ORIGINAL ARTICLE

# Using standardized patients versus video cases for representing clinical problems in problem-based learning

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**Purpose:** The quality of problem representation is critical for developing students' problem-solving abilities in problem-based learning (PBL). This study investigates preclinical students' experience with standardized patients (SPs) as a problem representation method compared to using video cases in PBL.

**Methods:** A cohort of 99 second-year preclinical students from Inje University College of Medicine (IUCM) responded to a Likert scale questionnaire on their learning experiences after they had experienced both video cases and SPs in PBL. The questionnaire consisted of 14 items with eight subcategories: problem identification, hypothesis generation, motivation, collaborative learning, reflective thinking, authenticity, patient-doctor communication, and attitude toward patients.

**Results:** The results reveal that using SPs led to the preclinical students having significantly positive experiences in boosting patient-doctor communication skills; the perceived authenticity of their clinical situations; development of proper attitudes toward patients; and motivation, reflective thinking, and collaborative learning when compared to using video cases. The SPs also provided more challenges than the video cases during problem identification and hypotheses generation.

**Conclusion:** SPs are more effective than video cases in delivering higher levels of authenticity in clinical problems for PBL. The interaction with SPs engages preclinical students in deeper thinking and discussion; growth of communication skills; development of proper attitudes toward patients; and motivation. Considering the higher cost of SPs compared with video cases, SPs could be used most advantageously during the preclinical period in the IUCM curriculum.

***Key Words:*** Standardized patients, Problem-based learning, Problem representation, Video case

## Introduction

It is apparent that problem-based learning (PBL) is one of the most widely adopted pedagogical methods around the world [1,2,3], although scholars still hold different views on the effectiveness of PBL in medical education [4]. The six characteristics of PBL described by Barrows [5]—(1) student-centered learning, (2) small group learning, (3) learning with the tutor as a facilitator or guide, (4) using authentic problems, (5) problems used as tools to achieve the required knowledge and problem-solving skills, and (6) self-directed learning—are highly aligned with the goals of contemporary medical education as well as other disciplines in professional and higher education including Business,

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Education, Nursing, the Arts, Science, and Pharmacy [6]. The quality of problem representation is critical for developing problem-solving skills [7,8]. Consequently, problem representation in PBL is essential for students to recognize clinical context and to identify patients' problems. The different methods of problem representation, which include the traditional paper cases, newspapers, clippings, audiotapes, video recordings, computer software, standardized patients (SPs), and real patients [9] may influence learning and the performance of medical reasoning in PBL differently. Unlike paper cases that represent problem situations in a written format, video cases and SPs can commonly preserve original language and nonverbal information, avoid depersonalization of the patients, and increase students' motivation to solve clinical problems [10,11,12]. Although video cases could increase authenticity in PBL, it also showed a lack of dynamic interactions, as the students tend to be passive gatherers of patients' data from video. Authors assumed SPs could overcome this shortcoming by having students actively engaged in interacting with SPs to collect patients' data. Thus, the purpose of the current study is to investigate students' learning experiences with using SPs as a problem representation method compared to using video cases in PBL.

# Subjects and methods

## 1. Research settings

Among a total of 41 medical schools in the Republic of Korea, over two-thirds of them have adopted PBL in their curriculum [1]. Inje University College of Medicine (IUCM) is one of the leading institutions that have actively advocated and implemented PBL for over a decade in the Republic of Korea. In 1996, IUCM implemented four 2-week-long PBL modules which had been adapted from the PBL model of the University of Newcastle, Australia. IUCM has expanded the PBL curriculum to comprise up to one-fifth of the entire 2-year preclinical curriculum over time. This expansion of the PBL curriculum was the first attempt among large medical schools in the Republic of Korea. IUCM has a student body of over 600 under an established traditional subject-centered curriculum for 2 years of premedical and 4 years of medical education.

In the spring semester of 2013, IUCM made a transition from video cases to SPs as the primary method of presenting clinical problems in PBL as a result of recognizing the importance of medical students' earlier exposures to authentic experiences with patients. Thus, the current study was conducted during this transition with the practical purpose of investigating students' responses to PBL using SPs.

## 2. Participants and data collection

A total of 99 second-year preclinical students at IUCM participated in this study. The 2-year preclinical curriculum of IUCM is based on an organ systems-based curriculum, in which each block begins with a 1-week PBL module followed by integrated lectures, computer-assisted case-based learning, and multiple assessments. Throughout the first year of the preclinical curriculum, the participants learned the pathophysiology of common clinical presentations, growth and aging, infection, hemato-oncology, the gastrointestinal system, the cardiovascular system, and the respiratory system. The participants also had experience with PBL using video as a problem representation method with complementary paper data about patients' laboratory results and radiologic findings during this first preclinical year. The participants were then introduced to two PBL sessions during their second preclinical year, titled the "Kidney and Urinary Tract" and the "Endocrine System and

Clinical Nutrition," which used SPs as a problem representation method. After the two SP-based PBL sessions, the participants were asked to complete a questionnaire comparing their learning experiences between SP-based PBL and video-based PBL on a 1 to 5 Likert scale, in which the 1 score meant strongly disagree and the 5 meant strongly agree.

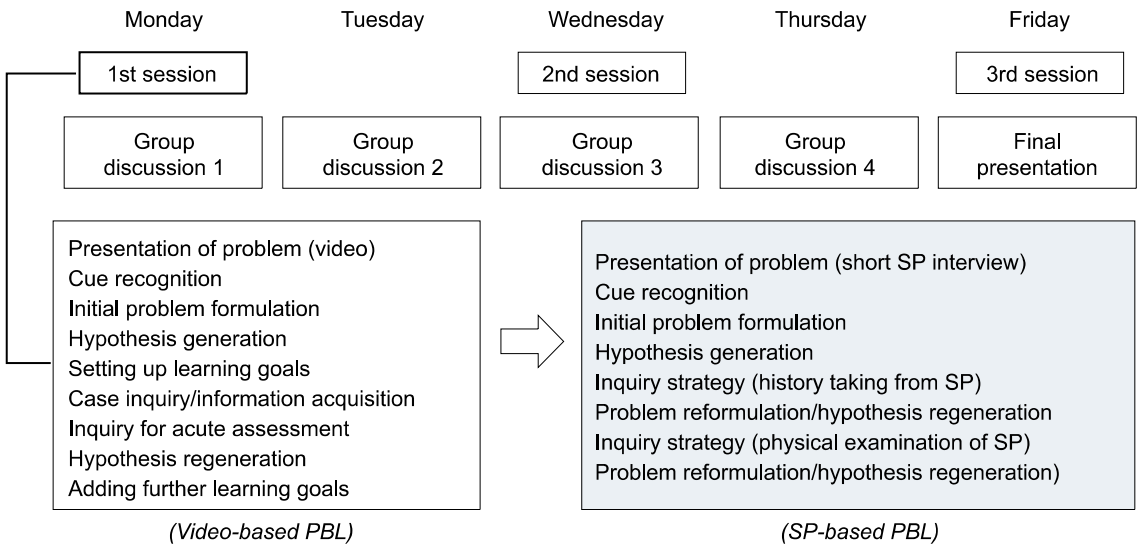
## 3. Instruments

The questionnaire consisted of 14 items which were divided into eight subcategories: problem identification, hypothesis generation, motivation, collaborative learning, reflective thinking, authenticity, patient-doctor communication, attitude toward patients (empathy & responsibility). The questionnaire is included in Appendix 1.

## 4. SP-based PBL procedure

IUCM has 19 PBL rooms equipped with a white board, a computer, a 42-inch TV monitor, a video recording system, tables for students, a tutor, and a student-SP encounter, an examination bed, and clinical examination equipment such as a sphygmomanometer. Ninety-nine students were randomly assigned into 15 small groups of 6 to 7 members. The SPs were employed from one of the Korean Standardized Patient Consortiums. During the PBL session, each small group of students interacted with a SP and heard the chief complaint from the SP for 5 minutes. Then, the students formulated problems and generated hypotheses for 50 minutes without the presence of the SP. Then for 20 minutes students interviewed the SP to take his or her medical history. Next, students discussed the case with their group for 10 minutes before they conducted a physical examination with the SP for 20 minutes. Finally, without the SP present, students were given time to reformulate problems and regenerate the hypotheses and then develop a further diagnostic plan for the case. The participants spent a week on each module (Fig. 1). As a result, it took a total of 2 weeks to complete two SP-PBL modules before they completed the survey.

Fig. 1. Weekly Schedule of the Problem-Based Learning (PBL) Module with the First Session of Video-Based PBL and the First Session of Standardized Patient-Based PBL




SP: Standardized patient.

## 5. Video-based PBL procedure

The same students had completed six sessions of video-based PBL related to growth and aging, infection, hemato-oncology, the gastrointestinal system, the cardiovascular system, and the respiratory system, before they experienced the above SP-based PBL. During the video-based PBL session, each group of students watched an initial part of the clinical video showing a patient complaining about his/her major symptom. Next, the students formulated problems and generated hypotheses for 50 minutes. Then, students watched the remaining part of the video showing a doctor interviewing a patient while taking the patient's medical history and conducting a physical examination. Finally, students were given time to reformulate problems and regenerate the hypotheses, and develop a further diagnostic plan for the case. The participants spent a week on each module in SP-based PBL.

## 6. Statistical analysis

For the statistical analysis of the collected data, paired t-tests were employed to compare the difference in the subcategories between video-based and SP-based PBL.

Table 1. The Effectiveness of Using Standardized Patients Compared with Using Video Cases in Problem-Based Learning

| Theme | Video case | SP case | Paired t (N) | p | d[a] | 95% CI for effect size | | Item | Video case | SP case |
|---|---|---|---|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | | | | Lower | Upper | | M (SD) | M (SD) |
| Problem identification | 4.10 (0.78) | 3.53 (0.88) | -4.38 (98) | 0.000 | -0.73 | -0.97 | -0.39 | I could easily recognize the clinical situation. | 3.99 (0.98) | 3.73 (1.01) |
| | | | | | | | | I could clearly identify and formulate problems. | 4.20 (0.73) | 3.30 (0.96) |
| Hypotheses generation | 3.66 (0.80) | 3.46 (0.76) | -2.05 (97) | 0.043 | -0.25 | -0.54 | 0.03 | I could systematically generate hypotheses. | 3.66 (0.80) | 3.46 (0.76) |
| Motivation | 3.01 (0.58) | 4.20 (0.61) | 13.25 (96) | 0.000 | 2.05 | 1.65 | 2.34 | This course was enjoyable and aroused my interest. | 2.77 (0.76) | 4.43 (0.77) |
| | | | | | | | | This course boosted my learning motivation. | 3.08 (0.74) | 3.93 (0.88) |
| | | | | | | | | This course increased my concentration power during the learning process. | 3.23 (0.71) | 4.15 (0.85) |
| Collaborative learning | 3.31 (0.79) | 3.65 (0.75) | 3.57 (97) | 0.001 | 0.43 | 0.15 | 0.72 | This course induced active group discussion. | 3.28 (0.88) | 3.76 (0.90) |
| | | | | | | | | I had efficient learning experiences during small group sessions with a tutor. | 3.35 (0.99) | 3.52 (0.95) |
| Reflective thinking | 3.12 (0.65) | 3.71 (0.82) | 5.23 (98) | 0.000 | 0.91 | 0.50 | 1.09 | I definitely realized my lack of learning through this course. | 3.29 (0.80) | 3.70 (1.01) |
| | | | | | | | | This course was helpful to self-reflection. | 3.11 (0.84) | 3.74 (0.90) |
| Authenticity | 2.58 (0.84) | 4.59 (0.61) | 19.70 (98) | 0.000 | 2.39 | 2.34 | 3.12 | I felt the presented case was realistic. | 2.58 (0.84) | 4.59 (0.61) |
| Patient-doctor communication | 2.01 (0.89) | 4.65 (0.61) | 24.74 (98) | 0.000 | 2.97 | 3.00 | 3.89 | I acquired the communication skills needed for developing a patient-doctor relationship. | 2.01 (0.89) | 4.65 (0.61) |
| Attitude toward patients (empathy & responsibility) | 2.70 (0.76) | 4.24 (0.73) | 14.50 (98) | 0.000 | 2.03 | 1.71 | 2.40 | I could empathize with the patient's medical problems. | 2.66 (0.77) | 4.05 (0.94) |
| | | | | | | | | I felt responsibility to care for patients. | 2.73 (0.91) | 4.42 (0.70) |

SP: Standardized patient, PBL: Problem-based learning, SD: Standard deviation, CI: Confidence interval.
[a]The effect size (d) for paired metric data was obtained based on the following: $d=(M_{SP\_Case}-M_{Video\_Case})/SD_{Video\_Case}$.

The SPSS Statistics version 21.0 program (IBM Corp., Armonk, USA) was used for this analysis.

## Results

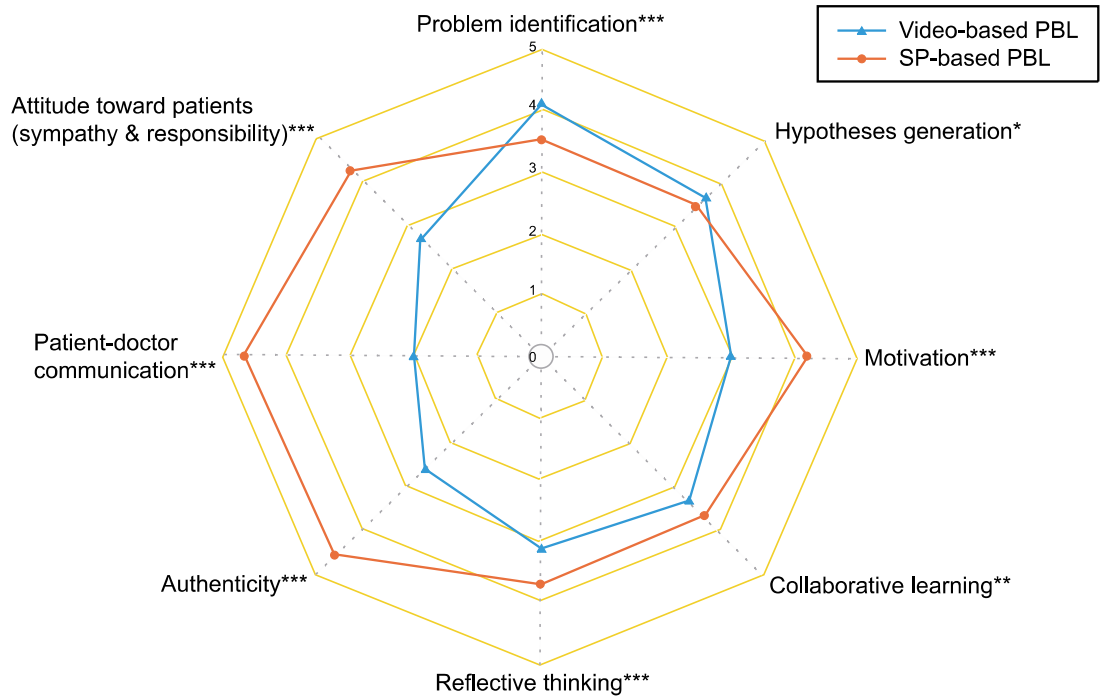
A total of 99 students' questionnaires were returned (100% response rate). The descriptive statistics for the fourteen individual items and the t-test results for the eight subcategories under which the items were classified are presented in Table 1. The results show that the participants perceived that using SPs in PBL led to significantly more positive experiences compared to using video in the following six subcategories: motivation, $t(96)=13.25$, $p<0.001$, $d=2.05$; collaborative learning, $t(97)=3.75$, $p<0.01$, $d=0.43$; reflective thinking, $t(98)=5.23$, $p<0.001$, $d=0.91$; authenticity, $t(98)=19.70$, $p<0.001$, $d=2.39$; patient-doctor communication, $t(98)= 24.74$, $p<0.001$, $d=2.97$; and attitude toward patients, $t(98)=14.50$, $p<0.001$, $d=2.05$ (Fig. 2). On the other hand, the students perceived that their tasks were easier and clearer in problem identification, $t(98)=-4.38$, $p<0.001$, $d=-0.73$ and hypotheses generation, $t(97)=-2.05$, $p<0.05$, $d=-0.25$ when they used video cases compared to when they worked with SPs.

## Discussion

### 1. Limitations of using either video cases or real patients in PBL

In order to heighten authenticity in the presentation of clinical problems, video cases and real patients are the two primary methods of instruction that have been considered. Replacing paper cases with video cases certainly improved students' data exploration, theory building, and

Fig. 2. Perceived Benefits of Using Standardized Patients versus Video Cases in Problem-Based Learning




*p<0.05, **p<0.01, ***p<0.001.

theory evaluation [10], although the passive learning experienced by watching one's history taking and physical examination on video could mislead students to superficial thinking rather than deep thinking [13].

The highest authenticity of clinical problems can be achieved by interacting with real patients, who arguably have great potential to engender authentic deep thinking in PBL [12,14]. However, arranging for real patients in PBL is a challenge, and using them may lead to ethical issues. An additional consideration is that, while untrained real patients may not be efficient for learning in a PBL setting, real patients could be essential resources for bedside teaching and observation through which students can learn history taking, physical examination, and communication skills [14].

## 2. Using SPs in PBL

Compared to real patients, SPs can be more manageable for education [15,16]. SPs would promote a smoother transition from textbook knowledge to active knowledge in clinical situations and even allow students to practice with simulated situations under difficult and sensitive medical conditions that might not be accessible otherwise. SPs can be controlled for educational purposes so that the instructor can design interactions between SPs and students to promote intended learning outcomes. The use of SPs shows advantages in learning history-taking abilities [17], clinical skills in ambulatory care settings [18], and communication skills [19].

## 3. SPs compared to case videos in students' experiences during PBL

The results of the current study reveal that using SPs in PBL is preferable to using case videos for students to gain communication skills in order to develop patient-doctor relationships, to experience the authenticity of presented cases, to cultivate a good attitude toward patients, and to increase motivation at a large effect-size level ($d>2$). The preference for using SPs over using video cases was also observed in promoting reflective thinking and in facilitating meaningful small group discussion at a small effect-size level ($d<1$). This superiority of SPs over video cases in these experiences implies that preclinical students could have a meaningful level of authentic experiences with patient-doctor interactions through SPs. Well-trained SPs could meaningfully interact with students in a way that provides first-hand experiences with patient-doctor relationships and can help to develop a proper attitude toward patients during history taking and physical examinations. These are unique advantages in SP-based PBL differentiated from that in video-based or paper-based PBL.

Increased realism in problem representation may motivate students, as Chan et al. [11] have reported that video-based PBL outperformed paper cases in increasing students' motivation to learn. Likewise, the current study shows that SPs in PBL triggers a stronger motivation to learn than video cases. In addition, the results indicate that using SPs leads students to exhibit more reflective thinking and meaningful collaborative learning than video cases.

## 4. A greater degree of clinical challenges offered by SPs compared with video cases in problem identification and hypotheses generation

PBL was originally designed for students to exercise hypothetico-deductive reasoning among different types of clinical reasoning [16]. The results of this study show that students practicing hypothetico-deductive reasoning felt more challenged by clearly identifying problems and systematically generating hypotheses during SP-based PBL compared with video-based PBL, although the actual differences were marginal based on the effect size

(d<1). Because problems presented by SPs can be true-to-life, equivocal meanings or vague expressions of SPs can be delivered through everyday language instead of medical jargon from textbooks. These challenges might play a significant role in guiding students to identify critical cues from ordinary conversation with patients, to elaborate on given problems and to generate hypotheses as an initial part of the hypothetico-deductive reasoning process, and in helping students to understand medicine in real-world contexts.

## 5. Shortcomings in using SPs

Using SPs in PBL has at least three major shortcomings [15,16]. First, it puts high demands on human resources, on finances, and on time for proper preparation and implementation. Secondly, it is difficult to maintain consistent high-quality learning experiences for students due to the complexity of compounding factors, such as SPs' experience level, SP training, tutor's experience with SPs and tutor training, and available learning resources and support. Lastly, some clinical problems are difficult to be presented by SPs, such as identifying a mass, edema, red eye, buffalo hump, pitting edema, and heart murmur.

## 6. Optimal use of SPs in a medical curriculum

Although the current study shows significant benefits in using SPs over video cases in PBL, the aforementioned shortcomings lead to an important practical question: what would be the optimal time periods for using SPs in PBL to maximize students' learning in a medical curriculum?

PBL is an effective learning strategy for improving problem-solving skills and for long-term retention of learning [20] that could be implemented for the entire duration of medical education, if the institution's goal is aligned with PBL's benefits. Likewise, the use of SPs for teaching and for the evaluation of medical knowledge and clinical skills also has a wide range of applications, such as training for history taking and physical examinations, the clinical practice examination, and the objective structured clinical examination [14,15]. Integrating SPs in PBL could empower students' experiences with PBL by making medical problems more authentic and by providing a smoother transition to a real patient. For the medical schools that have a significant PBL curriculum, such as IUCM where PBL has been implemented in one-fifth of its 2-year preclinical curriculum, we believe that the most effective time to implement SPs in PBL is during the preclinical training period prior to bedside training.

## 7. Limitations and recommendations for future research

The current study had several limitations. First, the sequence of the participants' experience was video-based PBL during their first preclinical year and SP-based PBL in their second preclinical year. This arrangement might have a temporal bias and maturation effect. In addition, different topics were used for video-based PBL (e.g., growth and aging, infection, hemato-oncology, the gastrointestinal system, the cardiovascular system, and the respiratory system) and SP-based PBL (e.g., kidney, urinary tract, endocrine system, and nutrition), respectively. Different learning contents might interact with the methods of problem representations in PBL and might lead to different learning experiences. Lastly, the results of the current study were based solely on students' self-reported learning experiences. Thus further research needs to consider employing counterbalanced experimental designs in order to control the identified potential biases and measuring students' learning outcomes beyond collecting student perceptual data.

In conclusion, our study demonstrates that using SPs

in PBL compensates for the limitations of video cases and real patients. The interactive SP-based problem representations hold more realism for clinical situations than video cases. Importantly, the higher realism in problem representations provides students with more meaningful challenges during their problem solving—problem formulation and hypotheses generation in particular. Despite the challenges of using SPs, such as high demands on resources and difficulties in the quality control of learning experiences, we conclude that using SPs is a more effective way of representing clinical problems to enhance PBL, and it is during the preclinical period that SPs in PBL can be used most advantageously in a medical curriculum.

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Appendix 1. Learning Experience Questionnaire Comparing Video-Based with Standardized Patient-Based Problem-Based Learning

| | Video-based PBL | Item | SP-based PBL |
|---|---|---|---|
| 1 | 1 - 2 - 3 - 4 - 5 | I could easily recognize the clinical situation. | 1 - 2 - 3 - 4 - 5 |
| 2 | 1 - 2 - 3 - 4 - 5 | I could clearly identify and formulate problems. | 1 - 2 - 3 - 4 - 5 |
| 3 | 1 - 2 - 3 - 4 - 5 | I could systematically generate hypotheses. | 1 - 2 - 3 - 4 - 5 |
| 4 | 1 - 2 - 3 - 4 - 5 | This course was enjoyable and aroused my interest. | 1 - 2 - 3 - 4 - 5 |
| 5 | 1 - 2 - 3 - 4 - 5 | I felt the presented case was realistic. | 1 - 2 - 3 - 4 - 5 |
| 6 | 1 - 2 - 3 - 4 - 5 | This course increased my concentration power during the learning process. | 1 - 2 - 3 - 4 - 5 |
| 7 | 1 - 2 - 3 - 4 - 5 | This course boosted my learning motivation. | 1 - 2 - 3 - 4 - 5 |
| 8 | 1 - 2 - 3 - 4 - 5 | This course induced active group discussion. | 1 - 2 - 3 - 4 - 5 |
| 9 | 1 - 2 - 3 - 4 - 5 | I definitely realized my lack of learning through this course. | 1 - 2 - 3 - 4 - 5 |
| 10 | 1 - 2 - 3 - 4 - 5 | I acquired the communication skills needed for developing a patient-doctor relationship. | 1 - 2 - 3 - 4 - 5 |
| 11 | 1 - 2 - 3 - 4 - 5 | I had efficient learning experiences during small group sessions with a tutor. | 1 - 2 - 3 - 4 - 5 |
| 12 | 1 - 2 - 3 - 4 - 5 | This course was helpful to self-reflection. | 1 - 2 - 3 - 4 - 5 |
| 13 | 1 - 2 - 3 - 4 - 5 | I could empathize with the patient's medical problems. | 1 - 2 - 3 - 4 - 5 |
| 14 | 1 - 2 - 3 - 4 - 5 | I felt responsibility to care for patients. | 1 - 2 - 3 - 4 - 5 |

The score 1 indicates strongly disagree while 5 indicates strongly agree.
PBL: Problem-based learning, SP: Standardized patient.