Effect of PBL and CBL Combined with Motic Digilab II System in Pathology Teaching of Foreign-Oriented Nursing Students

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Abstract

This study aimed to investigate the effects of PBL (Problem-based learning) and CBL (Case-based learning) combined with Motic digilab II system in pathology teaching of foreign nursing. One hundred and nine students majored in foreign nursing were included as the study subjects and were divided into two groups by random number table method, Group A received traditional teaching method in pathology teaching and Group B received PBL, CBL combined with Motic digilab II system. Compared with Group A, students in Group B scored higher on exams of tissue structure, gross pathology, and typical case ($P < 0.05$); Meanwhile, students in Group B also scored higher on cognitive maturity, inquisitiveness, critical thinking, self-confidence, systematization, analyticity, open-mindedness, and truth-seeking ($P < 0.05$); Compared with Group A, students in Group B spent more time discussing with classmates, learning via Internet, and

learning outside the classroom (P < 0.05); Compared with Group A, students in Group B scored higher in solidarity, communication, clinical thinking, and independent learning(P < 0.05). PBL and CBL combined with Motic digilab II system in pathology teaching for foreign-oriented nursing students could improve students' performance, learning initiative and, self-learning abilities and teaching satisfaction, and cultivating their critical thinking skills.

Keywords: foreign nursing; pathology teaching; PBL; CBL; Motic digilab II system; joint teaching; effect

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Introduction

According to World Health Organization, there is a global shortage of nurses, especially in the Middle East and developed regions and countries such as Europe and the United States. As members of the most highly respected health profession, nurses are in an enviable position to provide accurate and timely information to our patient populations [1, 2]. Overseas employment opportunities with good development prospects, excellent working environment and generous remuneration have attracted a large number of nursing talents in China [3]. In response to this demand, Chinese medical schools have opened foreign-related nursing majors and actively cultivated bilingual nurses who are in line with the development needs of the times and international standards [4, 5]. Students majored in foreign nursing need to master not only professional knowledge and skills after four years of study, but also need to successfully pass the national licensing examination, so as to lay a solid foundation for International Examination for Registered Nurses [6].

Nursing staffs in foreign nursing professions not only need to learn public courses such as language, moral education, English and information technology, but also need to learn professional courses including pathology [7]. Pathology is a branch of medical science primarily concerning the cause, origin and nature of disease, which is characterized by high volume of descriptions, concepts, and contents, microscopic analysis of samples. A person working in general pathology would be trained in the areas of laboratory analysis. Experimental teaching is one crucial pathology teaching strategy, which reduces difficulties in learning pathology and also plays a vital role in improving students' comprehensive literacy and training medical talents [8, 9].

The traditional teaching methods for pathology include specimens, wall charts, slides, videos and optical microscopes, etc., which could not meet the needs of modern medical education [10, 11]. In order to improve the traditional teaching mode, PBL and CBL combined with Motic digilab II system was adopted in the teaching of pathology this study, as reported below.

Materials and Methods

Data

One hundred and nine students majored in foreign nursing were included as the study population and were divided into two groups by random number table method; Group A (N=54) received

traditional teaching method and in group B (N=55), PBL, CBL combined with Motic digilab II system was adopted in pathology teaching. (1) Inclusion criteria: voluntary participation in the study; majored in foreign nursing. (2) Exclusion criteria: dropped out; unwilling to participate.

Methods

Both groups of students were taught theoretically and experimentally by the same teacher with extensive teaching experience, however, group A was taught with traditional teaching methods and group B was taught with PBL, CBL combined with Motic digilab II system. This study has been approved by the Ethics Committee of Zhengzhou Sias University. All students signed informed consent.

Group A: Students watch a 10-15min video to review the theories, then the teacher explains the key points and purpose of this pathology experiment with typical pathology sections (4-5) and large specimens (4-6) as diagnostic points. Students were divided into several groups to study the large specimens and observed the sections using light microscopy.

Group B: (1) Teaching preparation: the teacher introduces the features of teaching methods to students and divided them into 5 groups (N=11 for each group). A student with good performance was elected as the group leader; the teaching was carefully prepared by collecting relevant materials. The real case related to this experiment was introduced. Set up questions with regard to key treatment steps of this case, provide the case and the questions to the students, and ask the students to preview by consulting the materials. (2) Teaching process: The teaching process is carried out in the Motic digilab II interactive laboratory. The Motic digilab II system primarily consists of a computer software system, an image processing system, and a digital microscope system. The teacher introduces the case in advance to the students through multimedia and presents the problems that need to be solved. Capturing students' interest and getting students engaged were achieved by sharing real cases. The teacher transmits the images under his own microscope to the students through Motic digilab II interactive system, and the students can observe it via their own computer monitor. The teacher leads the students to observe the pathological sections of the case as well as the tissue structure and can use the mouse for instructions and indications. Every student can also transfer their own observed images via digital signals to the teacher's computer, and raise questions through voice. The software system includes examination software, image analysis software and interactive teaching software. Students can capture microscopic images and save them; Following demonstration, students are grouped to discuss for 20min, and then a member of each group was invited to summarize the main points respectively; Finally, the teacher summarizes and analyzes the key points and difficulties in learning, and guides them to complete the electronic lab report.

Outcome Measurement

（1）Exam scores [12]: students in both groups participate in laboratory skills exam, ranging 0-100 points, which included microscopic structure diagnosis, large specimens, and typical case analysis. The higher the score, the better the performance.

（2）Critical thinking skills scores [13, 14]: CCTDI (California Critical Thinking Disposition Questionnaire) was used to evaluate the critical thinking skills of both groups, including cognitive

maturity, inquisitiveness, critical thinking, self-confidence, systematization, analyticity, open-mindedness, and truth-seeking on a 1-6 Likert scale, with 1 indicating strong disagreement and 6 indicating full agreement, ranging from 70 to 420 scores and scores ≥280 suggesting the presence of positive critical thinking.

（3）Learning initiative: time discussing with classmates, learning via Internet, and learning outside the classroom were compared between two groups.

（4）Self-evaluation scores [15]: Two groups of students were evaluated in terms of solidarity and collaboration, communication, clinical thinking, and independent learning on a 1-5 point Likert scale, with 1 point indicating very poor and 5 points indicating very strong, with higher scores indicating higher self-evaluation.

（5）Teaching satisfaction score [16]: Students were surveyed on their satisfaction with teaching regarding whether the teaching method could enhance communication between teachers and students, improve students' practical skills, improve the ability to analyze and solve problems, expand students' thinking ability, enhance students' learning initiative and enthusiasm, and improve teamwork, ranging 0-100, with >90 indicating very satisfied, 60-90 indicating basic satisfaction, and <60 indicating dissatisfaction, and very satisfied + basic satisfaction = total satisfaction.

Statistical Methods

SPSS22.0 was used to analyze the data. Measurement data was expressed as mean±standard deviation. The *t* test was performed for data conforming to normal distribution, and the Mann-Whitney U test was performed for those not conforming; Count data [n (%)] was examined by X^2 test. $P<0.05$ suggested the existence of statistical significance.

Results

Comparison of baseline data

There was no significant difference between the two groups when comparing various baseline data such as gender, age, and entrance exam scores ($P > 0.05$) (**Table 1**).

Comparison of exam scores

Students in group B had higher scores in exams on tissue structure, gross pathology, and typical case than group A ($P < 0.05$) (**Figure 1**).

Comparison of critical thinking skills scores

Students in Group B had higher scores on cognitive maturity, inquisitiveness, critical thinking, self-confidence, systematization, analyticity, open-mindedness, and truth-seeking compared to Group A ($P < 0.05$) (**Figure 2**).

Comparison of learning initiative

Students in group B spent more time discussing with classmates, learning via Internet, and learning outside the classroom compared to group A ($P < 0.05$) (**Figure 3**).

Comparison of self-assessment scores

Students in group B scored higher in terms of solidarity, communication, clinical thinking, and independent learning skills compared to group A ($P < 0.05$) (**Figure 4**).

Comparison of student satisfaction

The teaching satisfaction rate in group B was 98.18%, higher than 62.96% in group A ($P< 0.05$) (**Table 2**).

Discussion

Competency based education is popular in Canada and the United States, which is an important institutional support and philosophy of modern education [17]. There is high shortage of nurses in international nursing labor market. China's medical schools have been set up foreign nursing specialties from the 1980s. Due to incomplete content knowledge, lack of faculty, and evaluation system, there still exists a gap between China and western countries on nursing [18, 19]. Pathology is a required course for students majored in foreign nursing and is learned through watching videos, observing pathological sections and large specimens to understand the process of pathological changes and deepen students' understanding of theoretical knowledge [20, 21]. However, this teaching model has obvious limitations. Due to limited number of specimens, coupled with space and time constraints, only twenty to thirty students could learn at the same time, which is not conducive to the understanding of the lesion [22]. Secondly, it is also difficult for students to observe pathological sections in this teaching mode; On the one hand, some students have difficulty in finding typical pathological changes even after spending a considerable amount of time. On the other hand, teachers need to constantly answer similar questions raised by students and go back and forth in the classroom during the teaching process, which not only wastes time but also reduces the learning efficiency [23, 24]. This study adopted PBL, CBL combined with Motic digilab II system in pathology teaching.

The results of this study showed that students in Group B had higher self-evaluation scores, exam scores, critical thinking skills scores, learning initiative, and teaching satisfaction than Group A ($P< 0.05$), suggesting that PBL and CBL combined with Motic digilab II system could improve students' exam scores, learning initiative and, self-learning satisfaction and teaching satisfaction, and enhance their critical thinking skills. We speculated that PBL is a teaching method in which students learn by actively engaging in real-world and personally meaningful projects, driving students' thinking through problems, guiding them to take the initiative to investigate, stimulating their interest in learning, and improving their ability to identify, analyze and solve problems. Contents of pathology are difficult to memorize, and students seldom have chance to apply theoretical knowledge to clinical practice, and the learning efficiency has yet to be further improved [25]. CBL is a case-based teaching method. Students were divided into several groups and analyzes typical cases through group discussion, which can not only fully stimulate students' learning interest and cultivate critical thinking, but also enhance their memory of knowledge and improve learning efficiency [26]. The Motic digilab II system integrates modern information technology into the traditional teaching process by organically combining teaching sessions such as demonstration, questioning, observation, and discussion, which largely optimizes pathology teaching [27]. After using this system, teachers and students can observe the slices simultaneously, which is convenient for communication and discussion; Teachers can

monitor and browse the dynamic process of slice debugging by every student, identify problems in time, and give students accurate guidance; Motic digilab II system can also synthesize colorful information and display it in various forms. Classroom teaching, teaching preparation, and correction of homework could also be done via the system. Motic digilab II interactive system can also activate the classroom atmosphere and improve students' learning initiative through sound, text and images [28]. Motic digilab II system can be used as an important platform for PBL and CBL to enhance the interactivity between teachers and students and share learning resources, which can not only maximize learning efficiency, but also fully stimulate students' learning interest and learning satisfaction.

In conclusion, PBL and CBL combined with Motic digilab II system is effective and conducive to improving students' exam performance, learning initiative and, self-learning satisfaction and teaching satisfaction as well as their critical thinking skills.

Limitations: Motic digilab II system is a little slow in presentation of the content of pathology, thus students are prone to brain fatigue and visual fatigue which needs to be improved in the future.

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Declaration of conflicting interests

The Authors declare that there is no conflict of interest.

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Table 1. Comparison of baseline data [n (%)]/($\bar{x}$ ±s)

Data		Group A (n=54)	Group B (n=55)	t/X^2	P
Gender (cases)	Male	11 (20.37)	13 (23.64)	0.169	0.681
	Female	43 (79.63)	42 (76.36)		
Age (years)		20.15±2.19	20.21±2.23	0.142	0.888
Entrance exam score (points)		89.63±2.58	89.69±2.51	0.123	0.902

Table 2. Comparison of student satisfaction [n (%)]

Group	Number of cases	Very satisfied	Basically satisfied	Dissatisfied	Total satisfaction
Group A	54	21 (38.89)	13 (24.07)	20 (37.04)	34 (62.96)
Group B	55	29 (52.73)	25 (45.45)	1 (1.82)	54 (98.18) *
X^2					21.729
P					<0.001

Note: * P < 0.05 compared to group A.

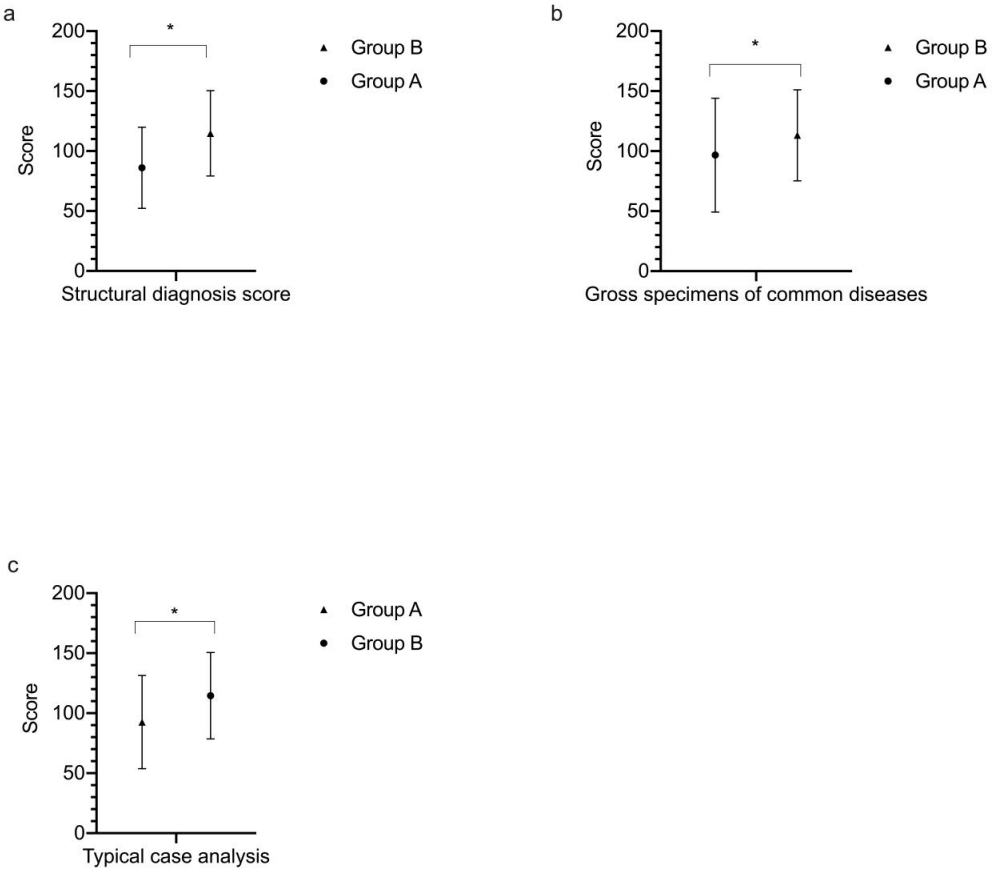

Figure 1. Comparison of exam scores between two groups. a) Tissue structure; b) gross pathology; c) typical case. * indicates comparison with group A, P< 0.05.

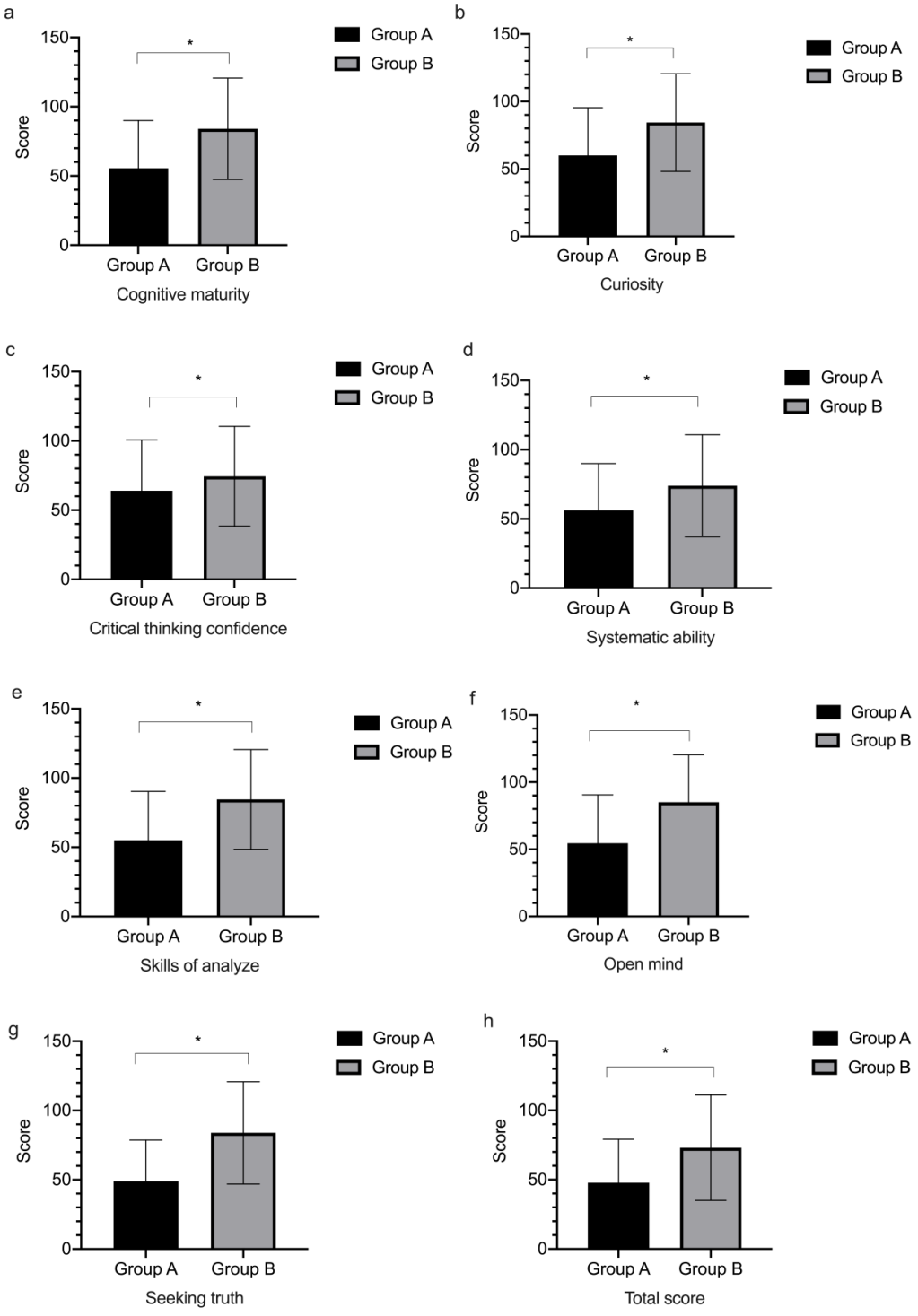

Figure 2. Comparison of critical thinking scores between two groups. a) Cognitive maturity; b) inquisitiveness; c) critical thinking self-confidence scores; d) systematization; e) analyticity; f) open-mindedness; g) truth-seeking scores; h) critical thinking skills; t indicates comparison with group A, $P< 0.05$.

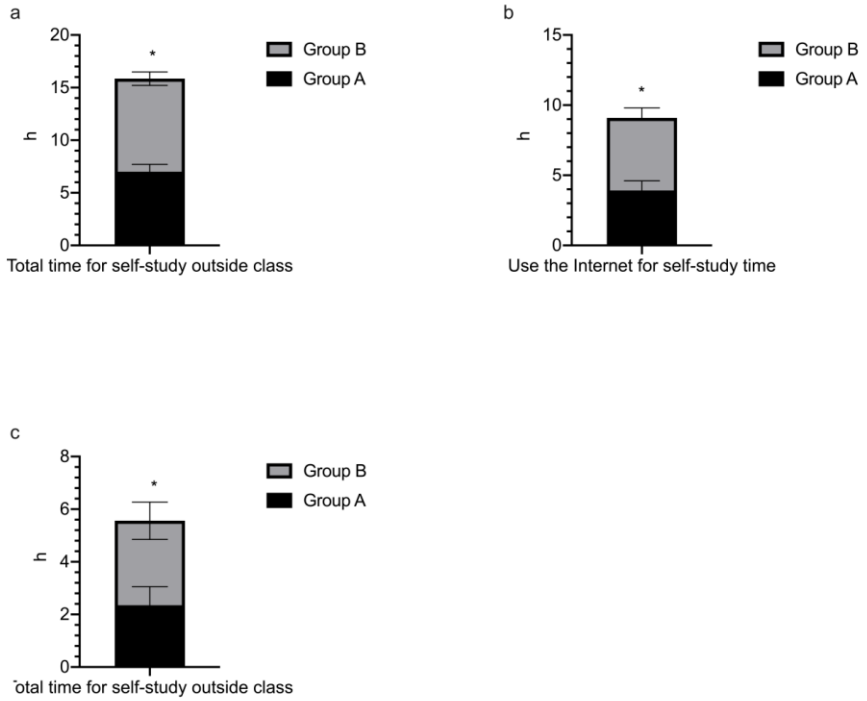

Figure 3. Comparison of learning initiative between the two groups. a) Extracurricular self-study time; b) Time for on-line self-study; c) Time spent on discussing with classmates. * indicates comparison with group A, $P < 0.05$.

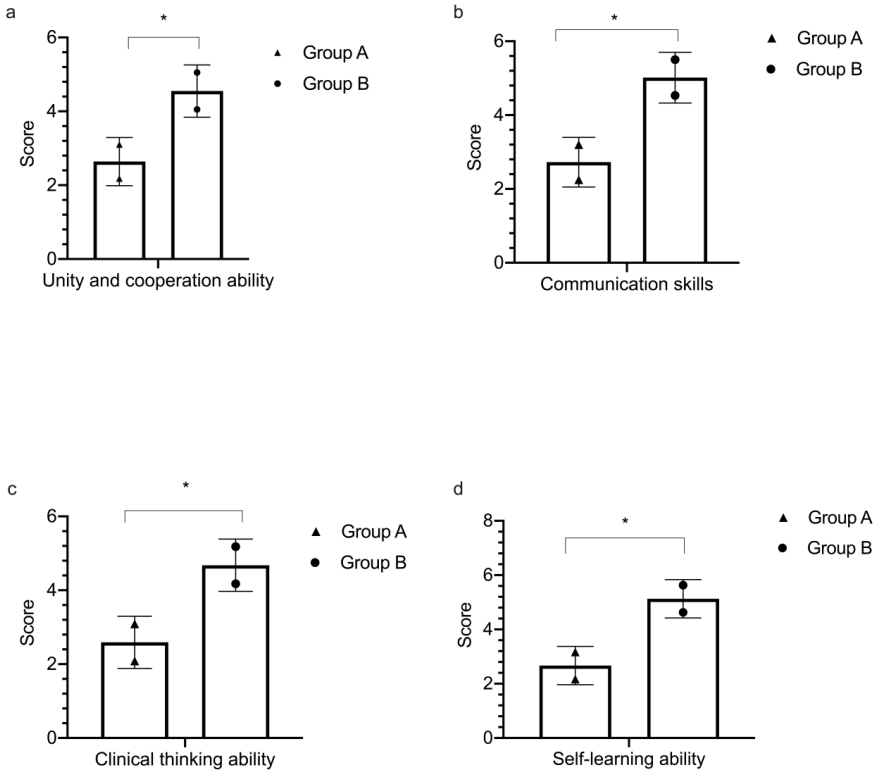

Figure 4. Comparison of self-assessment scores. a) Solidarity and collaboration; b) communication; c) clinical thinking skills; d) independent learning scores. * indicates comparison with group A, $P < 0.05$.