Review

Facilitating problem-based learning among undergraduate nursing students: A qualitative systematic review

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ABSTRACT

Objectives: The purpose of this study was to identify and synthesize the best available evidence on the perspective of undergraduate nursing students on facilitating elements that contribute to their success with PBL.
Design: a qualitative systematic review of the literature according to meta-aggregative methodology using the JBI SUMARI system was conducted.
Data sources: Data was collected across CINAHL, Medline, Embase, Eric, Teacher Reference Center and reference lists.
Research methods: Out of 378 articles, 101 were retrieved for examination and eight were retained after methodological analysis.
Results: 51 findings, matched with a verbatim, were extracted and aggregated in five categories: 1) in PBL, the nursing tutor models clinical reasoning and leadership skills; 2) the quality of group interactions is critical to the success of nursing students with PBL; 3) nursing students go through the process of learning with PBL; 4) through PBL, nursing students acquire skills that foster clinical reasoning; and 5) when the PBL method is used as intended, nursing students understand its purpose and process. These categories were aggregated in two syntheses worded as recommendation for practice.
Conclusions: The synthesized recommendations are: 1) tutors should be trained to effectively guide the team work of undergraduate nursing students along the PBL process in order for them to achieve its goal; and 2) nursing students should be securely introduced to PBL and experience the development of their clinical reasoning through PBL. Future research should focus on the strategies undergraduate nursing students use to succeed with PBL and the effectiveness of PBL in enhancing critical thinking and collaboration skills.

Facilitating Problem Based Learning Among Undergraduate Nursing Students: A Qualitative Systematic Review

In an increasingly demanding healthcare context, nurses are expected to develop complex clinical reasoning skills in order to solve clinical problems, make the most suitable care decisions to ensure positive health outcomes (Billings and Halstead, 2016). Various teaching and learning methods, such as Problem-Based Learning (PBL), have been developed to prepare nursing students for clinical practice in this complex environment.

1. Background

PBL was first introduced in the late 1960s (Barrows and Tamblyn, 1980). Since then, the PBL method has been used as an educational strategy in many of the health sciences and in nursing education since the 1980s (McMillan and Dwyer, 1989). PBL is defined as the "learning that results from the process of working toward the understanding or resolution of a problem" (Barrows and Tamblyn, 1980, p.18) under the guidance of a faculty named tutor in PBL. In addition to the outcome of acquisition of new knowledge related to a problem, PBL is one of the teaching methods used to build professional skills essential to nursing, such as self-directed and collaborative learning (Barrows and Tamblyn, 1980).

1.1. Components of the PBL process

Barrows and Tamblyn (1980) hypothesized that if the students learn

by using the skills they need to acquire; they will more readily develop them.

One of the goals of self-directed learning is to help students recall information learned (Barrows and Tamblyn, 1980). It is an essential component of evidence-based practice (Profetto-McGrath, 2005). Self-directed learning is defined as the students' ability to study independently and to take responsibility for their own learning, including the planning, implementation and evaluation of their own work (Levett-Jones, 2005). Self-directed learning includes the identification of: 1) self-learning needs; 2) what is important to learn; and 3) learning resources (Barrows and Tamblyn, 1980). This ability to assess oneself seems to be a key element of academic performance (Abar and Loken, 2010). Self-regulation, the ability to maintain activities, cognitions and emotions oriented toward the pursuit of goals, regardless of stress (Zimmerman and Schunk, 2011), fosters the students' self-efficacy in PBL (Bandura, 1997). This includes self-initiated actions to identify effective and appropriate learning strategies, as well as developing and maintaining motivation (Zimmerman and Schunk, 2011).

By working with colleagues in small groups, students develop collaborative learning skills. Group learning gives students the opportunity to share, compare and debate about the information they have found and learned (Barrows and Tamblyn, 1980) and thus to develop their clinical reasoning skills. Furthermore, the development of positive interpersonal relationships and effective teamwork fosters the development of the leadership skills that are needed to solve problems in healthcare (Huber, 2014). To understand how students, develop their collaborative learning skills in PBL sessions is important because these skills can be transferred to team work in a clinical setting.

1.2. The goal of PBL

The goal of the PBL process is to improve clinical reasoning skills through problem solving and critical thinking among students. The PBL learning process begins with the selection of problem that is considered as a stimulus for active learning (Barrows and Tamblyn, 1980). Problem-solving refers to the systematic process used to identify and analyze a situation, and to generate possible solutions in order to find the best answer and to resolve the problem (Altun, 2003). To solve the problem, students make choices based on their evaluation of the alternatives they have uncovered. They develop their critical thinking skills, a judgment based on the analysis, evaluation and inference drawn from the evidence, and also develop the ability to explain the reasoning process upon which their critical judgment is based (Alfaro-Lefevre, 2017).

Simmons (2010) defines clinical reasoning in nursing as "a complex cognitive process that uses formal and informal thinking strategies to gather and analyze patient information, evaluate the significance of this information and weigh alternative actions (p. 1155)." The process of learning clinical reasoning may be affected by factors such as learning style, culture, self-efficacy or emotional intelligence (Alfaro-Lefevre, 2017).

1.3. Studies on PBL

Studies of students' satisfaction with PBL and effectiveness of this approach as a teaching method reveal varying results (Kirschner et al., 2006). In a qualitative study, Cooke and Moyle (2002) reported that students appreciated the PBL method and found it suited to improve their critical thinking skills. On the other hand, Biley and Smith (1999) identified areas of students' dissatisfaction with the method as: 1) anxiety making the transition from a traditional curriculum; 2) perception of an unstructured program with an unclear purpose; 3) not knowing what to focus on for learning; 4) difficulty with collaborative learning; and 5) confusion about the tutor's role. It is necessary to clarify the process by which nursing students acquire the skills necessary to achieve mastery of PBL.

1.4. Systematic reviews on PBL

Review databases of the Cochrane, Campbell, BEME and JBI collaborations were examined. A systematic review encompassing the meaningfulness and appropriateness of PBL among undergraduate nursing students was not found in the literature reviewed. A positive relationship between PBL and critical thinking among nursing students was reported in two reviews of quantitative studies. (Oja, 2011; Kong et al., 2014); however, Yuan et al. (2008) did not support this positive relationship in their review. These discrepancies of results among systematic reviews may be linked to a lack of homogeneity of PBL practice in nursing education (Walker and Leary, 2009), such as the role of the tutor (Williams and Paltridge, 2017), the activities that were exercised (Yew and Goh, 2016) and the personal learning environment (Patterson et al., 2017) warranting the exploration of factors conducive to the enhancement of nursing students' experience with PBL.

1.5. Objectives

The overall goal of this qualitative systematic review was to identify and synthesize the best available evidence on the perspective of undergraduate nursing students about the elements and strategies that contribute to their success with PBL. Specific objectives were to: 1) explore attitudes, beliefs, knowledge and behaviors regarding PBL among undergraduate nursing students; and 2) explore the perception of undergraduate nursing students about the utilization of social and environmental resources for PBL.

2. Methods

2.1. Design

A meta-synthesis was performed according to the meta-aggregative methodology for qualitative systematic reviews from the Johanna Briggs Institute (JBI) (The Joanna Briggs Institute, 2014). This review of qualitative studies from the interpretative and critical paradigms included qualitative descriptive methods, phenomenology, grounded theory, ethnography, feminist theory, discourse analysis or action research. The meta-synthesis was grounded in the categories defined by the primary researchers so as to not reinterpret the data out of context. A qualitative PICo (The Joanna Briggs Institute, 2014), where P equals population, I the phenomenon under study and Co the context, defined inclusion criteria.

2.1.1. Population
Perspectives of undergraduate nursing student. Perspectives of teachers, students from other disciplines, or other levels of nursing education were excluded.

2.1.2. Intervention
PBL. Teaching methods combining PBL with another teaching strategy or integrating only some of the components of PBL were excluded.

2.2. Context

Studies of PBL in the classroom setting including: collaborative learning, role of the tutor, learning strategies, individual factors, organizational resources, and the process of PBL. Studies of PBL in the clinical setting were excluded.

2.3. Data collection

In order to capture their full scope, a search for both published and unpublished studies from inception up to August 2016 was conducted and used the keywords and subject headings presented in Table 1.

Table 1
Keywords and subject headings

Population	Phenomena of interest	Context
"Students, Nursing"[Mesh] or MW "Students, Nursing, Undergraduate " or MW "Student Attitudes"	"Problem-Based Learning"[Mesh] or MW "Problem-Based Learning"	"Schools, Nursing"[Mesh] or "Education, Nursing, Undergraduate "[Mesh] or MW "Schools, Nursing" or MW "Education, Nursing, Undergraduate "

This search strategy was used to find both published and un-published studies. A three-step search strategy was used. An initial, limited search of MEDLINE and CINAHL was followed by analysis of the words contained in the title, abstracts, and the index terms used to describe articles. A second search using all identified keywords and index terms (Table 1) was then undertaken across CINAHL, Medline, Embase, Eric, and Teacher Reference Center. Individual search strategies were developed for each database to take into account the differences in thesaurus terminology and indexing. This search was not limited in date, in order to include articles for relevance and methodological quality rather than articles based on the publication date. The literature search identified a broad range of evidence from different sources including peer-reviewed journals, conference proceedings, dissertations, and websites. The reference list of all relevant articles was searched for additional studies that were not found in the databases.

The review generated 316 published studies. Although the databases dedicated to teaching included a number of studies on PBL, none of them was conducted among nursing students. Twelve residual duplicates were identified using the Endnote reference manager and removed. The titles and abstracts of 206 articles were not relevant to the inclusion criteria or written in Asian language (4) and were excluded. The 101 remaining articles were further assessed for relevance against the inclusion and exclusion criteria after reading the full articles. Ninety-two studies were excluded because the population, intervention or setting did not match the inclusion criteria or because the methodology described was not qualitative. One study was found neither in databases, nor upon request. Thus, nine studies were included for methodological assessment.

2.4. Data assessment

Prior to inclusion in the review, the remaining nine papers were assessed by two independent reviewers for methodological validity, using the Critical Appraisal Checklist for Qualitative Research from the Joanna Briggs Institute (Lockwood et al., 2015) as presented in Table 2. Studies were included when reviewers agreed that seven out of 10 criteria were met, in order to control for methodological diversity. Any disagreements that arose between the reviewers were resolved through discussion with a third reviewer. One study did not comply with most criteria defining a qualitative methodology.

Eight studies were included as illustrated in Table 2. The

dependability of studies as assessed by their methodological congruence was good. For three studies, the philosophical perspective was only implicit. The credibility of several of the studies was weakened by the lack of statement on the cultural or theoretical location of the researchers and their possible influence on the results of the study. However, the participants' voices were represented adequately across all the included studies. Thus, the confidence in the output of the meta-synthesis, graded according to the Conqual score (Munn et al., 2014), lies between moderate and strong. The inclusion process was monitored according to the PRISMA statement (Moher et al., 2009), as presented in Fig. 1.

2.5. Data analysis

Thematic synthesis was conducted by the first author, who has expertise in qualitative data analysis, and two co-researchers. The findings or themes, matched with a verbatim illustration, from each study were pooled using the JBI SUMARI system (The Joanna Briggs Institute, 2016). The findings were then categorized on the basis of similarity in meaning. These categories were then pooled into syntheses in order to generate a single comprehensive set of statements representing that aggregation and informing practice.

3. Results

3.1. Data extraction

The data from the eight included studies was extracted with the JBI SUMARI system (The Joanna Briggs Institute, 2016). Data on the purpose of the study, methodology, participants, data collection and findings were recorded in order to guide the interpretation of the results, as presented in Table 3. Two studies were conducted in both Australia and Thailand and one study in respectively Canada, South-Africa, Turkey and the UK. The findings of this systematic review may thus be transferable to any of these cultural settings. Phenomenology was used in two studies, grounded theory and comparative case study in one study each, qualitative descriptive designs in the four other studies. Data was collected through interviews in four of the studies and by journaling or a questionnaire in two studies. Open-ended questionnaires and focus groups were used to collect data in two studies.

Table 2
Critical Appraisal Checklist for Qualitative Research (Lockwood et al., 2015)

Criteria/studies	1	2	3	4	5	6	7	8
Congruity between the stated philosophical perspective and the research methodology	Yes	U	U	Yes	Yes	Yes	Yes	U
Congruity between the research methodology and the research objectives	Yes	U	Yes	Yes	Yes	Yes	Yes	Yes
Congruity between the research methodology and the methods used to collect the data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Congruity between the research methodology and the representation and analysis of data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Congruity between the research methodology and the interpretation of results	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Statement locating the researcher culturally or theoretically	Yes	No	U	No	U	No	Yes	No
The influence of the researcher on the research, and vice-versa, is addressed	Yes	Yes	No	No	No	No	Yes	No
Participants, and their voices, are represented adequately	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Research is ethical	Yes	U	U	U	Yes	Yes	Yes	Yes
Conclusions appear to flow from the analysis or interpretation of the data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total	10	6	6	7	8	8	10	7

Notes. U = Unclear

3.2. Data synthesis

Only the findings matched with a univocal or credible verbatim were extracted from the primary studies. The 51 findings were entered, as labeled by the primary authors, in the JBI SUMARI system (The Joanna Briggs Institute, 2016). These findings were then aggregated into categories, according to similarity of meaning, by three independent researchers. Differences in choice of categorization were resolved through discussion. The five elicited categories were regrouped in two syntheses, thus completing meta-aggregation as presented in Fig. 2.

The two syntheses are worded as declamatory statements of the uncovered evidence or recommendations for faculty who plan to use PBL for teaching. They are informed by the perspectives of the students involved in the studies reviewed. Synthesis 1 refers to the perception of undergraduate nursing students about the utilization of resources for PBL and synthesis 2 to their attitudes, beliefs and behaviors regarding PBL.

3.3. Synthesis 1

Train tutors to effectively guide the teamwork of undergraduate nursing students toward the development of their clinical reasoning skills in the PBL process. Two categories inform this recommendation.

3.3.1. Category 1.1: Modeling

To help students develop their PBL related learning skills, the tutor should: 1) foster relevant and higher level questioning about the clinical scenarios among the students; 2) appropriately manage information sharing; 3) give meaningful feedback and correct misinformation; 4) foster participation of each member of the group and; 5) help students develop their learning skills. The tutor should be possessing current expertise about the clinical scenarios and who use their expertise to foster questioning among the students. Homogeneity among tutors is needed for students to experience cohesiveness in the PBL process.

3.3.2. Category 1.2: Group Interactions

It is the role of the tutor to facilitate the interactions among the members of the group and to guarantee the conditions critical to the success of PBL: 1) Group of a manageable size; 2) willingness of members to contribute to information seeking and synthesized sharing; 3) willingness to lean on each one's strength; 4) keeping focused on solving the problem at hand; 5) listening actively to each participant's contribution; and 6) taking responsibility for distributing speaking time among all the participants.

3.4. Synthesis 2

Thoroughly lead nursing students to discover how they will develop their clinical reasoning in PBL. The perspectives of students, elicited from the primary studies that inform this recommendation, were grouped in three categories.

3.4.1. Category 2.1: Learning process

To master the PBL process, nursing students need to develop several skills: 1) managing the emotional state related to any preconceptions about PBL; 2) adapting to a teaching format that, at first glance, may seem to lack structure; 3) retrieving relevant information and organizing it in a meaningful format; and 4) learning to use time management skills; 5) learning how to learn from others and collaborating with them.

3.4.2. Category 2.2: Clinical reasoning

PBL fosters clinical reasoning through increasing self-efficacy in: 1) self-learning; 2) using clinical reasoning pathways; 3) solving clinical problems; 4) transferring skills to clinical practice; 5) building knowledge as a team; and 6) developing leadership skills. PBL helps nursing students to become independent learners, motivated to seek new information by relying more on problem solving skills than on experience.

3.4.3. Category 2.3: PBL method

Focused thinking is initiated when the group is presented with a clinical case study scenario and group members divide tasks to research the topic. It is maintained as students seek and summarize the content of the scenario. Use of a case study as the clinical scenario guides the process in several ways by: 1) fostering individual and group questioning; 2) mobilizing learning resources; 3) generating knowledge; and 4) organizing how knowledge is shared. With time and experience, the process of using group learning to solve a problem becomes clearer.

4. Discussion

To inform the use of PBL among nursing educators, the two synthesized findings generated by the pooling of data extracted from the primary studies are discussed in the light of learning theories such as social-cognitive theory (Bandura) and self-learning theory (Kuiper and Pesut, 2004).
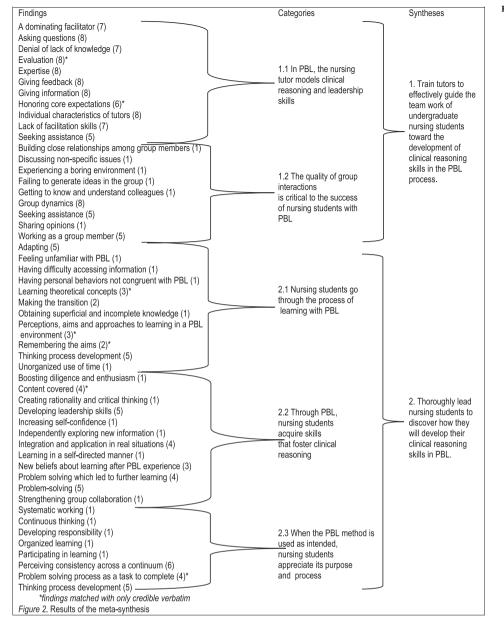
4.1. Synthesis 1

Tutors must model leadership and clinical reasoning skills to initiate vicarious learning among undergraduate nursing students (Bandura, 1997; Geitz et al., 2016). The tutor fosters problem-solving self-efficacy

Table 3
Description of studies included in the meta-synthesis

	Purpose	Method	Students	Data collection	Authors' findings
1	Perceptions of PBL (Arpanantikul & Luecha, 2010)	Phenome-nology	147 1st year (Thail.)	Open-ended questionnaire + semi-structured interviews	PBL was perceived as enhancing learning, collaborative work, problem solving, critical thinking, finding learning resources, curiosity and self-confidence. There were also perceptions that PBL failed to improve learning processes and knowledge acquisition. Engaging in collaborative learning was perceived as challenging.
2	Perceptions of a PBL based program (Biley, 1999)	Grounded theory	45 (UK)	Open-ended questionnaire + focus group	Benefits of PBL were identified. However, PBL also engendered frustration, uncertainty and fear, thus generating tension among novice students. PBL was perceived as time consuming.
3	Beliefs and approaches to learning of a high and a low achieving students (Forbes, 2000)	Compara-tive case study	2 2nd year. (Aus.)	Semi-structured interviews + journaling	The motivation for nursing and the beliefs about how nursing should be learned determined learning goals and involvement. Internal locus of control fostered satisfaction with knowledge development. Organizational and research abilities fostered the attainment of learning goals. The learning environment supported goal attainment. Students may need support when using the PBL method for the first time.
4	Variation in perceptions of learning outcomes (Forbes, 2001)	Phenome-nography	91 prereq. (Aus.)	Open-ended questionnaire	PBL focused students' attention on problem-solving, critical thinking and integration of theory in clinical practice.
5	Perspectives to inform future curriculum (Klunklin et al., 2011)	Qualitative descriptive	25 (Thail.)	Semi-structured interviews	At first, PBL engendered uncertainty and anxiety. After adapting to the learning process, students reported better problem-solving skills, systematic and creative thinking, leadership skills and recall of important content. PBL promoted students' self-directed learning and critical thinking.
6	Consistency within a PBL program (Landeen et al., 2013)	Qualitative descriptive	31 (Can.)	Focus group + semi-structured interviews	Assisting entering students to clarify their preconceptions of teaching and learning might decrease anxiety and increase satisfaction over time.
7	Students' experience (also of tutors, but not used here) (Lekalakala-Mokgele, 2010)	Qualitative descriptive	8 focus groups (South-Africa)	Focus group	Senior students preferred tutors who fostered self-directed learning. 1st year students needed more control until they understood how PBL worked. Tutors were expected to know the PBL method and facilitate the PBL experience.
8	Expectations and experiences regarding tutors (Mete and Sari, 2008)	Qualitative descriptive	21 (Turkey)	Focus group	Tutors were perceived as having a strong influence on the dynamics in the group. Students expected tutors to : 1) be fair; 2) use their knowledge of the content to ask relevant questions and connect discussions with clinical practice; 3) help determine important points to stimulate analysis and synthesis skills; 4) give feedback and correct wrong information at the end of a session and; 5) use regulation skills to foster a safe and active learning environment.

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Fig. 2. Results of the meta-synthesis

Findings	Categories	Syntheses
A dominating facilitator (7) Asking questions (8) Denial of lack of knowledge (7) Evaluation (8)* Expertise (8) Giving feedback (8) Giving information (8) Honoring core expectations (6)* Individual characteristics of tutors (8) Lack of facilitation skills (7) Seeking assistance (5)	1.1 In PBL, the nursing tutor models clinical reasoning and leadership skills	1. Train tutors to effectively guide the team work of undergraduate nursing students toward the development of clinical reasoning skills in the PBL process.
Building close relationships among group members (1) Discussing non-specific issues (1) Experiencing a boring environment (1) Failing to generate ideas in the group (1) Getting to know and understand colleagues (1) Group dynamics (8) Seeking assistance (5) Sharing opinions (1) Working as a group member (5)	1.2 The quality of group interactions is critical to the success of nursing students with PBL	
Adapting (5) Feeling unfamiliar with PBL (1) Having difficulty accessing information (1) Having personal behaviors not congruent with PBL (1) Learning theoretical concepts (3)* Making the transition (2) Obtaining superficial and incomplete knowledge (1) Perceptions, aims and approaches to learning in a PBL environment (3)* Remembering the aims (2)* Thinking process development (5) Unorganized use of time (1)	2.1 Nursing students go through the process of learning with PBL	
Boosting diligence and enthusiasm (1) Content covered (4)* Creating rationality and critical thinking (1) Developing leadership skills (5) Increasing self-confidence (1) Independently exploring new information (1) Integration and application in real situations (4) Learning in a self-directed manner (1) New beliefs about learning after PBL experience (3) Problem solving which led to further learning (4) Problem-solving (5) Strengthening group collaboration (1) Systematic working (1)	2.2 Through PBL, nursing students acquire skills that foster clinical reasoning	2. Thoroughly lead nursing students to discover how they will develop their clinical reasoning skills in PBL.
Continuous thinking (1) Developing responsibility (1) Organized learning (1) Participating in learning (1) Perceiving consistency across a continuum (6) Problem solving process as a task to complete (4)* Thinking process development (5)	2.3 When the PBL method is used as intended, nursing students appreciate its purpose and process	

findings matched with only credible verbatim

Figure 2. Results of the meta-synthesis

among the students by giving positive informative feedback on the students' learning process in a triadic reciprocal causation between the tutorial and group environment, the individual and PBL (Bandura, 1997; Demirören et al., 2016). Self-efficacy is affected by self-regulation, including self-assessment and self-motivation that may guide the reflective component of clinical reasoning (Kuiper and Pesut, 2004). Tutors should remember that PBL aims to develop both cognition about solving clinical problems and transformative meta-cognition so that students may transfer this skill to the situations they will encounter as nurses (Billings and Halstead, 2016).

According to Moust (2010), the tutor's role is to guide the students in learning both the content necessary to solve the problem and the process of PBL, as well as to regulate the group's dynamics. Tutors facilitate this process through: 1) helping group members reach an agreement regarding how the group will function; 2) fostering the collaborative learning required to solve the problem at hand; 3) demonstrating leadership skills by steering toward the goal of PBL and; 4) instilling a positive and safe learning environment that will allow the team to demonstrate a spirit of enquiry and sharing (Moust, 2010).

According to Leary et al. (2013), it is the tutor's expertise in the PBL process that positively influences the students' learning, thus warranting the need for PBL tutors to be mentored in combining content and pedagogical knowledge (McKendree, 2010).

4.2. Synthesis 2

If students understand that PBL is designed to foster their clinical reasoning skills in complex clinical situations (Barrows and Tamblyn, 1980; McGarry et al., 2011), it will add meaning to the learning process. Students should understand that taking responsibility for the self-learning fostered by PBL becomes mandatory due to the rapid obsolescence of scientific knowledge (Billings and Halstead, 2016). Developing self-learning means becoming aware of one's own learning strategies (Moust, 2010).

In PBL, self-learning is conjugated with collaborative learning, another skill necessary for efficient nursing and interdisciplinary care. For collaborative learning to increase, the PBL group should have the opportunity to solve several clinical problems together over time (Hommes et al., 2014). Students should understand that collaboration fosters learning, particularly in complex situations (Kirschner et al.,

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