

Application of Team-Based Learning of Ophthalmology in China

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Abstract

OBJECTIVES

The purpose of this study was to explore whether Team Based Learning (TBL) was effective method compared with Traditional Didactic Lecture (TDL) in improving problem solving and study ability about clinical course of ophthalmology in medical students. We also cared about the view and satisfaction of TBL in Chinese students.

METHODS

Two hundred and seventy-five students of 5-year clinical medicine program from Central South of China University participated in our study program, one hundred and forty enrolled in modified TBL course. A questionnaire including closed and open-ended items, was distributed to students immediately following completion of the TBL session and we collect one hundred and eight valid questionnaires. Descriptive statistics were used to analyze the quantitative data. The effects of the TBL module on student performance were measured between the groups using a one-way between groups Analysis of Variance (ANOVA) test by the Individual Readiness Assurance Test (IRAT), the Group Readiness Assurance Test (GRAT), and final examination scores (FESs) compared with other class which didn't apply TBL session.

RESULTS

140 students achieved 72.65 mean test scores on test questions that assessed their knowledge of ophthalmology using the modified TBL strategy compared 135 students achieve 70.8 mean scores with TDL method ($p=0.3434$). The performance was significantly better during GRAT compared to IRAT in pre-class quiz. TBL learning method was favored and acceptable by most medical students compared to the TDL session.

CONCLUSIONS

Application of modified TBL to ophthalmology improved students' performance, self-study, teamwork and increased their class engagement and satisfaction. But TBL should be further optimized and developed to enhance the educational outcomes.

Introduction

Team-based learning (TBL) was first popularized at University of Oklahoma in the 1970s, for the response to increasing class size and concern about the effectiveness of learning from lectures to large groups [1, 2]. It is an educational strategy that characterized by individual work, teamwork, and immediate feedback and enables student to discuss and follow structured process to enhance their active engagement [3].

With the number of medical student increase, TBL had received much attention in large group education [4]. What's more, it is more competition for medical student to acquire knowledge and skills, and the ability of self-study, collaboration with each other to solve problem is highly important in this involution era [5].

However, the most popular education method for Chinese students is traditional didactic lecture (TDL). The students more prefer to follow what teachers had talk than active participation into class discussion. The major shortcoming of TDL is that the students receive information passively and they had little opportunity to expression opinion and exercise critical thinking. They are reluctant to initiative preview textbook and have less interesting on active thinking, thus most student cannot apply the knowledge flexibly.

To improve medical teaching method within large class, here we apply TBL in ophthalmology clinical class to evaluate the way of education efficiency and student's learning ability. We launch TBL with the help of advanced electronic equipment of superstar App and aimed to assess the satisfaction and academic impacts of TBL on ophthalmology and investigate whether any other improvement of TBL would carry out.

Methods

Participants

Our study population comprised Year 3 medical students (clinical of Medicine) from Central South of China University. In the third year, students move to hospital, where they rolled into various medical subspecialties including ophthalmology; undergoing clinical clerkship during our TBL course. Eight faculty members who had been a part of the TBL teacher. In total 140 students participated in the TBL session. Human Research Ethics Committee of Central South University approved study. All methods were carried out in accordance with relevant guidelines and regulations.

Learning outcomes of the TBL

The score of IRAT and GRAT, including of score of comprehensive clinical application at the end of class and FESs were selected to provide learning outcomes in our assessment. What's more, satisfaction questionnaire and evaluation of teaching goal also contain in our results.

Structure of team-based learning

The TBL session was 2.5 h in duration. It was held outside of the students' regular weekly schedule to preview with MOOC video and book. The students divided into 10 teams per class and distribute with evenly gender, each team consisted of approximately 14 members. Two or three teachers were randomly allocated to these group to participate the discussion section during GRAT and comprehensive clinical application task.

The process of team-based learning

Pre-class reading Prior to class, all students were allocated compulsory readings and pre-recorded lectures to review.

Individual readiness assurance test (IRAT)

All students were required to complete an online quiz with superstar APP on the beginning of class. The quiz consisted of 10 multiple choice questions, with one single best answer or multi choice for each question. The questions were aligned with the pre-class reading and pre-recorded lectures. Students were provided with a 15min window to complete the quiz, and at completion, they were provided with their total score.

Group readiness assurance test (GRAT)

The same IRTA quiz was repeated by the students in their teams. The test was administered online, and students submit once answer per team, with the intent of promoting discussion to establish team consensus.

Immediate feedback and clarification from the facilitators

The correct answers were then released and explained, giving immediate feedback on team responses in about 30min. The teacher offered clarification, particularly where individuals or teams had trouble.

Extended lecture

Our teachers give an interest lecture with an intend of exploiting the horizon of medical student on ophthalmology learning, the content of lecture including the progress of scientific research, operation of each disease and advanced medical technology. The time of this lecture last about 1 hour.

Clinical problem-solving activities

Students worked in their teams on problem solving activities, using knowledge consolidated through the prior steps. There was opportunity within the immediate feedback session for students to initiate discussion and challenge answers.

TBL modification

Each TBL class had a professional team of facilitators including: three ophthalmologists. The facilitators had been provided with prior training in TBL facilitation by either attending face-to-face training semester. In our modification we provide additional profession research lecture and specialty clinical lecture with international language, which including elements such as how to prompt clinical reasoning through questioning.

Data collection

We collected data using a multiple questionnaire regarding the TBL experiences. The questionnaire was distributed to student immediately following completion of the TBL session. The questionnaires included closed items (using a five-point Likert Scale, with 1 being 'strongly disagree', and 5 being 'strongly agree').

The interviewers used a guide that contained 7 standardized, open-ended interview questions 13 which asked about general impressions of the dissemination of TBL at the school, degree of TBL use in specific courses, scholarship on TBL and future. A series of prompts were included to ensure that each question was explored in similar detail between interviewers. A copy of the interview guide is provided in Table 1. All interviews were conducted over the telephone.

Data analysis

We used the descriptive statistics method to analyze our questionnaire data. Thematic analysis was used to build an understanding of the students' experience of the TBL session. A portion of the data was read by the first author and analyzed to identify initial themes. Following negotiation of meaning with the second author, a coding framework was developed and applied to the full data set.

Differences in proportions between TBL and PL groups were tested using the χ^2 test; differences in means of IRAT and GRAT scores were tested using two-sample t-test if normality and homogeneity assumptions were satisfied otherwise the non-parametric Mann-Whitney-U test was applied. A one-way analysis of variance (ANOVA) was used to compare the IRAT, GRAT, application exercise and final examination scores among the four quartiles of students stratified according to BOLs. All analyses were performed by SPSS software version 22.0 (SPSS Inc., Chicago, IL, USA).

Ethics approval

The IRB (Institutional Review Board) at Xiangya Hospital, Central South University, approved the study. Participation was voluntary, consent forms were signed, and anonymity was guaranteed. All methods were carried out in accordance with relevant guidelines and regulations.

Results

One hundred of forty students participated in our study TBL method (table 1). Of these, one hundred of eight questionnaires were collected at the end of our class. Mean age was 20.8 ± 0.69 years (all values expressed as mean \pm SEM); 43.52% were male and 64.81% come from city.

Class Performance

The proportion of correct answers was significantly higher during GRAT compared to IRAT (Figure 1) and with more practice with TBL training, the performance of IRTA is getting better and better each time (Figure 1). These results confirmed that group problem solving was more effective than individual problem-solving, The average score final exam (Figure 2) with TBL were 72.65 while the class without TBL training were 70.8. There was no significant difference between students with or without TBL (P

=0.3434). However, the number of fail student is much higher in TDL than TBL (31vs 17) and the pass student is more in TBL than TDL (36 vs 25). The number of fair, good and excellent student are similar in TBL and TDL (43 vs 40,37vs 35 and 7 vs 5)

The data showed that TBL training can match to our previous traditional method at least, and some other ability such collaboration and expression had strength during this education method.

Evaluation of TBL on teaching objectives

Students were asked to rate their TBL experience at the end of the module. We first evaluate the teaching objectives of TBL model, and the result showed in Table 1. About 33.33% disagree that TBL can meet teaching syllabus, percentage become smaller about 25.93% disagree that they grasped the key point and difficulties in TBL class. Most of our student, proximately 14.81% disagree that the teaching content extend widely than TDL. In regardless of efficient in learning knowledge with TBL training only 24.08% agree they enhanced than before. We next evaluate the discussion and Clinical problem-solving part on TBL, we get a higher percentage of agree their role in learning knowledge, what's more student about 94.45% are willing to spend more time on preview. This is an important ability of self-learning and increase their competitiveness in future study.

Evaluate learning ability and interest in ophthalmology

We next investigate the effect on learning ability and study interest, we focus on oral expression, independent thinking and time management, the percentage of disagree are 20.37%, 18.52% and 25.93% (Table 2), there seem no significant difference between these abilities. Some other learning ability, such as self-learning and collaborate are thought to be improve at the percentage of 77.78% and 64.81%. We continue to assess the interest in ophthalmology and time in spent on including expand theme's scope of knowledge, the result showed that students agree or partially agree of this effect of TBL at 64.81%,69.44% and 92.59%.

Evaluate team working ability and clinical ability

The aim of TBL was to increase the ability of collaborate, thus we wonder whether teamwork was somewhat enhanced, and we also collect data of their clinical competence after our TBL class. We clarify our issue into following part, such as participation of each person, different opinions existence and acceptance. The data showed on Table 3,4. Most of student choose neutral attitude on each question. For the highest agree percentage, most classmate are thought the TBL help to improve teamwork at level of the acceptance of different views, on the other hand only 24.07% student thought they were concentrating when they debate, this means we should allocate more teacher to help each group to engage in discussion section.

Evaluate satisfaction of TBL

At last, we focus evaluation of satisfaction of TBL, students believed TBL helped to master their present knowledge, provided them with more opportunity of expression themselves and had a positive impact on their learning attitudes. In table5, however less student give satisfaction during these three questions, In Figure1 showed an increase score up to 80 and slightly down at 80-100 point when ask satisfaction with TBL. The score tendency of active atmosphere and discussion opportunity in TBL class is consistent with the satisfaction quiz (Fig4-6).

Discussion

Over the past 30 years, educators in college campuses have increasingly employed an group teaching method called TBL [6].It had been stated that collaborative can play a significant role in mitigating many of the challenges faced by intensified competition world. We embarked on a study of TBL to determine whether this instructional strategy had value for use in medical education. This study sought to explore the collaborate effectiveness and medical students' perceptions of their learning experience during TBL session on the curriculum of ophthalmology. TBL had a positive impact on acquiring knowledge and utilize it, we choose to apply TBL on ophthalmology because of small curriculum and independence, this is very applicable to analyze the role of TBL in medical education in China. By working together, students' GRAT scores were significantly higher than their IRAT scores. Students showed more interest and spent more time on ophthalmology. Additionally, the more than half of students were satisfied with our TBL approach.

Before our class, we use MOCC and guidebooks to publish tasks. TBL method was unacceptable at first because of heavy task, they didn't have enough time to preview all curriculum, after several TBL training, student tend to accept it and more will to spent time on preview.

During our class, we use Superstar APP for test during our TBL class, it can show the learning results immediately, so that students' wrong knowledge points are displayed in the form of pie chart (Figure 3), better than the previous scratch card. It is very convenient for teachers to understand students' knowledge.

It has been generally accepted that with group learning methods such as TBL, the groups should outperform the individuals [7]. The analysis of pre-class tests (Figure1) indicated that the average group scores were higher than the average individual scores. This result suggested that the group-based learning increasing problem solving than individuals. During the group discussion, students could communication and debate to resolving problem. Our education seems more effective compared to that acquired from listening to teachers based on response of questionnaire.

However, we also found that the section of group discussion was not fierce, the students are fear to communicate with each other even they had idea, this may on account of the spoon-feed education pattern, and Traditional Didactic Lecture is the most universal education model in china since primary school, the students are afraid of expression themselves, they are more inclined to listen than deliver their opinion.

In our survey, we collect feedback at the beginning of our TBL, most of the student are not acceptable for this model. 57.8% of them are more willing to come back to TDL. They complain with little time to preview because of heavy task of their study work. In the program of medical student in china, student enter medical undergraduate program after high school, this makes our students need to learn more basic knowledge in their MD program, and virtually increased the learning task of medical students.

Moreover, in our study we found TBL is superior to the lecture- based learning only when students have reached a comparably understand of ophthalmology theories; otherwise, it will be difficult for students to answer quiz and engage in effective discussion. he data show that about 47% of them have trouble of online quiz on the begin of class, but at the end of several TBL class, only 4.63% of the student agree of the difficulty of IRAT (Table 1). We thought this would be improvement of preview and learning ability though several times training. In addition, 35% of them thought the number of each group is overloaded, this affects the individual discussion in GRAT and Clinical problem-solving activities. There was a study demonstrated that the optimal size of a TBL team is considered to be five to seven members [8]. In our experience, 14 membrane is too much for group discussion and we thought the number should control under 7, since each of the member had opportunity to discussing.

Previous studies[9] have shown that one of the major benefits of TBL was to improve the learning outcomes. We evaluated the effect of TBL on students' performance by final exam scores (FES), and analysis the mechanisms by interpretation of questionnaire results (Table1-4). Interesting, our results showed that the FESs of TBL teaching had not significant been improved. But the fail rate has decreased markedly from 31 to 17, and this suggest the number of students mastering knowledge has increased. The questionnaire shows that enhancement of personal knowledge through interaction with team members and the time spent on understanding curriculum was improved, thus we thought TBL is an effective education to gain knowledge and more favor of improving teamwork ability, independent learning ability and knowledge application ability.

Interesting, our students are more willing to be neutral when there was a chose of neutral in each quiz, but they are likely to be partially agree if options had no neutral. This suggests that most of our student aren't sure about the effect of TBL on themselves, neither about their future planning. They indeed do not know what is most suitable for them. In general, the reason of this phenomenon may attribute to long time of spoon-feed education and students are reluctant to express their ideas too radicalness. We need to improve our discussion step since highest proportion of disagreement on team discussion facility understanding knowledge. At this point, TBL will be a kind of quality cultivation, learning from excellent team members.

In conclusion, we are using questionnaire to gain insight into the utilization of TBL in medical education. With the use of TBL increased, while it is not popularized in China undergraduate education. We are on the way to grope Chinese-adapted TBL model. Several factors at the faculty, student, course and administrative / curricular levels were associated with those changes. Those who desire to implement

TBL would do well to take these characteristics into account as they plan implementation efforts at their schools.

Declarations

Ethics Approval and Consent to Participate

The Central South University of Human Research Ethics Committee approved the study. Participation was voluntary, consent forms were signed, and anonymity was guaranteed. All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable

Availability of data and materials

Datasets supporting the conclusions of this article are included within the article. Additional data of individual is not available as per confidentiality agreements approved by the Human Research Ethics Committee, Central South University. Additionally, contacting W.W (wenyi_wu@csu.edu.cn) for detail data.

Completing interests

The authors declare that they have no conflicts of interest with the contents of this article.

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Author contributions

W.W and D.W design the questionnaire, W.W analyzed the data and wrote the manuscript, X.X, S.X. and D.W revised the manuscript.

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Tables

Table 1

Questionnaire results about the teaching objectives among students in the TBL

Question Frequency %		
TBL can meet the teaching requirements of the syllabus		
Strong agree	13	12.04%
Agree	37	34.26%
Neutral	22	20.37%
Disagree	31	28.7%
Strong disagree	5	4.63%
Have you grasped the key points and difficulties in TBL class?		
Strong agree	9	8.33%
Agree	54	50%
Neutral	17	15.74%
Disagree	20	18.52%
Strong disagree	8	7.41%
TBL teaching content has a wide coverage		
Strong agree	18	16.67%
Agree	35	32.41%
Neutral	39	36.11%
Disagree	12	11.11%
Strong disagree	4	3.7%
TBL makes us more efficient in achieving our goals and learning knowledge		
Strong agree	8	7.41%
Agree	18	16.67%
Neutral	45	41.67%
Disagree	28	25.93%
Strong disagree	9	8.33%
whether the knowledge in preview have been strengthened in the discussion		
Strong agree	21	19.44%
Partially agree	67	62.04%

Question Frequency %		
disagree	20	18.52%
Clinical problem-solving is helpful to clinical thinking and application of knowledge		
Strong agree	30	27.78%
Partially agree	66	61.11%
disagree	12	11.11%
Team discussion deepen the understanding of knowledge		
Strong agree	21	19.44%
Partially agree	63	58.33%
disagree	24	22.22%
We will be spent more time on pre-class preparation		
Strong agree	40	37.04%
Partially agree	62	57.41%
disagree	6	5.56%
IRAT at the beginning of TBL are not difficult		
Strong agree	44	40.74%
Partially agree	59	54.63%
disagree	5	4.63%

Table 2
Learning ability and interest

Question Frequency%		
TBL helps to improve our ability of expression		
Strong agree	8	7.41%
Agree	20	18.52%
Neutral	53	53.7%
Disagree	18	16.67%
Strong disagree	4	3.7%
TBL has trained our independent thinking ability		
Strong agree	8	7.41%
Agree	36	33.33%
Neutral	44	40.74%
Disagree	17	15.74%
Strong disagree	3	2.78%
More effective utilize and controllable of time to learning in TBL		
Strong agree	7	6.48%
Agree	16	14.81%
Neutral	49	45.37%
Disagree	29	26.85%
Strong disagree	7	6.48%
TBL improves our ability of self learning		
Strong agree	28	25.93%
Partially agree	56	51.85%
disagree	24	22.22%
TBL improves team collaborate ability		
Strong agree	23	21.3%
Partially agree	62	57.41%
disagree	23	21.3%
TBL stimulates our interest in ophthalmology or clinical medicine		

Question Frequency%		
Strong agree	14	12.96%
Partially agree	56	51.85%
disagree	38	35.19%
TBL makes us more willing to spend time on ophthalmology learning		
Strong agree	16	14.81%
Partially agree	59	54.63%
disagree	33	30.56%
TBL extends the knowledge of ophthalmology with extra-curricular content		
Strong agree	51	47.22%
Partially agree	49	45.37%
disagree	8	7.41%

Table 3
team work ability

Question Frequency%		
Most of members in our team participated in the project discussion		
Strong agree	16	14.81%
Agree	24	22.22%
Neutral	42	38.89%
Disagree	21	19.44%
Strong disagree	5	4.63%
Many different opinions emerge during the team discussion		
Strong agree	10	9.26%
Agree	31	28.70%
Neutral	47	43.52%
Disagree	16	14.81%
Strong disagree	4	3.70%
Different views can be accepted by others in teamwork		
Strong agree	12	11.11%
Agree	35	32.41%
Neutral	48	44.44%
Disagree	11	10.19%
Strong disagree	2	1.85%
Every membrane has opportunity to express their opinions in teamwork		
Strong agree	11	10.19%
Agree	28	25.93%
Neutral	50	46.30%
Disagree	15	13.89%
Strong disagree	4	3.70%
Everyone are focusing on discussion in teamwork		
Strong agree	9	8.33%
Agree	17	15.74%

Question Frequency%		
Neutral	53	49.07%
Disagree	24	22.22%
Strong disagree	5	4.63%

Table 4
clinical ability during TBL

Question Frequency%		
TBL improve our clinical reasoning thinking in problem solving section		
Strong agree	11	10.19%
Agree	27	25%
Neutral	54	50%
Disagree	13	12.04%
Strong disagree	3	2.78%
TBL teaching make us know more about eye surgery		
Strong agree	44	40.74%
Partially agree	55	50.93%
disagree	9	8.33%
We are more impressed with eye surgery in TBL		
Strong agree	55	50.93%
Partially agree	45	41.67%
disagree	8	7.41%
TBL improves our ability on how to take in and treat patients		
Strong agree	26	24.07%
Partially agree	60	55.56%
disagree	22	20.37%

Table 5: satisfaction of TBL

Question		Frequency%
We have no resistance to TBL		
Strong agree	7	6.48%
Agree	13	12.04%
Neutral	49	45.37%
Disagree	32	29.63%
Strong disagree	7	6.48%
TBL teaching mode is expected to be carried out in more subjects		
Strong agree	7	6.48%
Agree	10	9.26%
Neutral	39	36.11%
Disagree	30	27.78%
Strong disagree	22	20.37%
TBL teaching is an effective teaching method		
Strong agree	6	5.56%
Agree	16	14.81%
Neutral	53	49.07%
Disagree	22	20.37%
Strong disagree	11	10.19%

Figures

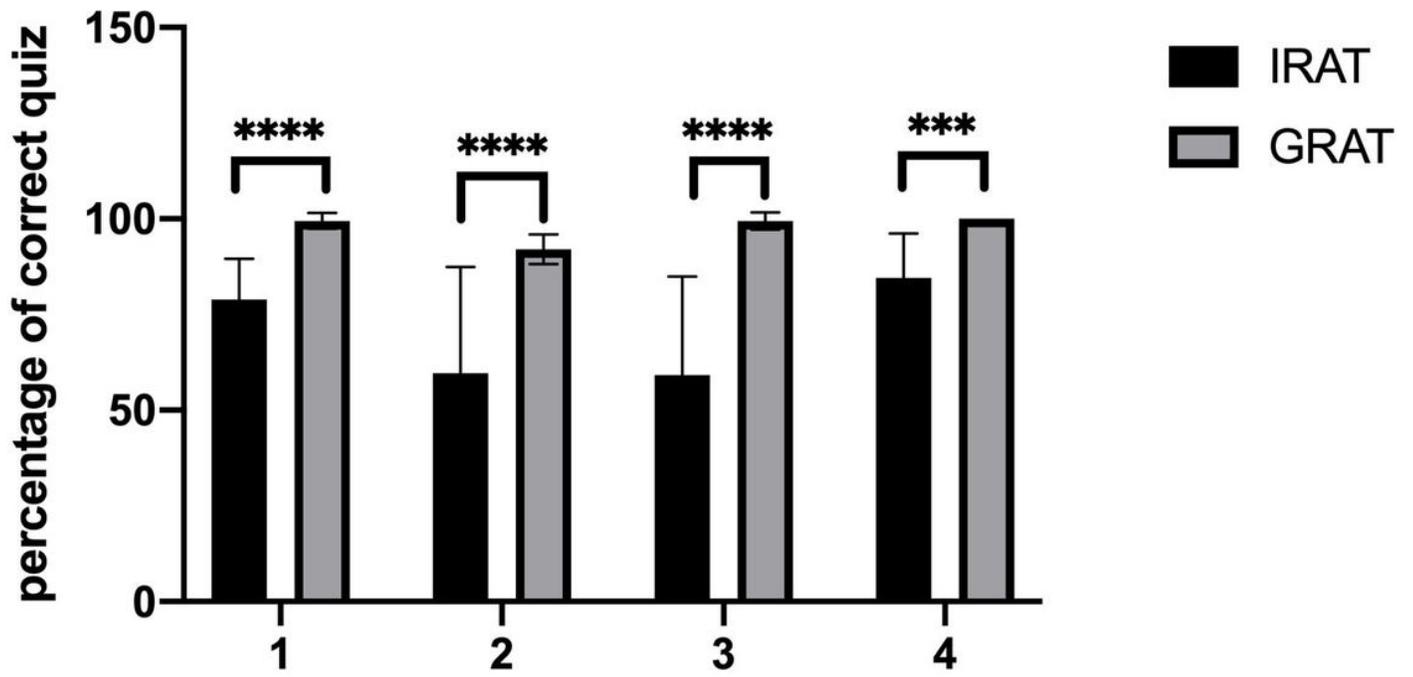


Figure 1

The score of GRAT and IRAT

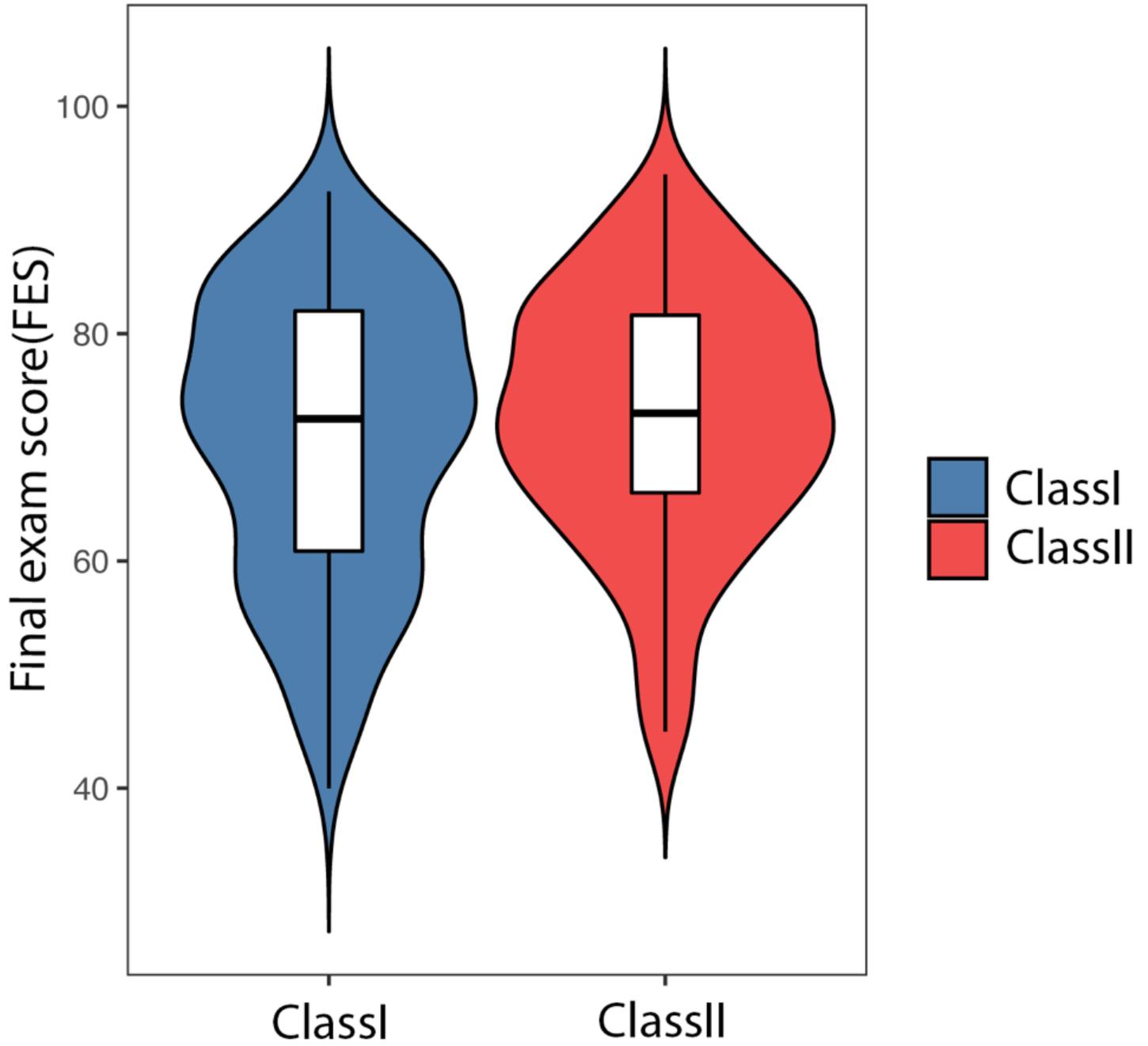


Figure 2

The final exam score of TDL and TBL education. ClassI using TDL and ClassII using TBL.

1. Which is not classified by the cause among these following types of cataract?

Answer: B

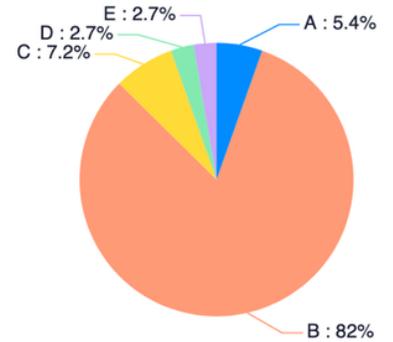
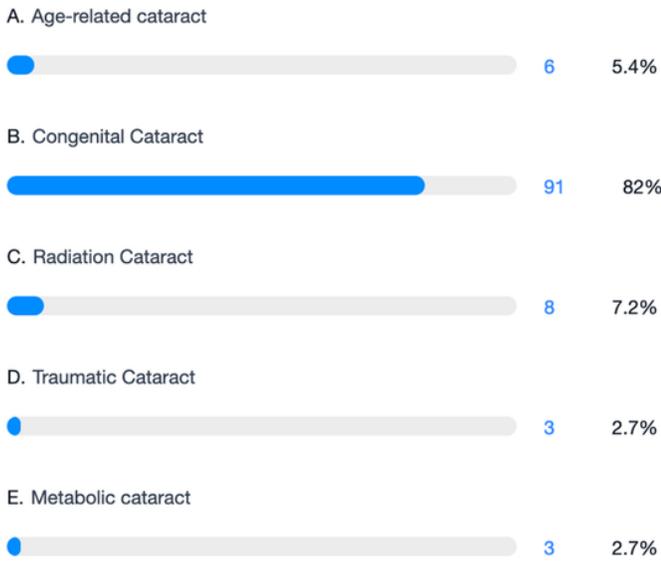


Figure 3

an example displays class quiz with choaxing APP. The answer show as pie chart and percentage of right answer.

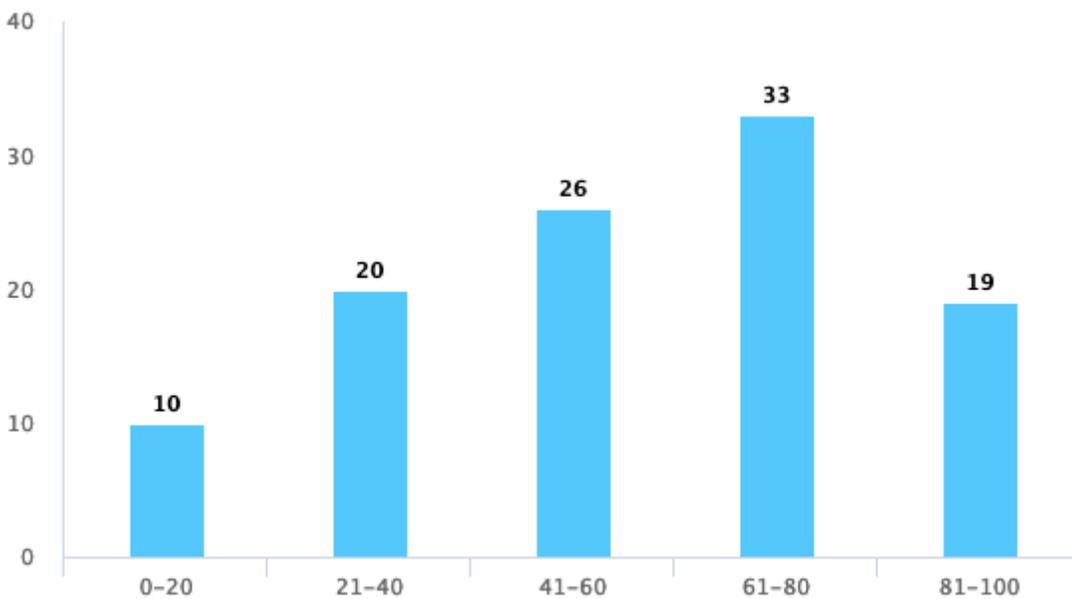


Figure 4

Your satisfaction with TBL teaching evaluation

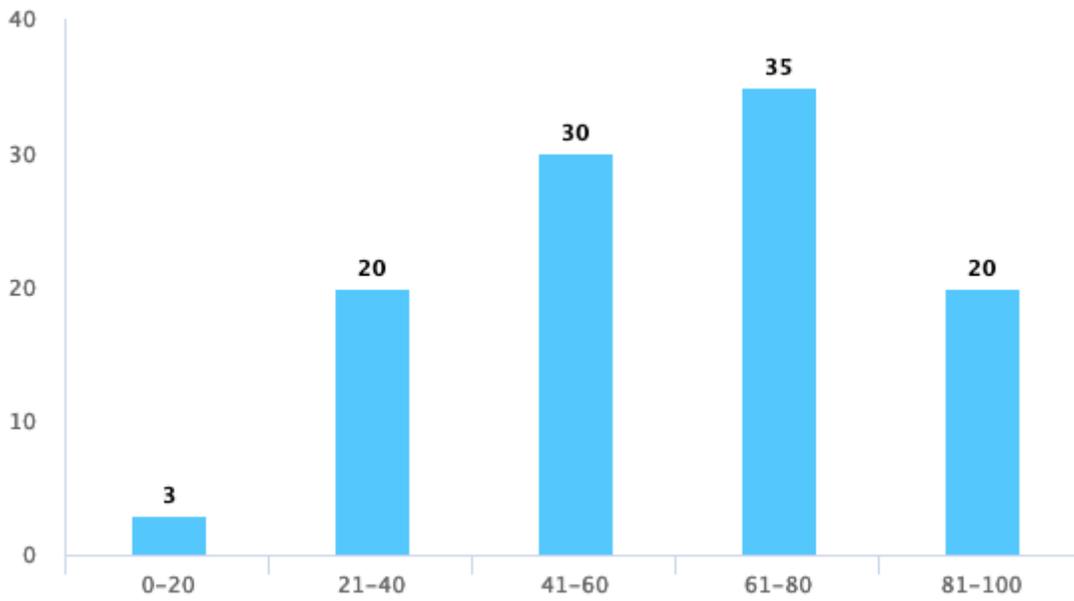


Figure 5

Evaluate the active atmosphere in TBL class

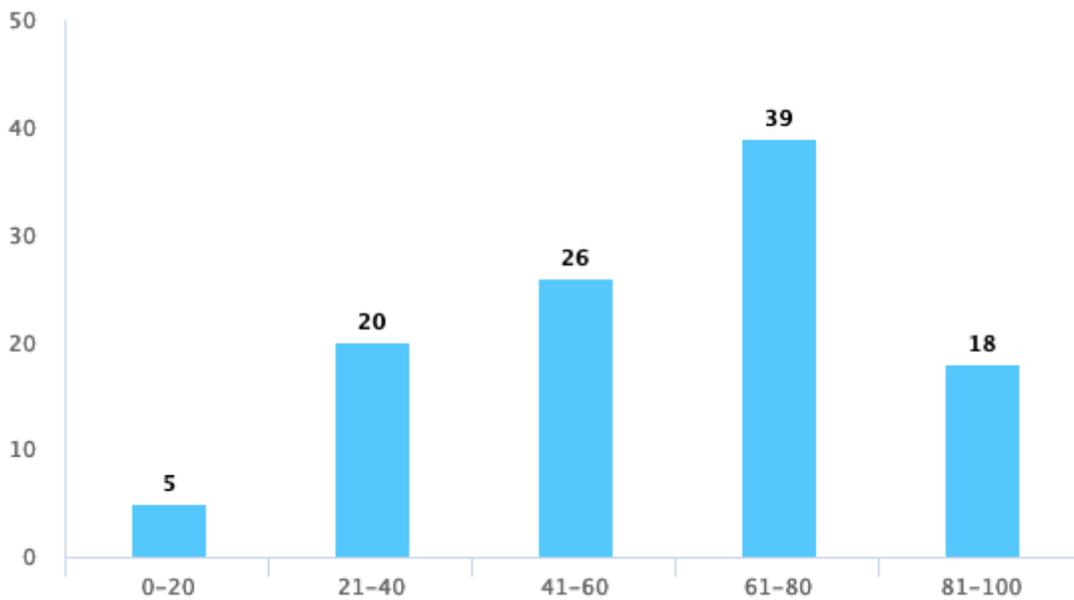


Figure 6

Discussions in TBL increase interaction between classmates or teachers