team training program. Nurse educa-tion in practice, 42, 102666.

Irvine, S., Williams, B., & McKenna, L. (2018). Near-peer teaching in undergraduate nurse educa-tion: An integrative review.

Nurse education today, 70, 60–68.

Irvine, S., Williams, B., Özmen, M., & McKenna, L. (2019). Exploration of self-regulatory be-haviours of undergraduate nursing students learning to teach: A social cognitive perspective. Nur-se education in practice, 41, 102633.

Jacobs S. (2017). A Scoping Review Examining Nursing Student Peer Mentorship. Journal of professional nursing : official journal of the American Association of Colleges of Nursing, 33, 212–22

Lawrence, K., Messias, D., Estrada, R. D., & Long, V. (2018). Peer Teaching in High-Fidelity Simulation: Participant Experiences and Reflections. Nurse educator, 43, 312–316.

Lee, J., Lee, Y., Gong, S., Bae, J., & Choi, M. (2016). A meta-analysis of the effects of non-traditional teaching methods on the critical thinking abilities of nursing students. BMC medical education, 16, 240.

Lorio, A. K., Florman, T. M., Gore, J. B., Housley, S. N., & Nelson, M. A. (2016). Power of Peer-Assisted Learning: An Interdisciplinary Mobility Laboratory Experience. The Journal of nursing education, 55, 83–86.

Markowski, M., Bower, H., Essex, R., & Yearley, C. (2021). Peer learning and collaborative placement models in health care: a systematic review and qualitative synthesis of the literature. Nelwati, Abdullah, K. L., & Chan, C. M. (2018). A systematic review of qualitative studies ex-ploring peer learning experiences of undergraduate nursing students. Nurse education today, 71, 185–192.

Pålsson, Y., Mårtensson, G., Swenne, C. L., Ädel, E., & Engström, M. (2017). A peer learning intervention for nursing students in clinical practice education: A quasi-experimental study. Nurse education today, 51, 81–87.

Peñuela-Epalza, M., & De la Hoz, K. (2019). Incorporation and evaluation of serial concept maps for vertical integration and clinical reasoning in case-based learning tutorials: Perspectives of stu-dents beginning clinical medicine. Medical teacher, 41, 433–440.

Pålsson, Y., Mårtensson, G., Swenne, C. L., Mogensen, E., & Engström, M. (2021). First-year nursing students' collaboration using peer learning during clinical practice education: An observa-tional study. Nurse education in practice, 50, 102946.

Putri, S. T., & Sumartini, S. (2021). Integrating Peer Learning Activities and Problem-Based Learning in Clinical Nursing Education. SAGE open nursing, 7, 23779608211000262.

Rossetti, A. M., Lettieri, A., Greco, L., & Dalponte, A. (2016). Sistemi per la valutazione della complessità assistenziale a confronto: revisione narrativa della letteratura. Assistenza infermieristica e ricerca : AIR, 35, 70–81.

Spence B. (2019). Using Bloom's Taxonomy Matrix to Reach Higher-Level Learning Objectives. Radiologic technology, 90, 622–624.

Rance, S., & Sweet, L. (2016). Developing clinical teaching capacities of midwifery students. Women and birth : journal of the Australian College of Midwives, 29, 260–268.

Yue, M., Zhang, M., Zhang, C., & Jin, C. (2017). The effectiveness of concept mapping on de-velopment of critical thinking in nursing education: A systematic review and meta-analysis. Nurse education today, 52, 87–94.

Spence B. (2019). Using Bloom's Taxonomy Matrix to Reach Higher-Level Learning Objectives. Radiologic technology, 90, 622–624.

Stenberg, M., Bengtsson, M., Mangrio, E., & Carlson, E. (2020). Preceptors' experiences of us-ing structured learning activities as part of the peer learning model: A qualitative study. Nurse education in practice, 42, 102668.

Tai, J., Molloy, E., Haines, T., & Canny, B. (2016). Same-level peer-assisted learning in medical clinical placements: a narrative systematic review. Medical education, 50, 469–484.

Tornwall J. (2018). Peer assessment practices in nurse education: An integrative review. Nurse education today, 71, 266–275.

Tayce, J. D., Saunders, A. B., Keefe, L., & Korich, J. (2021). The Creation of a Collaborative, Case-Based Learning Experience in a Large-Enrollment Classroom. Journal of veterinary medical education, 48, 14–20.

Tai, J., Molloy, E., Haines, T., & Canny, B. (2016). Same-level peer-assisted learning in medical clinical placements: a narrative systematic review. Medical education, 50, 469–484.

Tornwall J. (2018). Peer assessment practices in nurse education: An integrative review. Nurse education today, 71, 266–275.

Trotter T. L. (2021). Using the peer review process to educate and empower emerging nurse scholars. Journal of professional nursing : official journal of the American Association of Colleg-es of Nursing, 37, 488–492.

Underwood, S., Green, J., Walton, R., Hackett, K., Cooke, J., Pegg, M., & Armstrong, C. (2019). Evaluating the impact of a coaching pilot on students and staff. British journal of nursing (Mark Allen Publishing), 28, 1394–1398.

Westerdahl, F., Carlson, E., Wennick, A., & Borglin, G. (2020). Teaching strategies and outcome assessments targeting critical thinking in bachelor nursing students: a scoping review protocol. BMJ open, 10, e033214.

Wosinski, J., Belcher, A. E., Dürrenberger, Y., Allin, A. C., Stormacq, C., & Gerson, L. (2018). Facilitating problem-based learning among undergraduate nursing students: A qualitative system-atic review. Nurse education today, 60, 67–74.