



Review

Effectiveness of problem-based learning on the professional communication competencies of nursing students and nurses: A systematic review

Yuan Li^{a,#}, Xiu Wang^{a,#}, Xuan-rui Zhu^a, Yan-xin Zhu^c, Jiao Sun^{a,b,*}^a First Hospital of Jilin University, Changchun, 130021, China^b School of Nursing, Jilin University, 965 Xinjiang St., Chaoyang, Changchun, Jilin, China^c Weifang Medical University, Weifang, Shandong, China

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ABSTRACT

The objective of this systematic review was to estimate the effectiveness of problem-based learning (PBL) in developing the professional communication competencies of nursing students and nurses. We have searched PubMed, EMBASE, MEDLINE, PsycINFO, Cochrane Library, China National Knowledge Infrastructure, Wanfang Data Knowledge Service Platform, and VIP Database for Chinese Technical Periodicals to identify all the English and Chinese language studies that used PBL to determine the effectiveness of developing professional communication competencies of nursing students and nurses. Then two reviewers independently assessed eligibility and extracted data. Quality assessment using the Cochrane Collaboration's risk of bias tool for randomized controlled trials and Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MASARI) for quasi-experimental studies. A total of 12 studies were included, all of which were inclined to low bias. Eleven articles showed that PBL developed the communication skills of nursing students or nurses, while only one article revealed no significant difference between PBL and the traditional method. Owing to differences in experimental design and the method and duration of intervention, some of these studies combined PBL with other methods, and the evaluation tools were different. This systematic review cautiously supports the outcomes of PBL compared with traditional learning.

1. Introduction

Communication is a two-way interaction where information, meanings, and feelings are shared (Dunne, 2005). Effective communication conveys the right information, enables others to know an individual's feelings and meanings, expresses a kind attitude, and to a certain extent, helps to avoid interpersonal conflict and decrease misunderstanding. Therefore, communication issues not only belong to the field of psychology but also the field of sociology. Communication is the cornerstone of a relationship with a patient in all medical settings with the aims of creating a positive interpersonal connection, exchanging information, and making successful treatment-related decisions (Grassi et al., 2015). Effective communication are fundamental to good nursing care and are therefore important for nursing students to develop (Grant and Jenkins, 2014). A study on the teaching of communication in the nursing curricula shows that both students and faculty members value the communication competencies for safe and quality practice

(Boschma et al., 2010). The importance of communication also reflects on the interdisciplinary members of a hospital (Lancaster et al., 2015).

Communication pitfalls occur in over 15% of hospital admissions (Bartlett et al., 2008). As a result of patients' needs, nurses need to have communication ability (van Weert et al., 2005). Barriers to communication and cooperation may similarly exist between nurses and other professional colleagues from other specialized medical disciplines due to a lack of communication and understanding between them, thereby reducing the quality of care and perhaps even endangering patient's safety and outcome (Solomon and Salfi, 2011). Communication barriers between nurses and patients are categorized as nurse- and patient-related factors (Norouzinia et al., 2015). Patients often have complex communication needs that include cognitive needs, mobility, sensory and language barriers (Downey and Happ, 2013). In addition, they suffer from potentially stressful and unpleasant hospital experiences (Norouzinia et al., 2015). At the same time, many nurses and nursing students lack opportunities to learn communication psychology

* Corresponding author. First Hospital of Jilin University, Changchun, 130021, China.

E-mail addresses: liyuan17@mails.jlu.edu.cn (Y. Li), wangxiu1649@163.com (X. Wang), zhuxuanrui2019@163.com (X.-r. Zhu), zhuyanxin1124@163.com (Y.-x. Zhu), sunjiao@jlu.edu.cn (J. Sun).

Considered the first authors.

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systematically either in school or at work, a factor that hinders their ability to effectively communicate with their patients. Regarding the communication between multidisciplinary personnel, different perceptions and diverse professional focuses among the disciplines may lead to the barriers in communication and collaboration between nurses and other personnel (Siegele, 2009). In nursing, motivation, knowledge and skills contribute to the professionalism in the area of communication (Wloszczak-Szubzda and Jarosz, 2013). In terms of motivation, communication includes respect, tolerance for dissimilarity, respect for rights, and non-violation of another person's limits (Wloszczak-Szubzda and Jarosz, 2013). As for knowledge, communication incorporates contents that should be said in specified situations (Wloszczak-Szubzda and Jarosz, 2013). In some situations, nurses have insufficient knowledge or experience on the content to be communicated, such as death education, when the emotional load in nursing makes interactions between nurses and patients difficult (Kruijver et al., 2001), thus, recent research focused on training nurses in communication competency in the following cases: managing cancer patients (Moore et al., 2013, 2018; Langewitz et al., 2010; Coyle et al., 2015); sex education, where 56.8% of nurses felt uncomfortable when asked sex-related questions by patients (Kim and Nam, 2014), and in order to improve nurses professional communication competencies and provide sexual health interventions to patients, evaluating their knowledge and attitudes (Kim et al., 2014) about sex education and conducting training (Kim and Shin, 2016) are important; with regard to pharmacology knowledge education, Diamantouros et al. (2013) pointed that high-quality education for patients on this topic improves their compliance and reduction in complications, however, pharmacology knowledge is difficult to learn. Thus, professionals, including nurses, should sharpen their communicative competency in pharmacological issues (Zetterqvist et al., 2015); and temperance or cessation of drinking and smoking education, tobacco smoking and alcohol drinking are two preventable causes of illness and deaths (Reilly et al., 2014; Organization, 2008), yet numerous people still smoke or drink excessively. These two habits are dangerous, especially for patients with underlying diseases, and the difficulties in changing patients' cognition and behavior makes temperance education training for nursing students and nurses a necessary task to enable their effective intervention (Arthur, 1999). Communication barriers likely arise if nurses use inappropriate ways to communicate, are introvert, adopt an avoidance approach to communication (Oliveira and Braga, 2016), lack the ability to listen and recognize facial expressions and body language (Xin et al., 2014; Gultekin et al., 2016), and have poor self-expression skills and language organization (Wang et al., 2017). Communication barrier is central to conflict management because it often creates and reflects conflict (Wilmot and Hocker, 2007). Communication barriers among interdisciplinary members could likewise lead to safety hazards, which may increase the incidence of adverse events and cause varying degrees of loss to patients. Communication barriers tend to come from both nurses and patients. Improving patients' communication competencies require intervention at the social level to enhance the status of national culture and medical knowledge due to the high population turnover of patients. Such intervention is slow, and the effect would be difficult to measure. Preferably, nurses or nursing students should conduct the intervention to improve the communication with patients. Professional communication competencies training includes motivation, knowledge and skills.

Problem-based learning (PBL) is a modern problem-oriented teaching and learning strategy initiated by Professor Barrows, an American neurology professor from McMaster University in Canada, then widely used in Limburg University, Newcastle University, and Association of American Medical Colleges, nowadays, PBL is a major method to deliver medical education in the African, Asian-Pacific, European, Middle Eastern, American and Australian regions (Samy, 2008). PBL advocates students to identify problems by themselves, seek solutions to problems, and seek cooperation to overcome problems

together. This strategy cultivates students' abilities in self-learning, lifelong learning, problem-solving, practical thinking, innovation, collaboration and communication (Kong et al., 2014; Tang and Sung, 2012). In the early 1990s, four systematic reviews of undergraduate medical education cautiously supported the short- and long-term outcomes of PBL over traditional learning (Berkson, 1993; Vernon and Blake, 1993; Albanese and Mitchell, 1993; Norman and Schmidt, 1992). In daily work and life, gathering experience and learning from the problems are significant challenge; in this sense, PBL is a special kind of learning process because it consciously arranges the learning environment and uses proper application of teaching tools (Becker et al., 2006). Many articles show that PBL is an effective method in nursing education (Wosinski et al., 2018; Zhou et al., 2016; Qin et al., 2016; Khan and Al-Swailmi, 2015; Gould et al., 2015; Kong et al., 2014; Galvao et al., 2014). A group is taken as a unit for gathering data, and then a meeting is held for discussion. The entire process of PBL ultimately stimulates the thinking and learning enthusiasm of students.

During the implementation of PBL, the students form groups after finding problems in case scenarios, and work together to find relevant materials. During discussions, the students express their opinions and strive to solve the disputed questions. In this process, the communication ability of students improves and their knowledge broadens. Several articles on improving critical thinking ability were found during the review on improving the ability of nursing students and nurses via PBL methods (Carvalho et al., 2017; Yuan et al., 2008; Banning, 2006; Kong et al., 2014; Tang and Sung, 2012). Communication can effectively improve interpersonal relationships, provide accurate information, and reduce the occurrence of adverse events caused by communication barriers. However, no review yet exists on how the PBL method can improve professional communication competencies.

2. Review method

2.1. Purpose

The purpose of this systematic review is to compare effectiveness of PBL with that of traditional teaching and learning method in professional communication competencies of nursing students and nurses.

2.2. Inclusion criteria

Articles were included if they (1) described randomized controlled trials (RCTs) and quasi-experiments, (2) included nursing students or nurses, (3) used PBL as an educational approach, (4) evaluated communication as an outcome, (5) reported the sample size and the specific process, and (6) published in English and Chinese in a peer-reviewed scientific journal from 1990 to 2018. Studies were excluded if they (1) described observational, cohort, cross-sectional, case control, qualitative studies, general reviews, and meeting abstracts; (2) only included other subjects; or (3) were duplicate articles.

2.3. Search strategy

The search strategy aimed to check all articles published in Chinese and English peer-review journals that meet the inclusion criteria from 1990 to 2018. This review adopted a three-step retrieval strategy. First, MEDLINE and PubMed were pre-searched using the selected search words or keywords. Second, all relevant keywords from the title and abstract were identified, and then the words found from the text and abstract were analyzed to determine the content related to the theme. Third, a reference list of all the identified reports and articles was created to supplement this review. The retrieval database included the following: PubMed, EMBASE, PsycINFO, Medline, Cochrane Library, China National Knowledge Infrastructure, Wanfang Data Knowledge Service Platform, and VIP Database for Chinese Technical Periodicals.

The search terms/keywords included "nurse*," "nursing personnel,"

“registered nurse*,” “nursing*,” “patient*,” “client*,” “communication,” “personal communication,” “misinformation,” “communication program*,” “communications personnel,” “problem-based learning,” “problem based learning,” “problem-based curricular*,” “problem based curricula,” “experiential learning.” “active learning.”

2.4. Study selection and critical appraisal

Two independent authors (YL and XW) screened the titles and abstracts of all papers retrieved by the literature search to determine compliance with the inclusion criteria. After retrieving the full-text papers, the same two independent reviewers assessed the methodological quality by using Cochrane for RCTs and Joanna Briggs Institute (JBI) analysis for quasi-experiments. No substantive disagreement occurred for any of the papers.

2.5. Data extraction

The Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) was used for data extraction. General data, population, intervention, design, and results of the study were extracted.

2.6. Data analysis and synthesis

JBI was used for statistical analysis of the data. Conducting a meta-analysis was impossible because of the different intervention methods and outcome indicators. Therefore, the research results of this paper were presented and summarized in a narrative manner.

3. Results

3.1. Search results

A total of 1388 abstracts were retrieved from the literature, from which 303 duplicates were removed. After title and abstract screening, 1001 articles were excluded, 84 articles were selected for full-text review, then we assessed for eligibility according to the inclusion and exclusion standards. Finally, a comprehensive review was conducted to exclude 72 articles, and 12 articles remained. The data abstraction process is shown in Fig. 1.

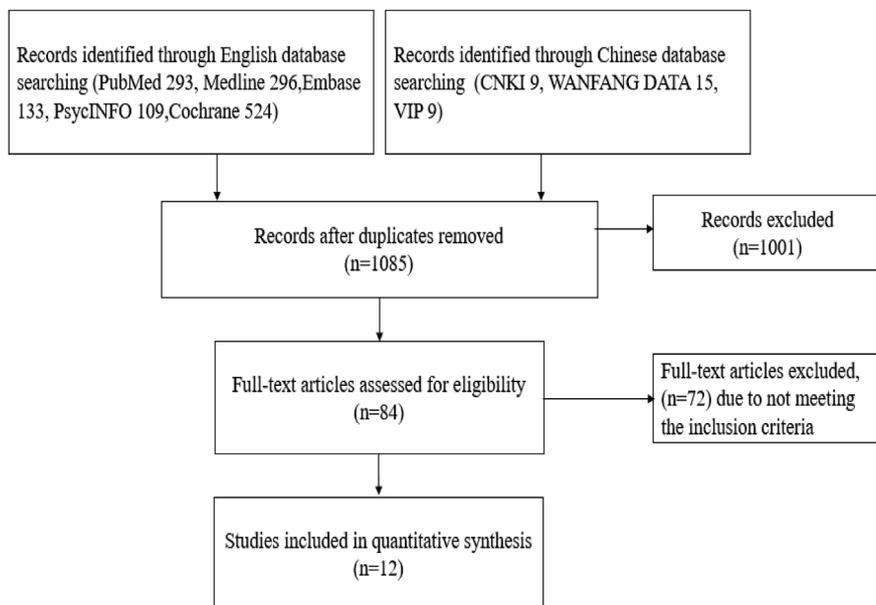


Fig. 1. Flowchart of the selection process for the included studies.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Becker et al. 2006				+	+		
Kim and Shin 2016				+	+		
Ma et al. 2012			●	+	+		
Mei 2016			+	+	+		
Xin et al. 2014	●		+	+			

Fig. 2. Risk of bias summary: judgments of review authors about each risk of bias item for five randomized controlled trials.

3.2. Characteristics of included studies

The 12 studies were published by January 2018, with six in English and six in Chinese. Six of the studies took place in mainland China (50.0%), two in Hong Kong (16.7%), and the others in the United States (n = 1), Ireland (n = 1), Sweden (n = 1), and Korea (n = 1). The length of intervention ranged from 4 h to one year. All the studies included only Chinese and English articles, and all used scales, questionnaires, paper, learning journal or interviews to collect data. Nine studies (Arthur, 1999; Becker et al., 2006; Cusack and O'Donoghue, 2012; Kim and Shin, 2016; Wong et al., 2001; Zetterqvist et al., 2015; Cao et al., 2015; Dong and Zhao, 2014; Xin et al., 2014) were before-

Table 1
Problem-based learning intervention studies.

Reference (Country)	Sample size (IG/CG)	Characteristics of participants	Intervention/description of PBL	Research design/Level of evidence	Findings/Results
Arthur (1999) Hong Kong, China	212 (106/106)	212 Bachelor of Nursing students, 68 registered nurses (RN), the rest are undergraduates (UG).	UG1, n = 73; UG2, n = 71; RN1, n = 33; RN2, n = 35. Three 2 h PBL workshops were arranged. UG1 and RN1 completed PBL program first, followed by UG2 and RN2 one month later. Simulated Client. Experimental group and control group attended Session 1 (6 h lecture). Only experimental group attended Session 2 (Simulation–PBL program for 2 days, 4 h).	Quasi-RCT, crossover design. Data collection: Video of interview and Simulated Client Interview Rating Scale. Level 2c RCT, pretest and posttest design. Data collection: 12 evaluation items and 4 domains from the video content, with the communication in each scenario evaluated. Gender role perception, sexual knowledge, and sexual attitude scales. Level 1c Quasi-RCT, pretest and posttest design. Data collection: students' learning journals, case and cross-case analysis. Level 2d	The posttest results (basic humanistic communication skills and motivational interviewing skills) have a significant difference to the pre-test results. No difference between the two groups before the program. After the Simulation–PBL program, sexual knowledge and sexual attitude were improved for the experimental group compared with those for the control group. And it made students feel comfort in communicating with patients. PBL is an effective approach in death education. Nurses acknowledge their emotions on avoidance to gain a positive attitude. They are better equipped in knowledge and skills while communicating with patient and family.
Kim and Shin (2016) South Korea	47 (25/22)	47 nursing students who passed the class in women's health nursing.	Three large groups, each group focused on one problem about death and dying. Each problem had three scenarios. Each large group was divided into four groups. The students met every other week to discuss the problem. Tutors underwent PBL training. The students were individually presented with two written cases describing patients treated with a combination of drugs. Each student identified the problems and found possible solutions. Then the students discussed the cases with an interviewer (MR).	Quasi-controlled trial, qualitative research Level 2c	Health Science students need to understand pharmacological processes to ensure patients' understanding, and there is a qualitative variation in the communication outcome for health care students.
Wong et al. (2001) Hong Kong, China	72	72 students who were enrolled in the fourth year of their degree studies at the university under study and became RNs.	The students were individually presented with two written cases describing patients treated with a combination of drugs. Each student identified the problems and found possible solutions. Then the students discussed the cases with an interviewer (MR).	Quasi-experiment design. Data collection: questionnaire and English test aspects. Level 2c	PBL teaching methods based on clinical communication can effectively improve the students' English interest, improve their English clinical conversation ability.
Zetterqvist et al. (2015) Sweden	12	12 final-semester students from two Swedish universities (6 students each), including future doctors (4 students), future nurses (4 students), and experienced nurses (4 students).	45: experimental group, 41: control group. The control group used the traditional method, while the experimental group used the PBL method to learn the same English book for 16 weeks.	RCT. Data collection: questionnaire, ability tests. The questionnaire included improving analytical capability, enhancing self-learning ability and strengthening communication between nurses and patients. Level 1c	The results of the questionnaire showed a significant difference between the scores of theoretical and practical ability tests between the two groups.
Wang et al. (2017) China	86 (45/41)	86 Nursing students from the Heilongjiang University of Chinese Medicine.	Four groups, level IV nurses were selected as team leaders. Group training, PBL, training of sight introduction pattern, and examination of bedside mixed ability (GPTE) were done for one year.	Quasi-RCT, pretest and posttest design. Data collection: self-made questionnaire on "improving nursing evaluation ability," "developing problem solving skills," and "cultivating communication skills between nurses and patients." Level 2d	Significant differences were found on the pretest and posttest between the results of the questionnaire.
Mei (2016) China	240 (120/120)	240 nursing students on probation from a junior college.	The PBL method was used by choosing cases from successful communication and from communication disorders between nurses and patients to conduct a case analysis training and exchange role experience training.	Quasi-RCT, pretest and protest design. Data collection: communication skills assessment, self-made questionnaire, and nursing satisfaction questionnaire. Level 2d	The results of the communication skills assessment present a normal distribution. In the self-made questionnaire, all nurses think that PBL improves training efficiency, and improves their ability to solve problems. 14 nurses think that PBL improves communication skills.
Cao et al. (2015) China	21	21 nurses in the ICU department from a hospital in Wenzhou.	42: experimental group, 42: control group. Each small group was divided into four to five students. The control group used the traditional	RCT. Data collection: trainer teacher assessed each student's theory, technical operation, and	The results of the theory and technical operation and comprehensive ability showed a significant difference between the two groups.
Dong and Zhao (2014) China	15	15 nurses from the pediatric clinic and emergency department in a hospital in Xinjiang. They all hold college degrees.	Each		(continued on next page)
Ma et al. (2012) China	84 (42/42)	84 nursing interns from a hospital in Beijing, 40 from a polytechnic school, and 44 from a higher vocational school.			

Table 1 (continued)

Reference (Country)	Sample size (IG/CG)	Characteristics of participants	Intervention/description of PBL	Research design/Level of evidence	Findings/Results
Xin et al. (2014) China	126 (63/63)	126 first-semester nursing students from Jiangsu Vocational and Technical College.	teaching method, while the experimental group used the bedside teaching mode and PBL method for eight months. 63: experimental group, 63: control group. The control group used the traditional teaching method, while the experimental group used the PBL and task-driven method to learn communication between nurses and patients for four months for a total of 20 h.	comprehensive ability. Comprehensive ability includes the ability to communicate with patients, judge the ability of thinking, nursing record writing skills, and skills handling. Level 1c Data collection: Apply psychological tool of quantitative questionnaire to assess students' communication skills from five dimensionalities. After 3, 5, and 10 months of internship, the evaluation questionnaire for new nurses regarding the nursing service. Level 1c	The results of communication skills between the two groups are statistically different. The results of the pretest and posttest of the experimental group are statistically different. The satisfaction of patients and the number of medical complaints per person between the two groups are statistically different.
Cusack and O'Donoghue (2012) Ireland	92	92 students from medicine, nursing, physiotherapy, and diagnostic imaging profession participated in the IPE module during two semesters. Each PBL group had a staff facilitator from one of the health science disciplines.	8–10: each PBL group used the PBL and IPE (Inter-Professional Education) methods.	Quasi-RCT, pretest and posttest design. Data collection: evaluation of this module was undertaken using the questionnaire designed for this study. The questionnaire consisted of questions to rate the module and in accordance with the previous work done by the authors. Level 2d	91.4% students agreed that they were "overall satisfied with the module." Small group learning facilitates the acquisition of knowledge, communication skills, problem solving, sharing information, and respect for others. Building communication links will improve teamwork and promote better patient care.
Becker et al. (2006) America	147 (58/89)	147 senior undergraduate nursing students enrolled in a psychiatric nursing course at a large mid-Atlantic university.	58: experimental group, 89: control group. Used PBL and SP method for seven weeks. Experimental group interviewed an SP, wherein each student interviewed an SP for 30 min. A group discussion was done. Finally, the student videotaped the self-analysis with an accompanying handbook.	RCT, pretest–posttest design. Data collection: CKT, SSPE, and demographic data. The post-encounter SP checklist and author-developed SPFR. Level 1c	No significant difference was found between the two groups on the measures of interpersonal skills, therapeutic communication skills, and knowledge of depression.

and-after studies (Fig. 2), three studies (Wang et al., 2017; Mei, 2016; Ma et al., 2012) were post-test measurements, wherein one (Xin et al., 2014) measured patient satisfaction with nurse communication and quality of care at different time points, and the third one (Dong and Zhao, 2014) measured only patient satisfaction with communication at one time. The characteristics of the included studies are summarized in Table 1.

3.3. Characteristics of participants

The sample size of participants in the 12 studies ranged from 12 to 240, including 1065 nursing students from different degrees and grades. Forty nurses were working at hospitals, and 49 were other medical staff.

3.4. Outcome measurement

The outcome measuring tools used in the included studies were Simulated Client Interview Rating Scale (SCIRS) (Arthur, 1999), the Sex-Role Orientation and Sex-Role Ideology Scale, Chou and Ha's sexual knowledge scale, Sexual Attitude Scale (Kim and Shin, 2016), Communication Knowledge Test (CKT), the Student Self-Evaluation of Standardized Patient Encounter (SSPE), the post-encounter Standardized Patient checklist, the Standardized Patient Interpersonal Ratings (SPIR) (Becker et al., 2006), evaluation of students' understanding of the pharmacological concepts pharmacodynamics, pharmacokinetics and drug interactions (Zetterqvist et al., 2015), learning journals, student self-evaluation worksheets (Wong et al., 2001), and other self-made questionnaires (Cusack and O'Donoghue, 2012). Some literature measured participants satisfaction of their own communication abilities and learning model (Becker et al., 2006; Cusack and O'Donoghue, 2012; Mei, 2016; Cao et al., 2015; Wang et al., 2017), some measured patient satisfaction with nurse communication (Xin et al., 2014; Dong and Zhao, 2014).

3.5. Study quality

Four out of five RCTs had unclear descriptions in the random sequence generation (Mei, 2016; Ma et al., 2012; Kim and Shin, 2016; Becker et al., 2006) and one (Xin et al., 2014) that was high risk. All the studies did not describe their allocation, random schemes, and the blind methods of the subjects and intervention subjects. In the aspect of blind evaluation, (Ma et al., 2012), results were high risk and (Mei, 2016) a unified knowledge base was used for assessment that had low bias risk. The outcome indicators of the studies were low risk because they had no loss of interview. The possibility of selective reporting of results was low. Overall, five RCTs were low risk. All the studies for the quasi-experiments had clear objectives. Three studies (Solomon and Salfi, 2011; Cusack and O'Donoghue, 2012; Zetterqvist et al., 2015) had unclear descriptions in their sample selection process as well as inclusion and exclusion criteria. Five articles (Wong et al., 2001; Cusack and O'Donoghue, 2012; Zetterqvist et al., 2015; Dong and Zhao, 2014; Cao et al., 2015) did not implement blind methods for subjects or results. One articles (Cusack and O'Donoghue, 2012) did not have specific descriptions of sample loss. The adverse reactions or side effects in all the quasi-experiments were unclear (Arthur, 1999; Cusack and O'Donoghue, 2012; Wong et al., 2001; Zetterqvist et al., 2015; Cao et al., 2015; Dong and Zhao, 2014; Wang et al., 2017). One study (Cao et al., 2015) adopted the method of self-assessment of the research object on the outcome index, which lacked objectivity and was judged as inappropriate. The quality of the studies is summarized in Tables 2 and 3.

3.6. Effects of interventions

Eight out of 12 studies used the PBL method or PBL combined with

other methods to intervene while aiming at the problems in the communication process between nurses and patients, including the communication contents (Arthur, 1999; Cusack and O'Donoghue, 2012; Wong et al., 2001; Zetterqvist et al., 2015; Kim and Shin, 2016) and methods (Wang et al., 2017; Dong and Zhao, 2014; Ma et al., 2012; Xin et al., 2014; Becker et al., 2006) of the problems. One study used the PBL method to conduct multidisciplinary cooperation, through which learning and communication between nurses and other medical personnel affect the quality of care for patients and the outcome of patients (Zetterqvist et al., 2015). The other three studies are a combination of PBL or PBL with other methods to improve the communication abilities of nursing students or nurses and patients through comprehensive judgment (Ma et al., 2012; Mei, 2016; Cao et al., 2015).

Among all of these articles, the intervention of five articles for communication knowledge included alcohol withdrawal, sex education-related question, death education, medication use, therapeutic nursing with depression related problems. Arthur (1999) mentioned that nursing students were trained by PBL and simulated clients. Simulated clients is an effective way to evaluate the quality of health care delivery, in the process, a team member or assistant pretends to be a real client or patient (standardized patient) to seeks service or care according to prearranged script (Fitzpatrick and Tumlinson, 2017). They conducted a brief motivational interview with patients who had alcohol problems using a cross-experiment method, wherein they intervened with the experiment group first and then the control group after a month. Finally, with the use of the Simulated Client Interview Rating Scale (SCIRS) developed by the author to assess the effect on the two groups before and after the intervention, PBL and SC were shown to have a positive effect (Arthur, 1999). Kim and Shin (2016) indicated that nurses must be knowledgeable about sexual problems and comfortable with sex-related communication. However, more than half of the nurses felt uncomfortable during sex-related questioning, a situation that often causes communication barrier between nurses and patients. The senior nursing students in the experimental group experienced interference in their education problems by PBL and simulation-based learning through a group discussion and an interview. The results showed that students were able to gain this ability to actively cope with discomfort in sex-related communications with patients. Wong et al. (2001) showed that death usually occurs in the hospital. Hence, caring for dying patients is a major part of healthcare service. However, nurses felt a sense of discomfort and inadequacy when communicating with dying patients and bereaved relatives. The research team introduced death education using the PBL approach, which changed the attitude and behavior of nurses in caring for the dying as well as increased confidence in comfort in communicating with dying patients. Zetterqvist et al. (2015) pointed out that more drugs are being developed and are easily accessible, leading to drug abuse. Health sciences students need to develop an in-depth understanding of the pharmacological process to ensure that patients understand it, while knowledge in professional communication need to be considered as a basic and complete aspect of education in health sciences. When the PBL approach was used with 12 students (4 future doctors, 4 nursing students, and 4 clinical nurses) on pharmacological education, the students made an impact on the result of the pharmacological information communication. Becker et al. (2006) developed knowledge training for nursing students on communication and depression. A total of 147 nursing students were randomly divided into experimental and control groups, where the former used PBL and SP and the latter used the traditional teaching methods. No statistical difference was observed.

The four articles focused on the form of communication. Wang et al. (2017) used PBL to improve the English communication ability of clinical nurses. The experimental group used PBL method, whereas the control group used the traditional method. An evaluation by professional foreign language teachers found that significant differences in oral communication abilities, English lexis, listening skills and clinical nurse-patient communication were found between the two groups

Table 2
Cochrane Collaboration's tool for assessing risk of bias.

Domain	Kim and Shin (2016)	Mei (2016)	Ma et al. (2012)	Xin et al. (2014)	Becker et al. (2006)
1. Random sequence generation	0	0	0	–1	0
2. Allocation concealment	0	0	0	0	0
3. Blinding of participants and personnel	0	0	0	0	0
4. Incomplete outcome data	0	1	–1	0	0
5. Blinding of outcome assessment	1	1	1	1	1
6. Selective reporting	1	1	1	1	1
7. Other bias	0	0	0	0	0
TOTAL	2 (Low bias)	3 (Low bias)	1 (Low bias)	1 (Low bias)	2 (Low bias)

before and after the test. Sedgwick and Garner (2017) supported the view that socio-pragmatic competence in language tests for nurses is very important. Dong and Zhao (2014) used the PBL method on 15 pediatric nurses undergoing communication skills training. They discovered problems from the specific case through the communication skills assessment (including service etiquette, form of communication, strain capacity, language expression ability, and communication effect) and self-made questionnaires. The results showed that the training efficiency and communication ability were improved, and the families of the children had higher satisfaction rates in the post-test compared with the pre-test. Xin et al. (2014) divided 126 higher vocational nursing students into experimental and control groups. The experimental group used the PBL approach and the task-driving method, whereas the control group used a conventional education method. Communication ability was measured by using questionnaires in five dimensions and with rating for patient satisfaction. The results showed that the experimental group demonstrated better communication abilities than the control group ($P < 0.01$). In addition, the experimental group rated higher than the control group in patient satisfaction ($P < 0.01$), with the number of per capita medical disputes in the experimental group lower than that in the control group ($P < 0.01$). Cusack and O'Donoghue (2012) pointed out that 94.8% of ninety-two students were satisfied with the communication skills sessions, 91.4% of the students satisfied with the training mode, communication skills of the students had a significant difference between pre-test and post-test measurements.

In addition, Ma et al. (2012) divided 84 nursing students from secondary school and higher vocational colleges into experimental and control groups. The experimental group was taught by PBL and bedside teaching methods, where teachers assessed the students' theories, operations, and comprehensive abilities (including communications with the patients, critical thinking, record writing, and examination disposal and evaluation) before the end of the internship. The results showed that the theoretical and operational performance, comprehensive ability of the experimental group was higher than that of the control group. Cao et al. (2015) included 21 nurses in the ICU, trained for one year using Group training, PBL, Training of sight introduction pattern and Examination of bedside mixed ability (shorthand for GPTE), employee evaluation forms to assess comprehensive capability, and self-made GPTE questionnaire to assess opinions of these nurses. The results showed that the comprehensive ability score after training was higher than that before training. The difference was statistically significant, with the results of the GPTE questionnaire showing that the majority of nurses believed that the training mode improved their ability in nursing evaluation, emergency response, and communication with patients. Mei (2016) divided 240 internship nursing students from a junior college into experimental group and a control group. The experimental group used PBL approach, whereas the control group used traditional method for two weeks. Interest in learning, improving the analytical ability, strengthening self-learning ability and communication between teachers–students and nurses–patients were measured by a satisfaction questionnaire. The measured grades of the two groups showed that the scores of the experimental group were higher than those of the control

group ($P < 0.05$).

One study (Becker et al., 2006) indicated that the effect of the PBL approach had no significant difference compared with the traditional approach, whereas others supported the results of the PBL method.

4. Discussion

The purpose of this systematic review was to evaluate the role of PBL in improving the communication ability of nursing students and the communication effects between nurses and patients. The use of PBL improved the nursing students' and nurses' knowledge in specific situations, such as alcohol withdrawal (Arthur, 1999), sex education (Kim and Shin, 2016), death education (Wong et al., 2001), medication use (Zetterqvist et al., 2015). As such, PBL contributes to solving the communication barrier between nurses and patients. PBL training on knowledge in specific situations were able to reduce the discomfort and uncertainty of nursing students and nurses when they communicating with patients who suffered from adverse situations. These professional communication competencies can be improved to a certain extent. The use of PBL also improved the nursing students' and nurses' skills in communication, such as language expression, understanding between nurse-patient, communication skills (Ma et al., 2012), listening skills, ability to recognize facial expressions, ability to recognize body language, ability to identify the sound and tone (Xin et al., 2014), communication mode, strain capacity, communication effect and etiquette (Dong and Zhao, 2014). This review included 12 articles, with nine pre-post-test research studies (Arthur, 1999; Becker et al., 2006; Cusack and O'Donoghue, 2012; Kim and Shin, 2016; Wong et al., 2001; Zetterqvist et al., 2015; Cao et al., 2015; Dong and Zhao, 2014; Xin et al., 2014), and three post-test measurement studies (Wang et al., 2017; Mei, 2016; Ma et al., 2012), and included 1065 nursing students and 40 nurses.

The Cochrane and JBI evaluation tool scores indicate that most RCT studies lack a specific description of random and hidden allocations. In addition, all studies lacked standardized outcome evaluation indicators, thereby possibly influence the results and effectiveness of PBL. Although all the studies used PBL as a teaching and learning method for intervention, the specific process and intervention length of PBL, as well as the outcome indicators, varied. Thus, the conclusion that PBL is more effective than traditional teaching method in improving professional communication competencies needs to be treated with caution.

For nurses, effective professional communication is vital to effective health care provision (Norouzinia et al., 2015). It is the basis of providing quality patient care (Candlin and Candlin, 2014; O'Shea et al., 2013) and can improve nurse-patient relationships (Tay et al., 2012) as well as increase patient satisfaction, acceptance, and compliance (Norouzinia et al., 2015). Professional communication competencies also improve patients' health outcomes (Riedl and Schussler, 2017). Thus, nurses and nursing students need to improve their professional communication competencies to solve common problems in clinical practice.

Schmidt et al. (2011) indicated that in PBL, learners are presented with a problem to activate their prior knowledge. As the preconceptions of the learners are activated, they could more easily identify gaps in

Table 3
Summary of quality assessment of the quasi-randomized controlled trial.

Domain	Arthur (1999)	Wong et al. (2001)	Zetterqvist et al. (2015)	Wang et al. (2017)	Cao et al. (2015)	Dong and Zhao (2014)	Cusack and O'Donoghue (2012)
1. Was the causal relationship clearly stated in the study?	1	1	1	1	1	1	1
2. Were the selection and grouping processes and selection and exclusion criteria of the sample clearly described?	1	1	-1	1	1	1	-1
3. Was a blind method applied to the subjects and the results of the study?	1	-1	-1	1	-1	-1	-1
4. Were the baselines between the groups comparable?	1	1	1	1	1	1	1
5. Does it describe sample loss? Are the missing samples included in the analysis?	1	1	1	1	1	1	-1
6. Was the same way used to evaluate the outcome indicators?	1	1	1	1	1	1	1
7. Were the other measures that were accepted by each group the same?	1	1	1	1	1	1	1
8. Were the ways to assess adverse reactions or side effects described?	0	0	0	0	0	0	0
9. Were outcomes measured in a reliable way?	1	1	1	1	-1	1	1
10. Was appropriate statistical analysis used?	1	1	1	1	1	1	1
TOTAL	9	7	5	9	5	7	3
	Low bias	Low bias	Low bias	Low bias	Low bias	Low bias	Low bias

their prior knowledge; thereby enabling better learning to take place (the *activation–elaboration* hypothesis). With regard to the content of the nurse-patient communication barriers in clinical practice, including death, sex, withdrawal of bad habits, medication knowledge, and unfamiliarity with the professional knowledge among various medical disciplines and related concerns, the PBL approach aims to solve these problems and the communication barriers caused by a lack of knowledge and inexperience. PBL can be used to improve communication skills and address problems such as poor language expression ability, poor listening skills, and lack of recognition of the importance of psychology, thereby improving the ability of nursing students and nurses to express themselves, acquire knowledge on communication psychology, promote personnel exchanges and cooperation among various medical disciplines, and promote the improvement of their professional communication competencies. Only one article on communication content showed that the PBL method had no significant difference in improving communication ability compared with traditional teaching methods.

4.1. Limitations

The quality of included studies was assessed based on Cochrane and JBI guidelines, and several criteria were not clearly described in most studies included in the review. In addition, no uniform outcome indicators were stated in each of the three scopes of communication, and the varying outcome indicators of studies may affect the accuracy of the results of this review. According to existing studies included in the review, only two of the three dimensions of communication are analyzed. Motivation in communication requires further exploration.

4.2. Implications for future research

In the preliminary screening and writing process of this article, data from most research were obtained using the interview method and a self-made questionnaire to evaluate the effect of professional communication competencies improvement. The lack of a unified and effective scale and of unified outcome indicators was determined through these data. A significant difference in the reliability validity or reliability of the self-made questionnaire was found. The ability to communicate plays an important role in the fast pace of modern society. When information and meaning cannot be conveyed effectively within a short period of time, misunderstandings are likely to occur. Hence, considerable attention must be paid to the evaluation of professional communication competencies, especially the effect of the PBL on the ability to communicate. Larger sample size and high-quality research are likewise needed to support the conclusion.

5. Conclusion

This systematic review provided limited evidence that PBL is more effective than the traditional teaching method in improving the professional communication competencies of nursing students and nurses. The lack of consistency of intervention length and outcome indicators may have affected the results. In view of the limitations described above, a more effective and uniform test design and larger sample size are still needed to support the conclusion. High quality research should be planned to assess the effectiveness of PBL in improving professional communication competencies competency of nursing students and nurses.

Conflicts of interest

The authors have no conflicts of interest to be declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://>

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Appendix I. JBI Level of Evidence – Effectiveness

Level of Evidence	Effectiveness
Level 1 – Experimental Designs	Level 1.a – Systematic review of Randomized Controlled Trials (RCTs) Level 1.b – Systematic review of RCTs and other study designs Level 1.c – RCT Level 1.d – Pseudo - RCTs
Level 2 – Quasi-experimental Designs	Level 2.a – Systematic review of quasi-experimental studies Level 2.b – Systematic review of quasi-experimental and other lower study designs Level 2.c – Quasi-experimental prospectively controlled study Level 2.d – Pre-test-post-test or historic/retrospective control group study
Level 3 – Observational – Analytic Designs	Level 3.a – Systematic review of comparable cohort studies Level 3.b – Systematic review of comparable cohort and other lower study designs Level 3.c – Cohort study with control group Level 3.d – Case-controlled study
Level 4 – Observational – Descriptive Studies	Level 3.e – Observational study without a control group Level 4.a – Systematic review of descriptive studies Level 4.b – Cross-sectional study Level 4.c – Case series Level 4.d – Case study
Level 5 – Expert Opinion and Bench Research	Level 5.a – Systematic review of expert opinion Level 5.b – Expert consensus Level 5.c – Bench research/single expert opinion

(Source: JBI Level of Evidence; JBI, 2014)

Appendix II. Search strategy

Database (No time limit)	Search terms	Number of articles
PubMed	patient* or client* and nurse* or nursing* or nursing personnel or registered nurse* and communication or misinformation or communication program* or personal communication or communications personnel and problem-based learning or problem based learning or problem-based curricula* or problem based curricula or experiential learning or active learning	293
MEDLINE	(patient* or client*) and (nurse* or nursing* or nursing personnel or registered nurse*) and (communication or personal communication or misinformation or communication program* or communication personnel) and (problem-based learning or problem based learning or problem-based curricula* or problem based curricula or experiential learning or active learning)	296
EMBASE	(patient* or client*) and (nurse* or nursing* or nursing personnel or registered nurse*) and (interpersonal communication or communication or personal communication or misinformation or communication program* or communications personnel) and (problem based learning or problem-based learning or problem-based curricula* or problem based curricula or experiential learning or active learning)	133
PsycINFO	(patient* or client*) and (nurse* or nursing* or nursing personnel or registered nurse*) and (communication or personal communication or misinformation or communication program* or communications personnel) and (problem-based learning or problem based learning or problem-based curricula* or problem based curricula or experiential learning or active learning)	109
Cochrane	(patient* or client*) and (nurse* or nursing* or nursing personnel or registered nurse*) and (personal communication or misinformation or communication program* or communications personnel) and (problem-based learning or problem based learning or problem-based curricula* or problem based curricula or experiential learning or active learning)	524
WANFANG DATA	PBL and 护患沟通	15
CNKI	PBL and 护患沟通	9
VIP	PBL and 护患沟通	9
Duplicates removed		1085
Studies retained after both review (YES article)		13
FINAL study selection (after quality assessment)		13

Appendix III

Quantitative Data Extraction Form.

Author:

Journal:

Year:

Reviewer:

Method:

Setting:

Participants:

Number of Participants:

Group A

Group B

Interventions:

Group A

Control
Group B
Intervention
Outcome Measures
Definition
Authors Conclusions:
Comments:
Dichotomous data

Outcome	Intervention () Number/total number	Intervention () Number/total number

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