

# **The Effectiveness of Team-Based Learning for Undergraduate Education in China: A Systematic Review**

**Lu Yuxin**  
**Infrastructure University Kuala Lumpur**

**Charanjit Kaur Swaran Singh**  
**Universiti Pendidikan Sultan Idris**  
**Infrastructure University Kuala Lumpur**

*Team-based learning (TBL) teaching models are a student-centered teaching model widely used in Europe and the United States but are just beginning to be used in China. This research conducted a synthesis of previous scientific studies on the use of the TBL teaching model in Chinese undergraduate education to explore the impact of two main objectives: the TBL teaching model on Chinese undergraduate students' achievement and sustainability skills and using systematic Evaluation and Meta-Analysis (PRISMA) method to searched and screened 30 articles using China National Knowledge Infrastructure (CNKI) and google scholar, which was published from 2013 to 2023. The results of this study show that TBL teaching model is effective in improving Chinese undergraduate students' achievement, problem-solving skills and teamwork skills. Therefore, TBL teaching model can be implemented in Chinese undergraduate education. Still, the use of TBL teaching model is narrow due to its late start in China. More rigorous methodology and mixed-methods design of the study are needed to improve the transferability of the results.*

*Keywords: team-based learning teaching model, achievement, problem-solving skill, teamwork skill, Chinese undergraduate*

## **INTRODUCTION**

Nowadays, the lecture-based learning (LBL) teaching model is widely adopted in Chinese undergraduate education. However, with the development of society, the LBL teaching model, as a teacher-centered teaching model that emphasizes knowledge learning and ignores skill development, can no longer meet the requirements of students' overall development. In 2005, the Chinese Ministry of Education issued a public announcement requiring the improvement of teaching models and focusing on developing students' abilities (Ministry of Education, 2005). Team-based learning (TBL) teaching model as an increasingly popular student-centered teaching model worldwide, has a large teacher-student ratio and is well suited to the lack of teachers in Chinese education.

Michaelsen LK, an American educator, formally proposed the TBL teaching model. The TBL teaching model emphasizes pre-course and in-course learning, with students as the center and clear learning objectives, which to a certain extent, makes up for the shortcomings of the traditional LBL teaching model (Wang et al., 2022). This teaching model pays attention to group work and has six steps. First, Pre-work:

Students are divided into groups of 4 to 6 to study under teachers' guidance. The TBL teaching model requires students to be well prepared in advance with the materials provided by their faculty (de Carvalho et al., 2020). The second step is the Individual Readiness Assurance Test (IRAT): To ensure the effectiveness of pre-study, students are required to answer a short quiz beginning of the class to show their readiness for the materials provided; this short quiz is commonly referred to as Individual Readiness Assurance Test. Third, TRAT: After the IRAT, students will begin the Team Readiness Assurance Test (TRAT). TRAT consists of the same set of questions as the IRAT. However, the main difference is that students take the test in teams this time. Students get to discuss with their peers what they think the correct answer is and must answer each multiple-choice question until they get an answer that all group members agree on. Different perspectives in problem-solving discussions can positively impact learning and performance (Lu, 2021). When group members bring many different perspectives to a task, the collaborative knowledge-building that occurs in their pursuit of consensus is powerful, and students can develop valuable soft skills, such as teamwork or communication skills, as a result of the discussion. Fourth, Instructor feedback: After students finish the TRAT, the teacher will explain the questions based on student feedback (Michealsen & Sweet, 2008). After that, the teacher will then give the students some cases related to the lesson and the students and their team members will solve these cases based on their existing knowledge. This step is designed to mimic scenarios that may arise in the student's future jobs and to improve their problem-solving skills. Sixth, Peer Evaluation: Students will score each other, and the instructor will calculate the grade or adjust the group members based on these groupings, ensuring that groups have the opportunity to develop as learning teams (Rossien et al., 2022). The TBL teaching model can motivate students to learn actively, improve their ability to analyze, and solve problems, and develop their self-learning and lifelong learning abilities.

Constructivist theory suggests that personal understanding of the meaning of knowledge is limited and incomplete and that collaboration and conversation are important parts of constructing complete meaning. On the one hand, the idea-sharing activity enables learners to demonstrate their learning and provides an excellent opportunity for teachers to identify misconceptions and myths promptly. On the other hand, it stimulates learners to examine the authenticity of the information and promotes the development of thinking in an iterative cycle of 'sharing-questioning-negotiating-correcting' (Shen et al., 2021). These two perspectives share the main thrust of the TBL teaching model. The TBL teaching model are now widely used in medical education. The studies by Daou, Nelson, and Ainsworth et al. (Daou et al., 2022) (Nelson et al., 2020) (Ainsworth,2021) show that the TBL teaching model can improve students' achievement and soft skills. China's research on the TBL teaching model started relatively late. In 2009, Wang Tinghuai of Sun Yat-sen University introduced the TBL teaching model into the medical field in China and then the model was adopted in many medical schools in China. Since then, the TBL teaching mode has attracted the attention of many universities. For example, the Second Clinical Medical College of Three Gorges University, the Medical College of Sun Yat-sen University, Nanjing Medical University, the Medical College of Lanzhou University, and Tianjin Medical University have started using the TBL teaching model. However, at present, there are only 1,599 articles for the search keyword "TBL", and the TBL teaching model is still in the exploratory stage in Chinese higher education, no published systematic reviews or guidelines exist for the development and use of TBL in Chinese undergraduate education. This review aims to explore the effectiveness of TBL teaching model use in Chinese undergraduate education.

## **PURPOSE AND OBJECTIVE**

This study reviewed several studies on TBL teaching model in undergraduate education. The objectives of this research were as follows:

- (1) Is the use of TBL teaching model in Chinese undergraduate education effective in promoting the achievement of students?
- (2) What skills can be promoted by using TBL teaching model in Chinese undergraduate education?

## RESEARCH METHODOLOGY

Although many studies have been published on the use of the TBL teaching model in Chinese higher education over the past decade, particularly in areas related to medical education, there has not been a systematic synthesis of the literature on the TBL teaching model. Therefore, the purpose of this paper is to identify and evaluate the existing literature on the TBL teaching model and use it to conclude the effectiveness of the TBL teaching model for undergraduate education in China. The systematic evaluation program followed the Preferred Reporting Items for Systematic Evaluation and Meta-Analysis (PRISMA) 2020 statement (Page et al., 2021). The preparation of articles using the PRISMA methodology has three stages: identification, screening and inclusion.

20 July 2023, the researchers employed Google Scholar and China's largest database, China National Knowledge Infrastructure (CNKI), to identify the literature in the first stage of the identification stage, covering the period from 2013 to 2023. This study searched using keywords from the paper title, abstract, and keywords. "Team-based learning" and "higher education" were the search terms. Chinese and English were the only two languages available for the items that could be retrieved, and the period covered 2013 to 2023.

The second stage is screening, and it has two parts. Firstly, the inclusion and exclusion criteria of the literature were identified, which were:

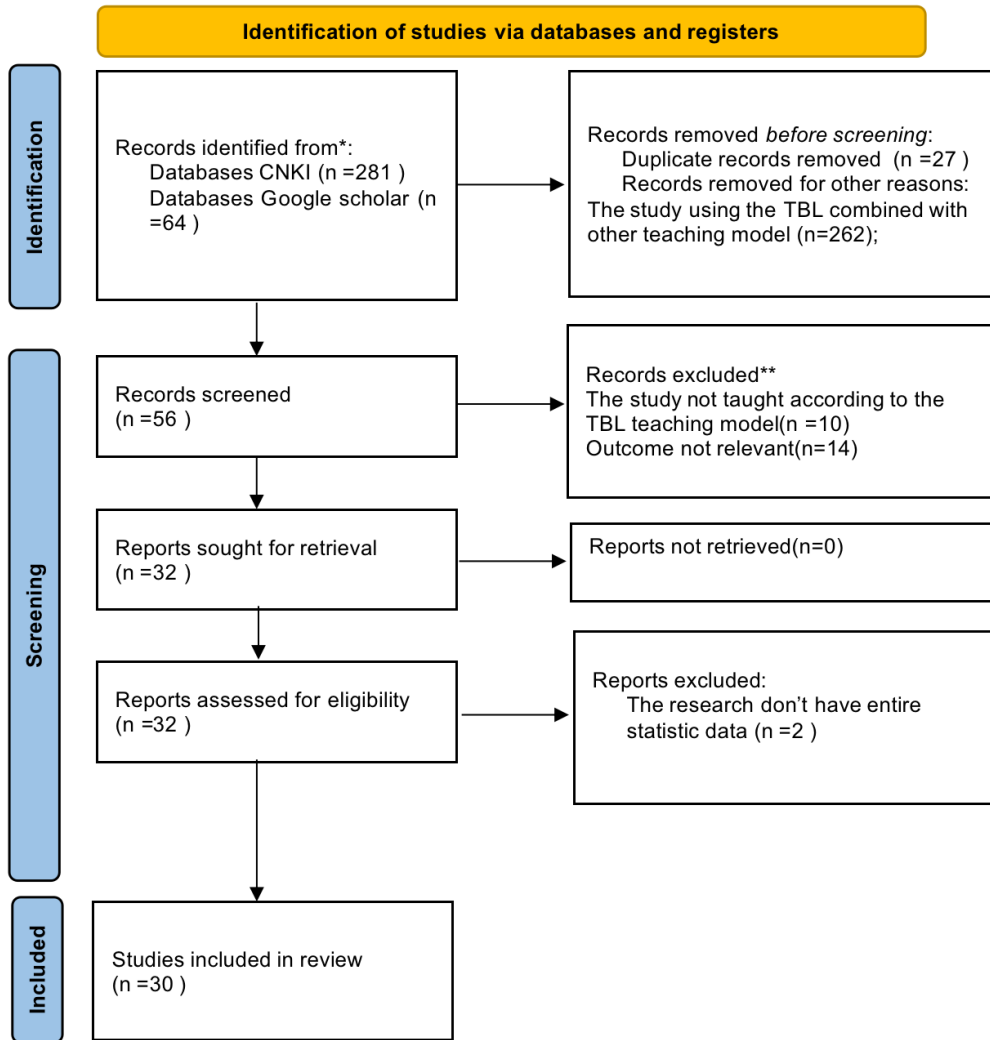
Inclusion Criteria: (1) The population was undergraduate students in China (2) Indicators for evaluating teaching effectiveness were complete measures, including grounded theory scores (3) Considering that other pedagogies may have an impact on the results, the selected studies had to be rigorously designed for TBL activities in a way that the studies followed Michaelsen and Sweet's (2008) 4S principle structure. (5) Studies in which TBL teaching model was used as a variable to assess the effectiveness of students' achievement and transferable skills (critical thinking or problem-solving skills, collaboration skills, etc.).

Exclusion Criteria: (1) Application of other teaching models that may have influenced the study results. (2) The population was doctoral, master's degree students or international students (3) No measurement data or don't have entire full-data (4) TBL activities were not designed strictly by the 4S principle structure of Michaelsen and Sweet (2008) or the process of the activities was not clear. (5) The effectiveness of the TBL teaching model on students' achievement and generic competencies (critical thinking or problem-solving, collaboration, etc.) was not assessed.

All articles that passed the first screening step were checked to see if they still fit the requirements during the second screening stage. At this stage, the articles' title and abstract will be analyzed for suitability. Two themes were identified in this study: the effects of TBL teaching model on Chinese undergraduate students' achievement and transferable skills. Eligible outcomes were broadly categorized as follows: the study of changes in students' achievement before and after the use of the TBL teaching model; changes in students' achievement when comparing the use of TBL teaching model with another teaching model; changes in students' generic competencies before and after the use of TBL teaching model; changes in students' generic competencies after comparing the use of the TBL teaching model with other pedagogy. lastly, confirmation of the article's compliance by reading the full article. This study collected data on the following areas: author, year, and source of publication, time of intervention, method of intervention, method of measuring student achievement, and method of measuring student transferable skills.

This review used the systematic Evaluation and Meta-Analysis (PRISMA) guidelines to locate as many pertinent studies as feasible. In order to assure the rigour and calibre of the papers included in our assessment, the researchers decided to restrict our search to two databases known for their quality and contributions to research, while the researchers increased our search terms. Most of the studies were within the scope of the medical study even though researchers emphasized the quality of the chosen articles. This is because the research population is undergraduate students in China, so all of the publications the researcher chose were published in China and the TBL teaching model there only recently become popular in China, and most of TBL teaching model used in medical education.

**FIGURE 1**  
**THE WORK FLOW OF IDENTIFICATION OF STUDENT VIA DATABASES AND REGISTERS**



**FINDINGS**

Based on the research methodology, 30 papers were finally selected for analysis as summarized in Table 1.

**TABLE 1**  
**SUMMARY OF SELECTED LITERATURE**

Titles	Authors	Published years	DOI
Research and Practice of Team-Based Learning (TBL) Model in Organizational Behavior Courses	Du YaNa	2023	DOI:10.3969/j.issn.1003-0166.2023.02.010
Observation of the effect of applying team-based teaching model (TBL) in clinical teaching in hospitals	Zeng YouQiang	2020	DOI:10.3969/j.issn.2095-9559.2022.03.76
Application of the TBL teaching method in the standardized training of dental general practice residents	Xie Xiao; Lv Jing et al.	2023	DOI:10.19748/j.cn.kqxf.1009-3761.2023.1.009
Exploration of the TBL teaching model applied to an integrated urology course	Qiu Hongyu; Zhao Shengmei et al.	2022	DOI:10.3969/j.issn.1674-9308.2022.07.012
The application of TBL pedagogy in the training of resident faculty for teaching room study competency enhancement	Yin Yin Zhang; Yu Lai et al.	2022	DOI:10.3969/j.issn.1674-9308.2022.17.023
Application of TBL teaching method in teaching otorhinolaryngology head and neck surgery checkup and feedback from teachers and students	Hu Juan; Wang Lijun et al.	2022	DOI:10.3969/j.issn.1674-9308.2022.19.024
A study of the teaching effectiveness of TBL methodology applied to pediatric interns' mini-lecture classes	Li JiangHong; Zhang Airun et al.	2022	DOI:10.3969/j.issn.1004-6763.2022.08.008
Application of TBL method in teaching analytical chemistry course in pharmacy program	Sun Na; Yin HongYan et al.	2022	DOI:CNKI:SUN:WGTX.0.2022-10-042.
Effectiveness of TBL teaching model in pharmacology labs	Xia Hong; Ding WenWen et al.	2022	DOI:10.3969/j.issn.1008-4118.2022.03.026
The Effectiveness of TBL Teaching Method in Teaching College Tennis Elective Courses	Xie Weifan; Li ZhenPeng et al.	2022	DOI:10.19379/j. cnki. Issn.1005-0256.2022.05.051
Practical exploration of using TBL teaching mode in the course of "Pathophysiology".	Yu Xiangyuan; Li ZhiHua et al.	2022	DOI:CNKI:SUN:GGJY.0.2022-06-018.
Systematic evaluation of the impact of TBL teaching method on learning outcomes in preventive medicine.	Xiang JunZhi et al.	2017	DOI:CNKI:SUN:XDYF.0.2017-03-046.

Comparative study of TBL teaching method in undergraduate neurology practicum teaching.	Lei Jing et al.	2016	DOI:CNKI:SUN:JXUY.0.2016-03-016.
Application of team-based learning combined with scenario simulation teaching method in clinical biochemical testing teaching	Zhou Lin et al.	2019	DOI:CNKI:SUN:JYYL.0.2019-10-042.
Application of TBL teaching method in medical psychology teaching	Sun XiuLing	2017	DOI:CNKI:SUN:GJTA.0.2017-S1-032.
Analysis of TBL teaching mode reform in obstetrics and gynecology	Liu HaiYan et al.	2017	DOI:CNKI:SUN:JXUY.0.2017-01-006.
Application of TBL teaching mode in respiratory internal medicine clinical internship teaching	Huang PanWen et al.	2019	DOI:CNKI:SUN:JXUY.0.2019-25-006
Meta-analysis of the impact of team-based teaching mode on medical students' learning outcomes	Song Jing et al.	2013	DOI:CNKI:SUN:ZOGU.0.2013-10-036
Comparison of TBL teaching method and traditional teaching method in pathology experimental teaching in local colleges	Li DaoKun et al.	2013	DOI:CNKI:SUN:JXUY.0.2013-02-030
Application of TBL teaching model in medical immunology experimental teaching	Shan Ying& Zhang Pei	2015	DOI:10.13754/j.issn2095-1450.2015.02.14
Application of TBL teaching method in rehabilitation specialty students' practicum teaching.	Zhou JianYun & Sun Wei	2018	DOI:CNKI:SUN:JYJY.0.2018-01-022
Application and effect evaluation of TBL teaching mode in pediatric dentistry teaching	Huang YongLi et al.	2013	DOI:CNKI:SUN:ZOGU.0.2013-07-062
Evaluation of TBL teaching method in cultivating medical students' clinical thinking ability	Meng Shan et al.	2015	DOI:CNKI:SUN:XYWS.0.2015-24-062
Application and effect of TBL teaching model in physiology course	Xu JingTing et al.	2013	DOI:CNKI:SUN:GYJX.0.2013-03-011
Preliminary application and student awareness survey of TBL teaching method in theoretical teaching of oral rehabilitation	Zhou HongBo et al.	2017	DOI:10.13566/j.cnki.cmet.cn61-1317/g4.201701026
Research and practice of clinical teaching reform based on TBL	Zhou Qing et al.	2017	DOI:10.13566/j.cnki.cmet.cn61-1317/g4.201706026

Application of TBL teaching method in physiology experimental teaching	Shang Lizhi et al.	2015	DOI:CNKI:SUN:ZDYS.0.2015-02-050
Application of TBL teaching method in undergraduate geriatric nursing education	Yang Jing et al.	2016	DOI:CNKI:SUN: SXHZ.0.2016-32-015
Application of TBL teaching method in theoretical obstetrics and gynecology teaching	Liu Jun & Zhang Jun Yu	2013	DOI:CNKI:SUN:ZGBN.0.2013-12-029
Application of TBL teaching model in medical functional experiment teaching	Zhang Haitao et al.	2014	DOI:10.13754/j.issn2095-1450.2014.04.11

A total of 30 papers were included in the study, all of which used at least qualitative methods, and 29 of which employed qualitative measures and the use of self-report instruments. Each study's sample size ranged from a minimum of 18 to a maximum of 237 students. In all of the included studies, the subjects were Chinese undergraduate students, most of the subjects involved were in medical education, and only one applied TBL teaching model to an economics course (Du, 2023), 1 applied to Physical Education (Xie et al., 2022), which may be related to the fact that TBL teaching model is widely used in medical education in Europe and the United States. Among the included studies, TBL was implemented for varying lengths of time, ranging from a single session to a course that lasted an entire semester, up to a maximum of 6 months. According to the principles of literature selection, the TBL instructional model for all courses strictly followed the conceptual model of team-based learning (Michaelsen and Sweet, 2008). In 28 studies, learning outcomes were assessed based on academic performance (standard test or I-RAT or T-RAT results). 25 studies found significant results favoring TBL in terms of test scores(Zeng, 2022)(Xie et al., 2023)(Zhang et al., 2022)(Hu et al., 2022)(Li et al., 2022)(Sun et al., 2022)(Xia et al., 2022)(Xie et al., 2022)(Yu et al., 2022)(Zhang et al., 2014)(Liu&Zhang,2013)(Shang et al., 2015)(Zhou et al., 2017)(Zhou et al., 2017)(Meng et al., 2015)(Huang et al., 2013)(Zhou&Sun,2018)(Shan&Zhang, 2015)(Li et al., 2013)(Huang et al., 2019)(Liu et al., 2017)(Sun,2017)(Zhou et al.,2019)(Lei et al., 2016)(Xiang et al., 2017). The 23 studies used a control group and compared test scores between using the TBL teaching model and a group that used the LBL teaching model. 21 studies showed significantly higher test scores after implementing the TBL teaching model(Zeng, 2022)(Zhang et al., 2022)(Hu et al., 2022)(Sun et al., 2022)(Xia et al., 2022)(Xie et al., 2022)(Yu et al., 2022)(Zhang et al., 2014)(Liu&Zhang,2013)(Shang et al., 2015)(Zhou et al., 2017)(Meng et al., 2015)(Zhou&Sun,2018)(Shan&Zhang, 2015)(Li et al., 2013)(Huang et al., 2019)(Liu et al., 2017)(Sun,2017)(Zhou et al.,2019)(Lei et al., 2016)(Xiang et al., 2017). Still, in one study it was shown that although students in the TBL group scored significantly higher than the students in the LBL group on a test one week after the implementation of the TBL and LBL teaching model in different groups, on the immediate after-school assessment, the TBL group scored higher than the LBL group on the but there was no statistically significant difference between the two groups on the variables, which implies that the TBL teaching model have no effective on students' achievement. (Qiu et al., 2022). Another study showed that although the final grades of students in the TBL group were slightly higher than those of the control group, there was no significant difference (Yang et al., 2016). After analysing seven articles using meta-analysis, Song Jing found that the theoretical knowledge assessment scores of the TBL group were slightly higher than those of the traditional teaching group. Still, the difference was not statistically significant (Song et al., 2013) In 3 quasi-experiment without a control group, it was found that scores on the tRAN were significantly higher than on the IRAN (Li et al., 2022)(Zhou et al., 2017)(Huang et al., 2013). In addition to comparing the TBL teaching model with the traditional LBL teaching model, there was also a study that examined comparing the TBL and problem-based learning teaching models, which showed that the test scores were significantly higher after the implementation of the TBL teaching model compared to the group that received the problem-based learning teaching models (Xie et al., 2023).

In addition to students' academic achievement, 14 studies assessed the impact of the TBL teaching model on generic competencies, and they found the TBL teaching model can enhance students' problem-solving and teamwork skills. Of these, 3 papers tested students' problem-solving skills using questionnaires, which showed that students using the TBL teaching model scored higher than before using the TBL teaching model at the end of the intervention on both student self-assessment and questionnaire scores and scored higher than students using the LBL teaching model, indicating a significant improvement in students' problem-solving skills (Du, 2023)(Yu et al., 2022)(Yang et al., 2016). Five studies assessed students' problem-solving skills based on the percentage of scores on objective questions (Qiu et al., 2022)(Sun et al., 2022)(Xie et al., 2022)(Meng et al., 2015)(Sun, 2017). The studies showed that in the exams after using the TBL teaching model, there was no difference between students' objective questions and those before using the TBL teaching model, but subjective question scores were increased and statistically different, suggesting that the TBL teaching model improves students' problem-solving skills. There were six studies on students' teamwork ability, using the method of student self-assessment. The results showed that students generally believed that their teamwork ability improved after using the TBL teaching model, which may be related to the fact that students need to engage in group discussions during the learning process (Du, 2023)(Hu et al., 2022)(Zhang et al., 2014)(Meng et al., 2015)(Sun, 2017)(Zhou et al., 2019).

## DISCUSSION

The TBL teaching model is an emerging teaching model, many studies to date have examined the effectiveness of the TBL teaching model compared to traditional teaching models, but the results have been inconclusive or inconsistent. Therefore, this article from 30 separate studies was analyzed to comprehensively assess the effectiveness of the TBL teaching model in Chinese undergraduate education. Although there was a high degree of heterogeneity in the included studies, most showed that undergraduate students after using the TBL teaching model had better knowledge and skill scores than those using the LBL teaching model.

### **The Impact of TBL Teaching Model on Chinese Undergraduate Students' Academic Performance**

Of all the 30 included studies, assessing the effectiveness of the TBL teaching model in terms of academic achievement was the most popular among researchers. Ninety per cent of the included studies compared TBL to the traditional LBL teaching model to validate the impact of TBL on student academic achievement by comparing the changes in student performance on standardized exams after implementing the different teaching models. The vast majority of the studies tested and compared students' academic performance immediately after using the TBL teaching model, and only one research compared students' performance at the end of the lesson and one week after the lesson after using the LBL and TBL teaching model, respectively. The results of the study showed that in the period after the teaching intervention, with the passage of time and the natural decay of memory, the LBL group's performance showed a trend of decline with a more obvious magnitude, while the TBL group's performance declined more gently, decayed more slowly, and even remained basically stable, indicating that the TBL teaching model produced the delayed and after-effects of the teaching effect (Qiu et al., 2022). 10% of the articles compared student iRAT and TRAT scores to confirm the effectiveness of the TBL teaching model in students' performance; regardless of the method of comparison, the researchers found significant results in favor of the TBL teaching model in terms of test scores. From the results of the included studies, TBL appeared to be useful for Chinese undergraduate education; however, when the researchers compared student iRAT and TRAT scores, each found higher gRAT scores. This consistent finding was expected because, in the TRAT portion of the TBL teaching model, students were able to discuss answers with team members and benefit from each other's knowledge. From the results of the included studies, only three papers found that the TBL teaching model had an increase in student achievement compared to the LBL method, but it was not significant. The non-significant results from the included studies do not mean that the TBL teaching model did not affect the above results, as the non-significant results were due to several methodological issues such as poor internal validity and small non-representativeness. These three studies also found that students'



preference for the TBL teaching model was higher than that of the traditional teaching model and that the TBL teaching model significantly improved their problem-solving skills and interest in learning; therefore, the failure of the TBL teaching model to improve students' performance may be because the period of use of this teaching model was short and the students needed a period of adaptation. In addition to this, due to the difficulty of implementing blinding in the teaching research process, the vast majority of included studies only used the TBL teaching model to teach students for a short period of time and did not take into account the effects of other factors on the effectiveness of the teaching and learning, for example, when a new teaching model is used compared to the commonly used teaching model, the students' interest in learning is heightened due to curiosity. At the same time, the teacher spends more time on the new teaching model, which may have an impact on the results of the experiment. The study did not clear whether the time on task was the same between the TBL and the control groups. Since time on task has been shown to improve performance (Borg 1980), it is conceivable that students performed better in TBL simply because more time was devoted to the topic. In addition to this, most studies have only implemented the TBL teaching model for a short period and then compared it to other teaching models, not studying the TBL teaching model for a long enough period of time to fully understand the possible effects of the TBL, therefore more longitudinal studies are needed to understand the long term effects of TBL on education.

### **The Impact of The TBL Teaching Model on Chinese Undergraduate Students' Competencies**

Regarding the development of competencies, according to the conceptual model of team-based learning (Michaelsen and Sweet, 2008) the main expected competencies are transferable skills. From the results of the included studies analyzed in this review, it is clear that TBL is effective in improving students' problem-solving and teamwork skills. The methodology used in most of the studies that addressed problem-solving skills was to compare the changes in students' scores on the Problem-Solving Skills Scale before and after they used the TBL teaching model, and some studies compared whether there was a significant difference in the scores of the subjective questions in the exams of the students who used the TBL teaching model and the LBL teaching model to verified the effect of TBL teaching model on enhance students' problem-solving skill. From the results of the included studies analyzed in this review, it is clear that TBL is effective in improving students' problem-solving skills and teamwork skills. Sun Lingfang conducted a pre-test and post-test on students using the Problem-Solving Ability Scale and found that the problem-solving ability scores of the participants in the experimental group improved by  $3.89 \pm 1.02$ , while the control group only improved by  $1.89 \pm 0.75$ , not only that, but the experimental grades of the experimental group students also improved significantly, which proves that TBL can improve the problem-solving ability of the students (Sun, 2022). Xie Weifan et al. applied TBL teaching model to an undergraduate tennis class. They found that the average score of subjective questions of the experimental group was significantly higher than that of the experimental group by analyzing the scores of subjective questions (Xie et al., 2022). Yu Xiangyuan used a questionnaire for students to conduct a self-assessment, and the results showed that 91.83% of the students believed that the TBL teaching model could improve their ability to analyze and solve problems (Yu et al., 2023). Other researchers echoed this view study (Du, 2023). There were 6 studies on teamwork skills, all of which used students' self-assessment, and the results showed that students generally believed that their teamwork skills improved after using the TBL pedagogy, which may be related to the fact that students need to have group discussions in the learning process. Although these results show that the TBL teaching model can enhance students' problem-solving and teamwork skills, most of the studies used randomized controlled trials, and the studies were based on the principle of convenience and ease of implementation, and the number of students in the study was relatively small; at the same time, due to the difficulty of blinding the implementation of the teaching and research process, the bias is difficult to control, and because the scales or questionnaires used in the measurement of the transferable skills of students are highly subjective, and the social response bias and volitional bias may occur, which may lead to the biased results.

## CONCLUSION

This systematic review provides a comprehensive understanding of the use of TBL teaching model in Chinese undergraduate education and student outcomes and emphasizes the scope of TBL applications and the variability of reported outcomes. Over the past five years, more and more educators have begun to experiment with the use of TBL teaching model in Chinese undergraduate education and have found that TBL teaching model has achieved good results in improving student learning outcomes as well as transferable skills. Still, because TBL teaching model started late in China and has been applied in a smaller scale, with most of the application focusing on medical education, and because of the imperfect evaluation system, this review found that the findings the main gaps in current research are the lack of randomized controlled trials, long-term trials, and studies in disciplines other than medical education to examine the impact of TBL teaching model on undergraduate education in China. Furthermore, in terms of learning outcomes, the included studies investigated different constructs, making it difficult to compare them. And there is no broad consensus on evaluation methods. Therefore, we suggest that future research could use the TBL teaching model in different subjects to observe the effect; studies using more rigorous methods and mixed-methods designs to improve the transferability of results and focus on the long-term impact of the TBL teaching model on student learning outcomes and competencies.

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