

# Intervention Effect of Team-Based Learning in Chinese Undergraduate Nursing Students

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## Research article

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# Abstract

**Background:** Different education systems or cultural backgrounds may influence the effectiveness of various educational approaches. Little literature explores the effects of TBL on Chinese undergraduate nursing students. **Method:** We implemented a quasi-experimental pre-/post-test quantitative and qualitative design to evaluate the intervention effect of TBL on undergraduate nursing students in eastern China. **Results:** The results showed that a significant difference was identified, as the post-test scores were higher than pre-test scores on average level of the Chinese version of Critical Thinking Disposition Inventory, the General Self-efficacy Scale and the Academic Self-efficacy Scale. Also, TBL obtained positive reflection from the students and the Teaching Supervision Team. TBL stimulated the students' learning interest and was well-accepted well by the nursing students. **Conclusion:** TBL could be widely used in undergraduate nursing education.

## Background

Current nursing teaching methodologies for classroom & clinical settings include lecture, discussion, demonstration, simulation and so on. The traditional teacher-centered classroom were prevalent in Chinese nursing education practices in the past decades (Lu & Kitt-Lewis, 2018). The most obvious advantage of the traditional teacher-centered classroom was its ability to impart knowledge to students in a limited amount of time. However, this kind of teaching made students receive information passively, which ultimately led to dissatisfactory learning outcomes and the impairment of students' capability for critical thinking and long-term knowledge retention (GC, D, LE., & AM, 2016; Vasan, DeFouw, & Holland, 2008). Currently, nursing schools around the world are shifting from teacher-centered pedagogies with individual-based education to student-centered models that feature group-based education (Keating, 2015; J. G. Ross & Bruderle, 2016). The importance of student-centered education has been emphasized in higher nursing education (Falk, Falk, & Ung, 2016). Student-centered education, such as team-based learning (TBL), flipping classrooms, and other methods are constantly being designed, innovated and explored.

TBL is one kind of student-centered education that actively emphasizes a collaborative and in-depth teaching approach via small groups. This method was designed to assist students in achieving the goals of learning and cooperation with others while working together as a team (Haidet, Kubitz, & McCormack, 2014; Hemmati Maslakkpak, Parizad, & Zareie, 2015). Developed in 1980s by Larry Michaelsen in the United States, TBL has been widely applied in higher education programs, such as nursing, medicine, pharmacy, dentistry and allied health education (Cheng, Liou, Tsai, & Chang, 2014; Haidet et al., 2014; River, Currie, Crawford, Betihavas, & Randall, 2016). TBL appears to be a strategy that confers strong pedagogical benefits for teaching applied pathophysiology (bioscience) to nursing students (Branney & Priego-Hernandez, 2018). Research has supported that TBL improves medical students' team dynamics and their perceived self-learning, problem solving and communication skills, as well as their professionalism and personal development (Zgheib, Dimassi, Bou Akl, Badr, & Sabra, 2016).

TBL also impacts teaching and learning by guiding students to take initiative in course participation via individual work, group discussions, and class discussion (Zgheib et al., 2016). TBL enables health professions educators to provide students with an authentic experience of cooperating with others to solve real-world clinical problems (River et al., 2016). TBL not only enhances student education but also benefits health outcomes and inter-professional collaborations, and it also improves faculty satisfaction and reduces faculty workload (Considine, Currey, Payne, & Williamson, 2014). TBL also has been utilized in some nursing skill courses in China (Lu & Kitt-Lewis, 2018).

Notably, different education systems or cultural backgrounds may influence the effectiveness of various educational approaches. Although a few nursing education reform focused on student-centered strategies, including TBL, which had been executed in China, operationalization of the practice has faced many challenges (Hu et al., 2018; Lu & Kitt-Lewis, 2018). Most nursing curricula were excessively disease-orientated and the theoretical and practical teaching were no longer sufficient to manage complex clinical situations. Also, little literature explores the effects of TBL on Chinese undergraduate nursing students. In this study, the learning interest, critical thinking ability and self-efficacies were surveyed by a pre-test and post-test to evaluate the effects of TBL; the surveys were designed according to specific guidelines (Parmelee & Michaelsen, 2010) regarding nursing students in eastern China.

## Methods

### 2.1 Design

The study implemented quasi-experimental pre-/post-test qualitative and quantitative design to evaluate the intervention effect of TBL on undergraduate nursing students. Following ethics approval, students signed a written report and confirm an expression of interest on TBL.

### 2.2 Participants

Two cohorts of one hundred eighty-four second-year nursing students from Yangzhou University were surveyed in the 2016-2017 and 2017-2018 academic years. All participants were enrolled in a four-year of nursing education program in the Nursing School of Yangzhou University (in Yangzhou City, Jiangsu province in the east of China). The mean ages of the two cohorts were  $20.45 \pm 0.73$  years and  $20.38 \pm 0.69$  years. Shown as Table 1.

### 2.3 TBL process

The participants were enrolled and divided into different teams in the 2016-2017 and 2017-2018 academic years. Each team was composed of 4-6 students, including a designated leader and 3-5 members. The TBL module was designed according to specific guidelines (Parmelee & Michaelsen, 2010). Briefly, the module included the following outcomes: identifying topics and forming groups; planning the learning task; carrying out the investigation; preparing the group presentation; and presenting the group project and evaluating achievement. The TBL module included common topics

related to nursing management practice, which included the following topics: outpatient and emergency room management, operating theatre management, nosocomial infections, communication and conflict, nurse's emolument, narcotic and analgesic drug management and so on. Each team had 15-30 minutes to present and 15-30 minutes to discuss the topic with other teams according to the course calendar.

## 2.5 Data Collection and Analysis

All participants of this study from the Nursing School of Yangzhou University received the pre-test and post-test online surveys. The data collection included a personal information form with three items (class and grade, age, gender), information regarding learning interest, the Chinese version of Critical Thinking Disposition Inventory (CTDI-CV) adopted from the California Critical Thinking Disposition Inventory (CCTDI) and the Self-efficacy Integrated Scale (SEIS).

CCTDI conceptualizes the constituents of a disposition for critical thinking in terms of seven traits that contribute to an individual's overall disposition toward critical thinking: truth-seeking, analyticity, open-mindedness, systematicity, self-confidence, inquisitiveness and maturity (Meici et al., 2004; NC & PA, 1994). The CTDI-CV is composed of 70 items using a 6-point Likert-type scale ranging from strongly agree (1) to strongly disagree (6). The overall CVI is 0.89, and the overall alpha is 0.90. The CTDI-CV is beneficial for assisting the nursing students in reflecting on their own critical thinking capabilities (Meici et al., 2004).

The SEIS consists of the following 3 scales: the General Self-Efficacy Scale, which contains 10 items on a 5-point Likert scale and involves five aspects, including study aptitude, talent, environmental sense, goal achievement and self-expectation (Zhang & Schwarzer, 1995); the Learning Self-Efficacy Scale, which contains 12 items to measure self-efficacy in regard to general learning ability during the learning process (Midgley et al., 2000; M. E. Ross, Blackburn, & Forbes, 2005) and the Self-Efficacy Scale for Self-Regulated Learning, which contains 9 items to measure the individual's self-efficacy for various self-regulated learning (Bandura, 1991).

The data were collected from participants using the self-reporting technique, and the identifiers removed after all variables were entered into a single database. The data analysis was performed by SPSS 22.0 software (SPSS Inc., Chicago, IL, United States). Demographic data, and inferential statistical analyses were performed by using chi-square tests, bivariate correlation analyses, independent *t*-tests and one-way ANOVA tests. In all analyses,  $P < 0.05$  was considered statistically significant.

Also, the post-test survey included 7 reflection statements (shown in Table 2) and some opening questions, such as "What is your experience of participating in the TBL?" and "Do you have any comments and suggestions to the future students who will participate in the curriculum or TBL?". Some students were asked "Is there any difficulty in the preparation process?", "How do you and your team solve the difficulties?", and so on. Teaching Supervision Team, which consisted of 7 senior educators with rich teaching experience, inspected two 45-minute lessons and offered feedback.

# Results

## 3.1 Course organization

The questions were included on the survey to evaluate the organization of the TBL modules in 2016-2017 academic year. The results showed the following: 74.2% of students agreed that the TBL approach was appropriate for the curriculum and designed TBL frequency and proportion are rational; 77.5% of participants agreed that the TBL assignments were arranged scientifically and in an executable manner; 81.8% of students agreed that the tutors were helpful in TBL and provided timely and appropriate feedback regarding the sessions; 51.5% of students agreed that the information provided during the initial induction week and in the course handbook adequately prepared them for what to expect; and 81.8% of participants agreed that TBL were more conducive to learning how to solve practical problems in clinical work. Shown in Table 2.

Also, the results about the most difficult part of TBL were Analyzing case and data (40.9%), Refining problems (30.3%), Collecting typical cases (19.7%), Organizing discussion (13.6%), Collecting data (6.1%), and Searching literature (4.5%) respectively.

## 3.2 TBL increased the level of critical thinking in undergraduate nursing students

To identify the intervention effect of the TBL practice on the level of critical thinking in nursing students, we analyzed differences in the CTDI-CV scores before and after TBL practice using One-Way ANOVA tests and *t*-tests. The results revealed a higher mean in the post-test total scores of the students in the experimental group compared with pre-test total scores ( $P=0.018$ ), especially for open-mindedness ( $P=0.014$ ) and analyticity ( $P=0.027$ ) among the seven subscales, as shown in Table 3.

Some studies have identified significant increases in disposition towards critical thinking in undergraduate nursing students based on their academic level or age (Hunter, Pitt, Croce, & Roche, 2014; Oh et al., 2011). Thus, we investigated the levels of critical thinking in nursing students of different academic years. The results also indicated that TBL modules significantly improved the critical thinking abilities of nursing students (data not shown).

## 3.3 TBL increased the self-efficacy scores of undergraduate nursing students

To identify the effect of TBL practice on the self-efficacy of nursing students, we compared the pre-test and post-test SEIS scores for different academic years of nursing students exposed to the same TBL in 2017. The results revealed that higher mean scores of the General Self-Efficacy Scale and Learning Self-Efficacy Scale were obtained by students on the post-test compared with the pre-test, as shown in Table 4. There was no difference in the scores of the self-efficacy for self-regulated learning between the pre-test and the post-test.

## 3.4 Learning interest and student satisfaction

The students were surveyed regarding their experiences after the TBL training module in 2016-2017 academic year (Figure 1). The students self-reported that 93.94% of them were very interested in the TBL modules, and 90.09% of students agreed that TBL helped them to cooperate with others. Over 80% of students believed that TBL improved their ability to discover, analyze and solve problems. Furthermore, the TBL sessions were deemed to be helpful for improving communication skills, organizational abilities and coordination and contingency capability by 60-80% students. Further, 59.1% students agreed that TBL more effectively encouraged them to search reference documents and seek new strategies. However, a few students said that their enthusiasm for participation was not as high when taking part in other teams' assignments because they did not prepare for these topics. In addition, a few students reported insufficient preparation time for TBL before the course calendar.

### **3.5 Reflection from students and Teaching Supervision Team**

The qualitative data was summarized mainly in terms of student preparation, instructional design, and lesson plan. The students had prepared and implemented the presentation elaborately. *"I like the TBL very much. It gave us an opportunity and a challenge to learn effectively. We prepared the presentation and discussed together more than 10 hours."* Also, the members of the teaching supervision team felt *"The students prepared and presented very well. The classroom atmosphere is very active."* TBL designed in the study was evaluated as a student-centered education. Members of the Teaching Supervision Team reported *"This lesson is a student-centered education and different from teacher-centered"* and *"Teachers play a guiding and regulating role in the process. It is a nice attempt of the teaching method reform"*. The students also said that *"The discussion based on a typical case was very interesting. We also liked to join other teams' discussion."* and *"Through active participation, I can show myself more bravely."* About the lesson plan, it was suggested by the Teaching Supervision Team as *"designed according to the teaching objectives"* and *"different links were compact design"*. TBL was widely recognized by the students. They admitted that *"TBL combined theory and practice, it is useful for us to put our knowledge into practice"*. The feedback from different sources also suggested that TBL was widely accepted and helpful for nursing students.

## **Discussion**

Choosing suitable teaching methods based on the characteristics of students has always been the focus of educational innovation. In the study, our aims were to evaluate the effects of TBL on nursing students in China. We found that TBL was well-accepted by the students and significantly increased their levels of critical thinking and self-efficacy.

Teams are an indispensable factor of the TBL process. In the present study, the teams were composed of 5 or 6 nursing students of different backgrounds in order to encourage multiple perspectives; this was the most suitable group size for TBL practice (LK, AB, & LD., 2004). It was shown that substantial knowledge was gained during a high level of engagement and discussion (Banfield, Fagan, & Janes, 2012). Part of the success of TBL is due to the preliminary work that students must do to make sure that they have

acquired enough knowledge in order to successfully finish the tests and take part in the applied activities (Morris, 2016). Among the student groups, TBL increases involvement and encourages students to prepare in advance, and TBL also enhances critical thinking, which is closely related to problem-solving ability and academic performance (H. R. Kim, Song, Lindquist, & Kang, 2016; Ofstad & Brunner, 2013). These skills and abilities are essential when practicing nursing in the future; therefore, it can be helpful to develop these skills early. In this study, all nursing students were satisfied with the TBL method, and 93.94% of them showed a strong interest in TBL practice. The results were consistent with findings of other studies on medical and pharmacy education and nursing students in Korea (H. R. Kim et al., 2016; Ofstad & Brunner, 2013; Sisk, 2011).

Critical thinking is characterized as higher-level thinking that involves knowledge, experiences, dispositions and intellectual abilities (Carbogim, Oliveira, & Püschel, 2016). It is a vital and effective skill for nurses in regard to planning and providing medical care to patients (Ilhan, Sukut, Akhan, & Batmaz, 2016; Kawashima & Petrini, 2004). As nurses face increasingly complex health-care situations, critical thinking can help them facilitate proper clinical decision-making and improve the quality of nursing care (Y. C. Huang, Chen, Yeh, & Chung, 2012; Rusch, Manz, Hercinger, Oertwich, & McCafferty, 2019). With better critical thinking skills, nurses are more likely to guard and enhance the welfare of individuals and society and to improve living quality (Kaya, Senyuva, & Bodur, 2017). It is of great importance to encourage nursing students to cultivate critical thinking skills, as evidence indicates that it may greatly benefit their future development (Ip et al., 2000). In this study, the average CTDI-CV score was above 280 for nursing students of different academic years, indicating that nursing students in eastern China had positive critical thinking skills. The findings were consistent with the results of medical students in China as reported by Lei Huang (L. Huang et al., 2015).

Eastern China had the fewest nursing recruits while having greater economic development and more nurses per 1000 people in the population (You, Ke, Zheng, & Wan, 2015), thus nursing education held an imbalanced distribution. Additionally, traditional teacher-centered methods prevalent in high school education before students entered nursing education programs in China did not promote critical thinking skills (Wang, 2012; You et al., 2015). To evaluate the effect of TBL on critical thinking ability of nursing students in China, we surveyed critical thinking among different levels of nursing students. The results show that nursing students' disposition for critical thinking was lower at the beginning of academic year but higher at the end, which indicated a disposition for critical thinking was enhanced over the academic years. The critical thinking skills of nursing students increased with their accumulation of knowledge and clinical experiences (L. Huang et al., 2015; D. H. Kim, Moon, Kim, Kim, & Lee, 2014). Moreover, TBL improved the scores of critical thinking of nursing students, especially on the subscale scores of analyticity and inquisitiveness.

"Self-efficacy may be defined as an individual's belief in his or her ability to succeed in a specific situation or accomplish a specific task", which is a definition based on Bandura's social cognitive theory (Bandura, 1977; Bandura, 1997, 2012; Yokoyama, 2018). From a theoretical and practical perspective, a learner with greater self-efficacy has more positive motivation, which results in higher academic achievement (CM,

2013; Yokoyama, 2018). TBL created a suitable and comfortable atmosphere to encourage listening and discussion. The learning teams were goal-oriented, and the students learned from each other by sharing their learning outcomes and encouraging each other. In the study, TBL increased general self-efficacy and learning self-efficacy of the nursing students. Taken together, TBL played an important role in developing critical thinking skills and promoting self-efficacy of nursing students.

## Conclusions

TBL significantly stimulated the learning interests and abilities of nursing students when cooperating with others, discovering problems, and analyzing and solving problems; thus, TBL was well accepted in eastern China. TBL significantly increased the level of critical thinking, general self-efficacy and learning self-efficacy of the students. TBL could be widely used in undergraduate nursing education

## Limitations

The first limitation of this study was the design without control groups. When we enrolled the participants to set as TBL groups or control groups, all students from two academic years signed up for the TBL groups. General self-efficacy may play a crucial role in the development of critical thinking of health care students. Critical thinking and learning self-efficacy have also been shown to positively correlate with academic performance; therefore, the correlation and internal relations of various factors should be considered in the future. In China, while much attention has been focused on increasing creativity and academic skills, nursing students will inevitably spend more time in training or practice. According to the students' reports, the average time they prepared for the presentation in total was approximately 2.5 hours for each team, which did not include personal independent learning time. Additionally, a proportion of students expressed a preference for face-to-face lectures (McNally, Azzopardi, Hatcher, O'Reilly, & Keedle, 2019). Thus, the applicability of TBL to all courses is subject to further exploration.

## Abbreviations

- Team-Based Learning, TBL
- Critical Thinking Disposition Inventory, CTDI-CV)
- California Critical Thinking Disposition Inventory, CCTDI
- Self-efficacy Integrated Scale, SEIS

## Declarations

- Ethics approval and consent to participate: The project was approved by the Teaching Committee of Yangzhou University, serving as an organization that conducts guidance, research, consultation, and

supervision on the teaching work of the whole university, which consists of more than 30 educators from various colleges of Yangzhou University.

- Consent to publish: Not applicable

- Availability of data and materials: The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

- Competing interests: The authors declare that they have no competing interests.

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- Authors' Contributions: LYX, HT & WSM were responsible for the study conception and design. LYX, HT, LHY, JY & YYY performed the study. LYX, LHY, YYY & QJL performed the data collection and analysis. LYX, HT & WSM were responsible for the drafting of the manuscript. LYX & HT made critical revisions to the paper for important intellectual content.

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## Tables

**Table 1.** Demographical characteristic of the Participants

Variable		2016-2017 academic year (n=66)	2017-2018 academic year (n=106)
Gender	Female	61	93
	Male	5	13
Age		20.45±0.73	20.38±0.69

**Table 2** Course organization evaluation from undergraduate nursing students (n=66)

Variable		agreed	uncertain	disagreed
1.	TBL is appropriate for the curriculum	49 74.2%	15 22.7%	2 3.0%
2.	TBL assignments were arranged scientifically and in an executable manner	51 77.3%	14 21.2%	1 1.5%
3.	TBL information provided and handbook are adequate	34 51.5%	20 30.3%	2 3.03%
4.	The tutors are helpful in TBL	54 81.8%	11 16.7%	1 1.5%
5.	TBL is more conducive to learning how to solve practical problems than regular lessons	54 81.8%	11 16.7%	1 1.5%
6.	TBL will increase confidence in copying with similar clinical conditions in the future	41 62.1%	22 33.3%	2 3.0%
7.	TBL frequency and proportion of teaching time are rational	49 74.2%	15 22.7%	2 3.0%

**Table 3.** Comparison of the mean scores of CTDI-CV between pre-test and post-test

Variable	Pre-test (n=66)	Post-test (n=66)
Total score	281.97±27.19	293.09±24.1*
Truth-seeking	36.45±7.28	37.52±6.16
Open-mindedness	40.98±5.81	43.45±5.58*
Analyticity	43.35±5.83	45.29±3.91*
Systematicity	38.23±4.33	38.98±6.58
CT self-confidence	39.86±6.33	40.64±6.08
Inquisitiveness	44.67±7.09	46.73±5.86
Maturity	38.42±7.79	40.48±5.92*

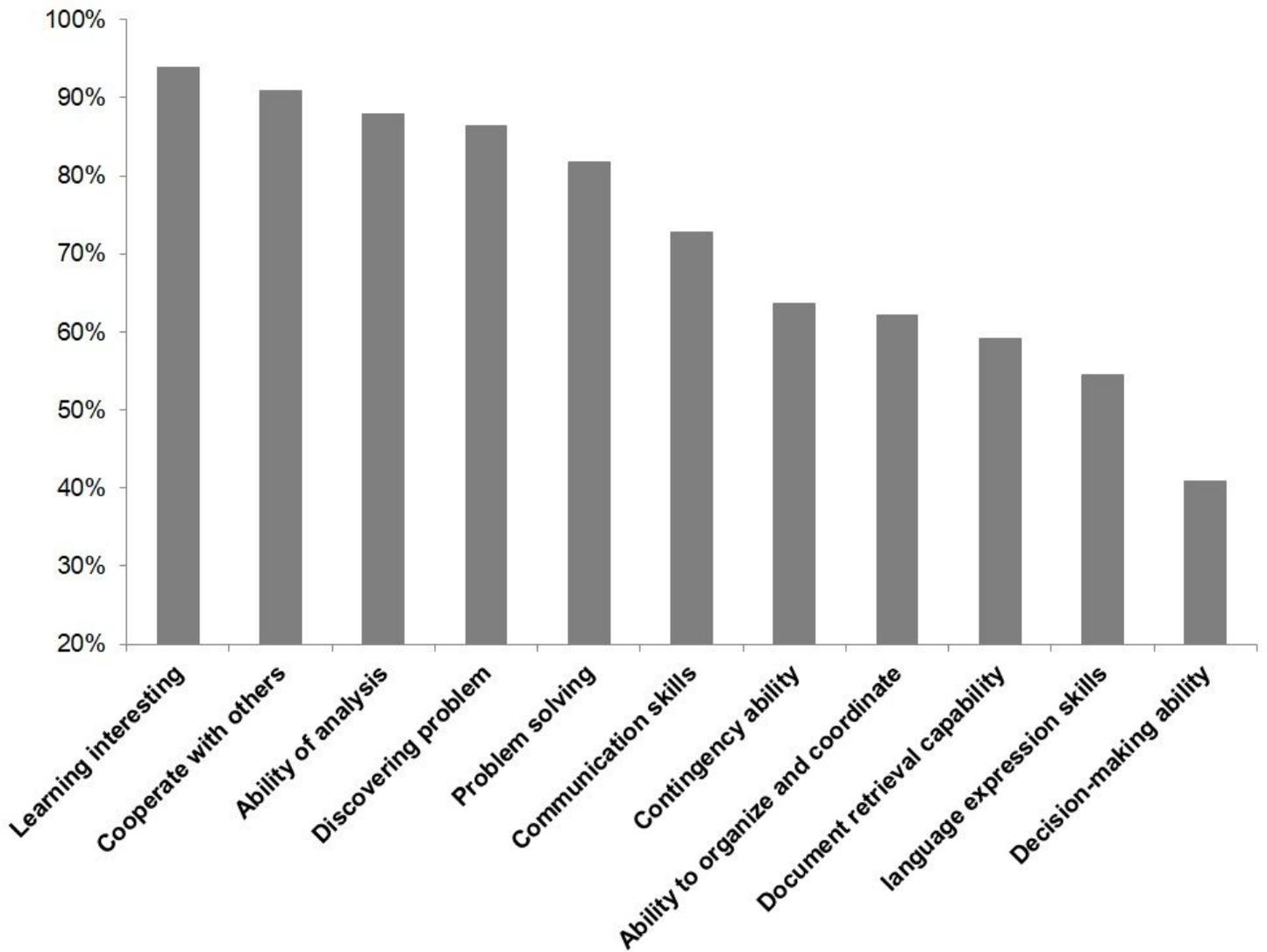
One-Way ANOVA tests and t-test for differences of means. \*The mean difference is significant at the 0.05 level.

**Table 4** Comparison of the mean scores of self-efficacies between pre-test and post-test

Variable	Pre-test (n=103)	Post-test (n=109)
General self-efficacy	3.373±0.494	3.573±0.494**
Academic self-efficacy	3.492±0.586	3.771±0.515***
Self-efficacy for Self-regulated learning	3.492±0.586	3.573±0.493

One-Way ANOVA tests and t-test for differences of means. \*\*The mean difference is significant at the 0.05 level. \*\*\* The mean difference is significant at the 0.001 level.

## Figures



**Figure 1**

Learning interest and student satisfaction. Students were surveyed regarding their experience after undergoing the TBL training module (Figure 1). TBL helped students to cooperate with others, enhanced their communication skills, and improved their ability to discover, analyze and solve problems.