Applied Participatory Learning for Teaching Professional English to Students Majoring in Nuclear Disciplines in China

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Introduction. This article deals with design and development of participatory learning. Three different perspectives: literature review, students' feedback and teachers' feedback were analyzed. The relevance of this study is determined by the apparent improvement of students' proficiency of English, deeper knowledge about their profession and higher self-confidence in and after classes. The purpose of this article is to use participatory learning methods to build a new and more effective educational process for professional English teaching.

Materials and Methods. Our research implemented the principle of participatory learning to improve the students' communicative ability of English. Visual aids were applied to enrich teaching methods and open classroom setting was adopted to upgrade the learning atmosphere. Group learning mode was to cultivate students' ability of communication and cooperation. Theme-based teaching setting was carried out to encourage students' self-study ability, knowledge summary ability and creativity. Questionnaires, interview and peer observation were used. The objectives of the experiment were 50 third-year students majoring in radiation protection and nuclear safety at Chengdu University of Technology.

Results. Survey results reflect different aspects of students' perception of the new settings, encountered difficulties in learning and new challenges for teachers. The positive feedbacks to the experiment were received from peer teachers. It is found that students of PLA group were more active, better performed in courses, and had an average increase of 8.18 points (total 100 points) in exams.

Discussion and Conclusion. Our results and discussions lie in the smart connection between nuclear studies and English learning, and are based on varied qualitative research methods to verify the effectiveness of participatory learning. Through the analysis of the results, it can be seen that participatory learning has changed the traditional teaching mode to a certain extent and the nuclear major students were more effectively engaged in the professional English classes. It is, therefore, recommended to apply the research results to engineering related ESP practices at universities and colleges in China or in other culture.

Keywords: participatory learning, professional English learning, qualitative evaluation, investigation method, nuclear major

Прикладное интерактивное обучение профессиональному английскому языку студентов по специальности «Радиационная защита и ядерная безопасность» в Китае

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Введение. Статья посвящена моделированию и разработке методов интерактивного обучения. Актуальность данного исследования состоит в улучшении владения английским языком у студентов, углублении знаний о профессии и повышении уверенности в себе в ходе учебного процесса. Цель статьи – описание создания нового и более эффективного процесса обучения профессиональному английскому языку.

Материалы и методы. В исследовании был использован принцип интерактивного обучения для улучшения у обучающихся способности к общению на английском языке. С целью обогащения дидактических методов были применены визуальные средства обучения, для улучшения учебной атмосферы использовалась открытая установка аудитории. Форма группового обучения применялась с целью развития у студентов способности к общению и совместной работе. Тематический подход к обучению – для поддержки навыков обучающихся к самостоятельной работе и к обобщению знаний, а также для поощрения их творческих способностей. Также были проведены анкетирование, интервью и наблюдение за сверстниками. Участниками эксперимента были 50 студентов III курса, изучающие радиационную защиту и ядерную безопасность в Чэндуском технологическом университете.

Результаты исследования. Результаты опроса отражают различные аспекты восприятия студентами новых установок и трудности, с которыми они сталкиваются в обучении, и новые задачи преподавателей. По итогам проведенного исследования обнаружено, что студенты группы PLA были более активными, лучше выступали на занятиях и показали среднее увеличение балла на 8,18 (всего 100) на экзаменах. Также была выявлена интеллектуальная связь между ядерной специальностью и изучением английского языка. Результаты основаны на разнообразных качественных методах исследования с целью проверки эффективности интерактивного обучения.

Обсуждение и заключение. Данная статья будет полезна для более эффективного изучения английского языка студентами инженерных специальностей в университетах и колледжах Китая и других странах.

Ключевые слова: интерактивное обучение, профессиональное обучение английскому языку, качественная оценка, метод исследования, радиационная защита и ядерная безопасность

Introduction

As one of the most effective means of communication, language can quickly transfer key information in communication [1]. For students majored in nuclear science, accurately and effectively understanding, while learning and researching the frontier topics, plays an important guiding role in their future development. Students' professional foreign language ability

determines the future development, as well as their international vision, self-learning ability and level of communication with practitioners from various countries [2; 3].

Professional foreign language teaching is generally based on certain foreign language knowledge of students including professional lexis for teaching grammatical analysis in sentences and writing skills[1]. This kind of method has formed a relatively solidified process, and the students are often meager in oral communication, speech expression, self-learning and other aspects.

The design of participatory learning is a key issue in this research. There is a question: What's the most important way to arouse students' learning enthusiasm, participation and autonomy? At present in the teaching of foreign languages for nuclear majors, the general idea is to select appropriate teaching materials for the main lecture. Teachers teach theory in class, mainly by teaching words, phrases, sentence translations, short text expressions and other methods similar to ordinary foreign language teaching. These methods make students passively accept knowledge. Viewing the core of these teaching methods, this kind of teaching process is only to change common words into professional words. Students cannot learn what they need to master in the professional foreign language teaching in the conventional way. As for professional foreign languages, the key point is to communicate accurately and thoroughly on the level of professional technology. Compared with ordinary foreign language learning, professional foreign language teaching has apparent differences in the characteristics and needs of students' learning. In short, teaching methods should be more consistent with each other [4; 5].

Participatory learning, also known as Participatory Learning and Action (PLA), is a kind of qualitative evaluation and investigation method emphasizing both theory and practice [6]. It is a series of new qualitative evaluation methods. In an equal, open and interactive process by using simple models, it can help teachers more directly, deeply, accurately and objectively understand characteristics and needs of students, and learn from students and with students [7].

Literature Review

A. Terapinyo believes participatory learning means that attention should be paid to the interaction between teachers and students in the learning process[2]. Teachers provide learning opportunities, atmosphere, environment and knowledge sources to facilitate learning [8].

W. Boonmun expressed the idea that participatory learning was a kind of teaching method, according to which learning activities should have been organized by teachers and learners to create knowledge and achieve the goal of teaching plans and curriculum[3]. Two groups of communication programs were designed to explore the effect of participatory learning before and after the experiment. The results showed that participatory learning contributes to the development of knowledge, emotion and intelligence. James P. Terry realized PLA itself is a process, not necessarily a guiding method, with the purpose of providing clear answers [9]. Its foundation lies in the complementary fields of action learning, action research and action science [10]. Ronald R. Yager considered participatory learning provides a learning mode, emphasizing the universal role of known things in the learning process [11]. He believes that participatory learning mode can be divided into at least two. One way is to establish a learning algorithm, such as learning algorithms in data mining. The second mode is to build an intelligent agent

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[1] Planas J., Montoriol M. Spanish Background Report on "Improving Teaching and Learning for Adults with basic Skill Needs". Paris, France: OECD; 2006.
[2] Terapinyo A. Youth Participatory Learning Regarding Waste Separation and Recycling in College: A Case Study of Samutsongkhram Technical College. Mahidol University; 2004. Available at: http://mulinet11.li.mahidol.ac.th/thesis/2547/cd364/4436196.pdf (accessed 18.02.2019).
[3] Boonmun W. Effects of Participatory Learning Program on Sexual Communication Between Fathers and Adolescent Sons. Mahidol University; 2007.

framework [12]. Chen-Chung Liu gave his idea that the creative nature of participatory learning activities is manifested in students' participation in making study plans [13]. Participatory learning activities allow students to have the space to decide the pace of their own story creation, including timetables of story creation activities or art works.

Agbulaul and Idu conducted a study entitled "The Impact of Participatory and Expository Approaches on Learning Agricultural Science in Senior Secondary Schools in Benue State" [14]. The study used pre-test and post-test design to evaluate the effects of participatory and illustrative teaching methods. A stratified sampling method was used to a sample of fifty students. Psychometric evaluation items were used in pretest and posttest stages. Test statistics were used to further analyze the average gain of pretest and posttest, and it was found that the participatory method was more effective than the explanatory method. Audrey Prost did a systematic review and meta-analysis of randomized controlled trials conducted in Bangladesh, India, Malawi and Nepal [15]. The research also assessed the impact on female groups using participatory learning and methodologies to determine the level of maternal mortality, prenatal mortality and stillbirth [16]. Latha conducted a research entitled "Activity based teaching to promote participatory learning" [17]. This study proposed an activity-based approach to facilitating participatory learning using simple activities and informal teaching models.

B. Missingham applied participatory learning to his postgraduate classes [18]. Participatory learning, he believed, aims to achieve a deliberative democracy in the classroom. Participatory learning and actions provide educators a "toolbox" for various educational and training contexts. G. Marzano briefly introduced the experience of social learning and computer-supported cooperative learning, which was carried out in a complex experiment on low literacy adult learners of online participatory learning [19]. Their main project objective was to study the advantages and disadvantages of online informal adult education. Omollo, Nyakrura and Mbalamula studied the application of participatory teaching method in Tanzania normal universities [20]. The purpose of this study was to explore the application of participatory teaching method in Normal University teaching, in order to understand whether teachers would use participatory teaching method in the classroom to improve the teaching and learning between students.

Nádia Salgado Pereira found out that college students and adolescents who participated in the study may increase their response to intervention [21]. He used participatory research to understand children and adolescents' experiences in nonviolent situations. C. K. Cini believed that participatory learning can be used in a variety of environments, including a range of different strategies for promoting individual learning at any age [22]. A questionnaire survey was conducted among 118 students from three colleges: male ($n = 58$) and female students ($n = 60$). In addition, this study also conducted unstructured interviews with professors ($n = 7$) to identify participatory learning strategies suitable for economics. Percentage analysis was used to interpret data. They had proved that participatory learning is a relevant way of learning economics because it provides learners with opportunities to interact, critically analyze, solve problems, apply economic problems to real world problems, and develop a good understanding of the economy. Learners were interested in taking part in learning activities instead of listening to monotonous lectures. The study also found that students showed a good attitude towards participating in classroom activities. Therefore, content and method play an important role in the overall development of individuals.

This paper is based on participatory learning methods and aims at the characteristics of professional foreign languages teaching strategy for nuclear majored students. Through open classroom settings, classroom activation, improvement of visual aids and participatory learning, with reference books and network resources,

students are trained in various dimensions. Meanwhile, an evaluation mechanism is established to evaluate and examine teaching quality in each step of the process. The progress and acceptability of students are improved in real time. In the whole teaching process, participatory learning is the focus.

Materials and Methods

The experiment settings and materials. All the participants were third-year students majoring in radiation protection and nuclear safety of Chengdu University of Technology (CDUT), with a total number of 50. Students were divided into 2 natural classes. The average age of the participants was 21 years old with an English level of B1-B2, the male-female ratio was 21:4 (reference group) and 25:0 (PLA group) respectively. The course was named "professional foreign language", and the class lasted 32 periods (4 periods per week, 8 weeks in total). The final exam was arranged one week after the end of the course.

The assessment method was divided into two categories, namely examination paper (70 %) and presentation (30 %).

The examination paper was divided into four categories with total points of 100. 10 single-choice were selected, 2 points for each. 5 Chinese-English translation and 5 points for each, 5 term-interpretation and 5 points for each question, and 2 writings with 20 points and 10 points respectively.

The topic of presentation was randomly selected. Teachers would grade students according to their research level, logical structure and language expression.

The final point of students was calculated by the formula below.

$$P_f = P_e \times 0.7 + P_p \times 0.3 \qquad (1)$$

Where P_f states the final points, P_e states the points of exam, while P_p states the points of presentation.

PLA. In the teaching of specialized foreign languages, the PLA methods can be used, such as group discussions, free enumeration and sorting, visual technology, analysis technology and role playing. In order to ensure effective teaching and enhance the interaction and trust between students, attention should be paid to adopting more skills and strategic methods when using these methods.

1. Group discussion is one of the most common PLA teaching methods and the core of PLA method. Other methods cannot be applied without group discussion. At the beginning of the discussion, introduce the topic to the group members, and then let the students express their views on the topic. It is a process where students sit together to talk and exchange views. Teachers can also ask questions about these views and discuss them further. In group discussions, teachers should have a keen mind, good coordination, organization and contingency skills, and be good at listening and asking leading questions.

2. Role-playing is a simulation or demonstration, usually by two or three volunteers for other students to reproduce a real scene. A role play can be long or short, it can be a short sketch of only one event, or it can deduce many questions about a subject. Role playing not only plays the role of performers, but also dramatically reproduces various roles for observers. The purpose is to let students "experience" a situation, concept or viewpoint by performing in front of other students or observing other students' performance. This method is very interesting and easy to establish friendship with students and increase students' confidence in learning. Not only does it provide an opportunity to understand the opinions of others, but it also creates an opportunity to explore sensitive topics that arise in the performance. For example, in the foreign language teaching of nuclear majors, students can play the role of purchasing nuclear materials. During the performance, students will use a large number of the foreign languages they have learned and put forward different purchasing opinions according to the characteristics of nuclear materials.

3. Case analysis, also known as case study, is to introduce students to a real or hypothetical situation (e.g. in the form of oral narrative, film, writing, etc.) so that students can discuss or possibly solve certain problems in this situation. It can be done either by individuals or by teams, but

it is generally considered better to do case studies in groups. In this way participants can learn from each other. Design cases must be careful and have clear goals in mind. The case should be brief, and sufficient background information must be provided. Take a nuclear waste pollution as an example: teacher puts forward that if there would be a nuclear waste leaking out from a nuclear power station 20 kilometers from the university, what measures should the government take to prevent and control of nuclear waste pollution or how to dispose of nuclear waste? The group can analyze the actual cases, and then puts forward reasonable solutions.

In addition, PLA has the following advantages in the process of professional English teaching and plays an irreplaceable role:

1. PLA has no preconceived framework, but achieves teaching through a more open process. Participatory learning process allows teachers to fully absorb the views of students and makes students dominant. Chances for students to clarify and analyze their own concerns can encourage them to actively participate in the design and implementation of teaching.

2. PLA can ensure that the course content meets the needs of students, thus laying the foundation for ensuring students' support and cooperation after the beginning of teaching. There is a greater chance of success in terms of both teaching objectives and the sustainability of teaching.

Open classroom setup and classroom activation. Before beginning a course, different open classrooms should be selected according to the number of students, English proficiency (referring to students' English ability), professional performance, personality and other aspects. The team should also be coordinated. Different from traditional classroom settings, the layout of the desks and the active areas of participatory learning need to be planned in advance.

Activating the classroom and breaking the traditional "freezing point" are the most important prerequisite for the smooth progress of participatory learning. Teachers need to get rid of students' strangeness to the new teaching mode and their inadaptability to the new environment in a limited time, so that students can participate in the new teaching process as quickly as possible.

Visual aids. For today's teaching habits most teachers prefer to use slides and blackboards. This kind of teaching aids is more suitable for traditional teaching and reproductive teaching. It possesses good practical value and drawbacks. For example, blackboard writing more or less will delay the time of classroom teaching, and the use of slides will reduce students' sense of participation and interest in the classroom. Teachers' ideas can be reflected by slides, but students' ideas may not be easily accepted and understood. Therefore, we develop some new visual teaching aids, such as colored cards, hanging paper, according to different needs. Flexible use of different teaching aids can bring a lot of room for class improvement.

Other methods. In professional English learning books and internet resources are indispensable extracurricular references. In the teaching process students are encouraged to use them to inquire in-depth study. According to different teaching themes, students can be allowed to consult relevant information after class. At the same time, teachers can share some foreign forums and technical theme websites to expand students' international vision.

Curriculum evaluation refers to the examination of objectives of the curriculum, the formulation and implementation of the educational objectives and the degree of realization, in order to determine the effectiveness of curriculum design and make decisions to improve the curriculum. The way of curriculum evaluation is varied. It can be either quantitative or qualitative. Educational testing or measurement is only one of them, and does not represent the whole curriculum evaluation. The object of curriculum evaluation covers a wide range of subjects, including the curriculum plan itself, teachers, students, schools involved in curriculum implementation, as well as the results of curriculum activities, that is, the development of students and teachers. Figure 1 shows the whole process of participatory learning.
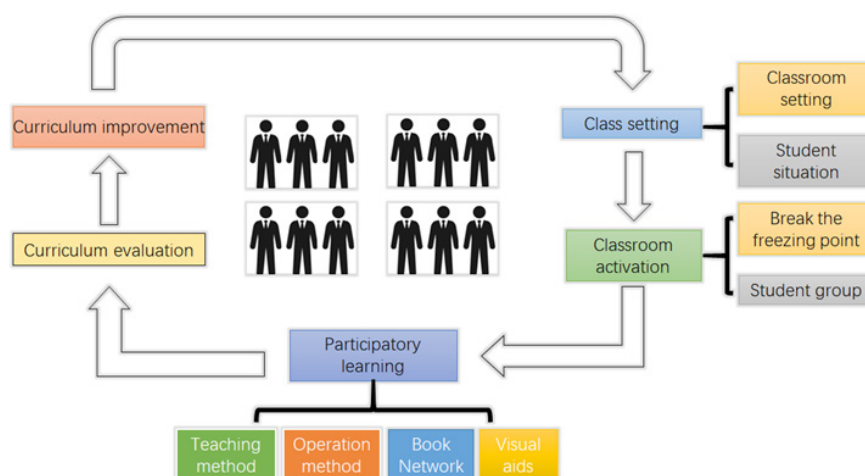
F i g. 1. Graphical representation of participatory learning process

Evaluation methods. Questionnaires. Questionnaires are printed in the form of questions that systematically record the contents of the survey. Designing questionnaires is the key to inquiring the investigation. Perfect questionnaires must have two functions, that is, they can convey the question to the person being asked and make the person comfort to answer [23]. To accomplish these two functions, the questionnaire design should follow certain principles and procedures, and use certain skills. In the survey nine straightforward questions were used to test the teaching results of participatory learning.

Interview. Kvale said interview is one of the effective ways to collect qualitative information[4]. In the process of face-to-face interviews, interviewers can clearly and intuitively feel the difficulties and thoughts of students, in order to better improve teaching methods. Because many problems are unexpected from teacher's point of view, only after the real understanding of students' adaptability, they can promote their teaching process.

Peer observation. Kate Thomson proposed that peer observation and peer review of teaching are much lauded in academic and educational development circles [24]. Peer observation in the teaching process provides an opportunity for observers to improve the quality of teaching practice [25]. It communicates good teaching practice experience among colleagues by sharing ideas about teaching practice and supporting each other's development of teaching skills [26].

Results and Discussion
Questionnaires' results. In order to reflect students' feelings about classroom settings more intuitively, a questionnaire is used. Nine simple and straightforward questions are used to summarize students' attitudes towards participatory classroom learning. The results are showed in figure 2 and the detail discussion is as follow.

Question 1: *Discussions conducted in the class under the guidance of the teachers are effective.* Sixty percent of the students strongly agree with this statement. Thirty-six percent agreed. It is proved that students' class discussion is very effective under the guidance of teachers.

Question 2: *In the participatory learning mode, the degree of knowledge acquisition and knowledge acquisition has been significantly improved.* Sixty percent of the students strongly agree with this statement. Thirty-two percent agreed. Eight percent of the students are not sure or disagree.

Question 3: *Peer group helps to improve learning of English.* It is worth noting

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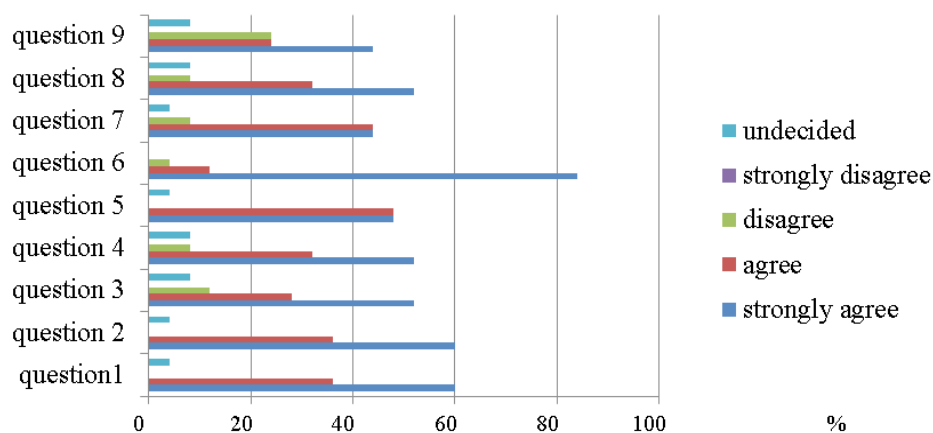[4] Kvale S. Interviews an Introduction to Qualitative Research Interviewing. Sage Publications; 1996.

F i g. 2. Students' intention distribution in questionnaires

that twenty percent of the students disagree or fail to confirm this sentence. This result shows that although the form of grouping is effective, it needs improvement.

Question 4: *Visual aids bring great room for classroom improvement.* Ninety-two percent of the students agree with this sentence. Teachers have developed some new visual teaching aids according to different needs. The results show that they can bring a lot of room for improvement in class teaching.

Question 5: *Develops broadmindedness through participatory activities.* Almost everyone agrees with this statement. It proves that participatory learning can not only change students' learning ability, but also improve their other qualities.

Question 6: *Change the monotonicity of learning English before, and take the initiative to participate in the classroom.* Ninety-six percent of the students think it is correct. For the current students, interest and sense of responsibility can greatly endow students with the "loyalty" of the current curriculum, and let students have the mentality of masters to learn. They also can greatly improve the acceptance of curriculum knowledge.

Question 7: *Become braver in speaking English after class.* Eighty-eight percent of students are more daring to express after learning. Students' "dumb English" and "difficult to speak" situation have been improved.

Question 8: *Participatory learning can closely associate English with its nuclear specialty.* Only eight percent students hold a negative attitude towards this remark. In view of the nuclear specialized English, we should plan different and independent curriculum tasks, so that students have a good autonomy in learning, and further can grasp the knowledge they have learned.

Question 9: *Curriculum and school resources are fully utilized.* Twenty-four percent of students believe that school resources are not well utilized. Students can check the relevant information after class. At the same time, teacher can share some foreign forums and technical theme websites to expand students' international vision.

Interview's results. During the interview, we raised three identical questions to each student. The first question is what projects are considered difficult in the PLA curriculum. Nearly 85 % of the students thought role-playing was more difficult, while 60 % and 55 % thought group discussion and case analysis were more challenging (see figure 3). The difficulties of students' role-playing in participatory learning are mainly revealed by data collected through interviews. Most students still feel shy and uncomfortable when they perform in front of others. Teachers can step by step choose performance segments, so that students can gradually adapt to the form of role performance. In group
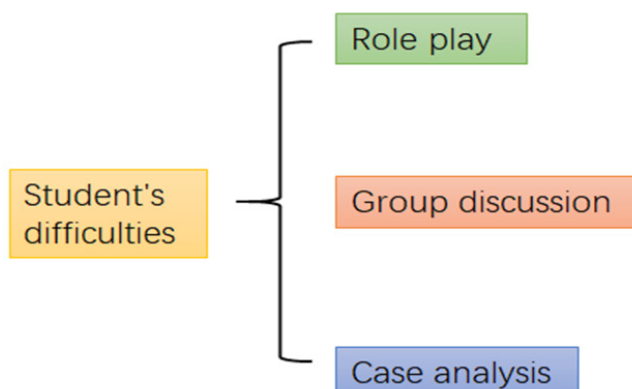
F i g. 3. Student's difficulties demo

discussions, the difficulty is that students are confused about how to better emerge into discussions and express their views on the topics. In our mind, to let students quickly and succinctly find what they want to express can become the future research direction. In another case analysis, when a teacher introduces a real or hypothetical scenario, students try to stand on their own point of view. Each student's thought is different and has different mainstream ideas. Therefore, students cannot be well integrated into the classroom.

The second question is whether to agree that participating in all kinds of participatory activities can help to cultivate self-study ability. 92 % of the students agree with this view.

The third question is whether participatory learning can help itself to change some traditional habits. Ninety percent of the students thought it had been changed. It should be noted that some of the traditional habits here are incorrect, which usually cause English learning to be slowed or motivation be decreased. But at the same time, nearly 90 % of the students' reactions have changed their habits. Some changes will decrease slightly after a period of time. In conclusion, it can be concluded that participatory learning has changed students' traditional learning habits and improved students' English ability, but more efforts are needed in the aspect of continuous improvement.

Peer observation's results. During the whole teaching process, five teachers from different majors were invited to observe and discuss after class (see table 1). Table 1 illustrates the basic information of the five teachers, the main problems they were observing in the class and the corresponding suggestions for the problems. Observation and discussion focused on two aspects. The first aspect is for teachers about which parts of the curriculum are more difficult and corresponding suggestions to each part. Four of the teachers agreed that the main challenges were resource utilization, visual aids and freezing point breakthroughs (see figure 4). The range of resource utilization is very wide. Teachers need to quickly select effective resources for the class. After observing and discussing the following methods, it will be adopted in the utilization of books and network resources: setting a theme for each group, letting students make PPT and completing literature review and reporting. It is useful to encourage each group or groups to determine topics regarding their interest, download relevant English literature from the campus digital library, read the English literature and take the initiative to email the authors, exchange and discuss with each other. Visual aids require teachers to stand at the student's point of view and help students understand. According to different needs, flexible use of different teaching aids and forms of presentation is demanded. Besides, ideas must be meticulous and comprehensive. The breakthrough of freezing point requires teachers to eliminate students' strangeness

T a b l e 1. **The basic information of participating teachers in peer, problems they were observing and correspondent suggestions**

| Name	Post	Research direction	Observation focus	Targeting problems	Recommendation / Remark
Jiao Luo	Lecturer	Professional English	Students' English Applying Ability	Is participatory teaching effective in improving English proficiency?	Affirmative attitude
Peiyan Luo	Lecturer	Nuclear physics	Utilization of Resources for Classroom Effectiveness	What specific methods should be adopted in the utilization of resources, concerning students' understanding of professional knowledge?	To set up English topics for nuclear majors and discuss about materials in groups
Qingxian Zhang	Professor	Radiation protection	Freezing point breakthrough classroom effect	What methods should be taken for freezing point?	To refer to English level for grouping
Guangxi Wang	Associate Professor	Nuclear engineering	The part of the class is relatively challenging for the teacher	What are the details that teachers need to improve in the participatory teaching process?	The main challenges are resource utilization, visual aids and freezing point breakthroughs
Li Jiang	Lecturer	Visual arts	Innovative effects of visual teaching aids	Whether the method of creating and using visual aids is reasonable or not	To think carefully and comprehensively and boldly adopt new materials
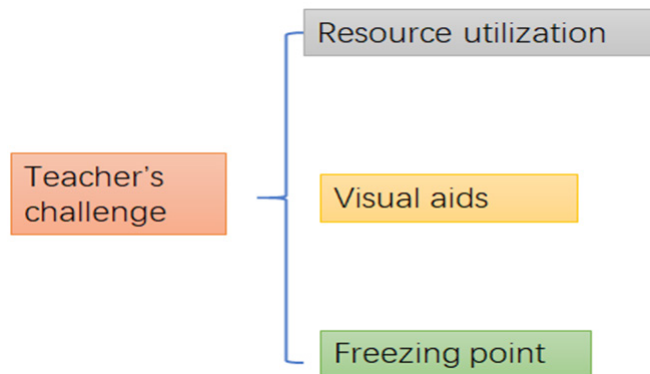
F i g. 4. Teacher's challenge demo

to the new teaching mode and their inadaptability to the new environment in a limited time, so that students can participate in the new teaching process as quickly as possible. After observing and discussing, the method to be adopted is to divide students into groups in different ways according to different types of students. If the students have the same level, they are randomly divided into groups. Through different selection conditions, the students are paired into one group, and several groups are grouped into one group. If the level of students is uneven, teachers should actively group, taking the large group level as the grouping criterion. These groups have

a good incentive effect on students' learning mechanism, enhance students' sense of collectivity and responsibility, and have a good role in promoting teaching.

The second aspect is to combine the traditional teaching method with the participatory learning method, so that students can learn more. Five teachers expressed positive attitude. It is believed that participatory learning classroom has a positive impact on students' enthusiasm, classroom effect and learning habits.

Student's improvements. In an exam points from the reference group and PLA group were collected (see figure 5) and the detailed analysis is as the following.

The single-choice mainly focuses on word comprehension and grammar. The gain average point of reference group is 11.80, while in PLA group is 16.24, increased by 4.44 points, scoring average increased by 22.2 %.

The translation test examined the ability to flexibly switch between Chinese and English. The obtained average point in reference group is 33.55, while in PLA group is 37.25. The average point has been improved by 3.7, and the point rate has been increased by 9.24 %.

The terminology explanatory part of the exam is to test students' understanding of knowledge and expression ability of language. The average point in reference group is 7.87, while in PLA group is 8.45. The point rate has been increased by 5.81 %.

Writing examines language expression and comprehensive capability. The average point in reference group is 20.98, while in PLA group is 21.84 showing 0.86 point increased. The point rate has grown by 2.86 %.

The pass rate of the examination papers has increased from 95 % to 100 %, with an average increase of 5 points. The significant increase in overall performance reflects the effectiveness of participatory learning.

Conclusion and Suggestions

Through the analysis of the results and the investigation of students, it can be seen that participatory learning has changed the traditional teaching mode to a certain extent, so that students can better participate in the classroom. After actively participating in the classroom, students can better apply their knowledge to practice. Team discussion, role playing and
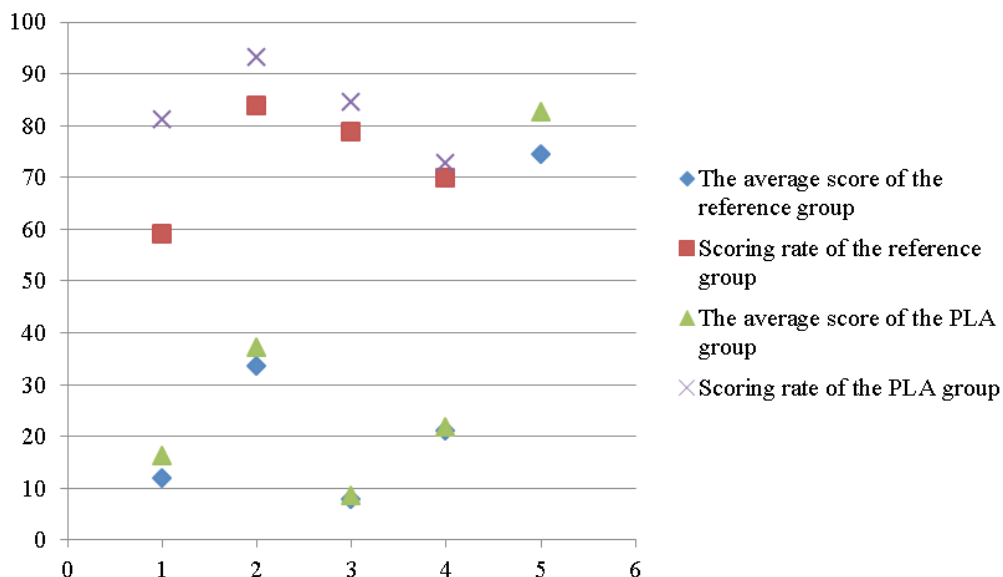

F i g. 5. Comparison of student achievement changes
in the two groups

other teaching methods break limitations of individual learning, so that students can continuously improve themselves while completing tasks. Moreover, the connection between nuclear majors and English is tight, which breaks the viewpoint that English is not related to students majored in engineering. The bold innovation of teaching aids, establishment of the classroom, active atmosphere and expanded content. Participatory learning enables college students to get rid of the inherent learning mode. As a result, they can rely on themselves to improve their professional English expression ability and become more self-confident.

REFERENCES

1. Villar R. The Importance of Language. *Journal of Hip Preservation Surgery*. 2018; 5(1):1-2. (In Eng.) DOI: 10.1093/jhps/hny002

2. Sidorenko T.V., Zamyatina O.M. Professional Competences of IT-students and their Development in Teaching Foreign Language. *Vestnik Tomskogo gosudarstvennogo universiteta* = Tomsk State University Bulletin. 2013; (68):141-147. Available at: http://journals.tsu.ru/vestnik/&journal_page=archive&id=881&article_id=1145 (accessed 18.02.2019). (In Russ.)

3. Ghaye T., Melander-Wikman A., Kisare M., Chambers P., Bergmark U., Kostenius C., Lillyman S. Participatory and Appreciative Action and Reflection (PAAR) – Democratizing Reflective Practices. *Reflective Practice.* 2008; 9(4):361-397. (In Eng.) DOI: 10.1080/14623940802475827

4. Palladino P., Ferrari M. Phonological Sensitivity and Memory in Children with a Foreign Language Learning Difficulty. *Memory.* 2008; 16(6):604-25. (In Eng.) DOI: 10.1080/09658210802083072

5. Ronald R. Yager. Participatory Learning with Granular Observations. *IEEE Transactions on Fuzzy Systems.* 2009; 17(1):1-13. (In Eng.) DOI: 10.1109/TFUZZ.2008.2005690

6. Palladino P., Ferrari M. Phonological Sensitivity and Memory in Children With a Foreign Language Learning Difficulty. *Memory.* 2008; 16(6):604-25. (In Eng.) DOI: 10.1080/09658210802083072

7. Missingham B. Participatory Learning and Popular Education Strategies for Water Education. *Journal of Contemporary Water Research & Education.* 2014; 150(1):34-40. (In Eng.) DOI: 10.1111/j.1936-704X.2013.03133.x

8. Botelho M. The Use of Group Participation and an Enquiry-based Study Guide with Computer Assisted Learning. *European Journal of Dental Education.* 2001; 5(3):109-12. Available at: https://www.ncbi.nlm.nih.gov/pubmed/11520333 (accessed 18.02.2019). (In Eng.)

9. Terry J.P., Khatri K. People, Pigs and Pollution – Experiences with PLA Methodology to Identify Problems of Pig-Waste Management at the Village Level in Fiji. *Journal of Cleaner Production.* 2009; 17(16):1393-1400. (In Eng.) DOI: 10.1016/j.jclepro.2009.06.001

10. Marzano G., Ochoa-Siguencia L. Challenges of Web-Based Participatory Learning. *Society. Integration. Education. Proceedings of the International Scientific Conference.* 2017; 2:458-467. (In Eng.) DOI: 10.17770/sie2017vol2.2395

11. Yager R.R. Participatory Learning with Granular Observations. *IEEE Transactions on Fuzzy Systems.* 2009; 17(1):1-13. (In Eng.) DOI: 10.1109/TFUZZ.2008.2005690

12. Omollo A., Nyakrura B., Mbalamula Y. Application of Participatory Teaching and Learning Approach in Teacher Training Colleges in Tanzania. *Journal of Scientific Research and Reports. Sciencedomain International.* 2017; 16(6):1-10. (In Eng.) DOI: 10.9734/JSRR/2017/34417

13. Chen-Chung Liu, Wei-Chen Chen, Hung-Ming Lin, Yun-Yin Huang. A Remix-Oriented Approach to Promoting Student Engagement in a Long-Term Participatory Learning Program. *Computers & Education.* 2017; 110:1-15. (In Eng.) DOI: 10.1016/j.compedu.2017.03.002

14. Agbulu O.N., Idu E.E. The Impact of Participatory and Expository Approaches on Learning of Agricultural Science in Senior Secondary Schools in Benue State. *Journal of Social Sciences.* 2018; 16(3): 245-249. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.554.2966&rep=rep1&type=pdf (accessed 18.02.2019). (In Eng.)

15. Kvale S. Interviews: An Introduction to Qualitative Research Interviewing. Thousand Oaks: SAGE Publications; 1996. Available at: https://is.muni.cz/publication/138966 (accessed 18.02.2019). (In Eng.)

16. Prost A., Colbourn T., Seward N., Azad K., et al. Women's Groups Practicing Participatory Learning and Action to Improve Maternal and Newborn Health in Low-Resource Settings: A Systematic Review and Meta-Analysis. *The Lancet*. 2013; 381(9879):1736-1746. (In Eng.) DOI: 10.1016/S0140-6736(13)60685-6

17. Latha E. Promoting Participatory Learning Through Activity-Based Teaching. *International Journal of Innovative Research and Development*. 2013; 2(10):13-16. Available at: http://www.internationaljournal-corner.com/index.php/ijird_ojs/article/view/133924 (accessed 18.02.2019). (In Eng.)

18. Missingham B. Participatory Learning and Popular Education Strategies for Water Education. *Journal of Contemporary Water Research & Education*. 2013; (150):34-40. (In Eng.) DOI: 10.1111/j.1936-704X.2013.03133.x

19. Marzano G., Ochoa-Siguencia L. Challenges of Web-Based Participatory Learning. *Society. Integration. Education. Proceedings of the International Scientific Conference*. 2017; II:458-467. (In Eng.) DOI: 10.17770/sie2017vol2.2395

20. Omollo A.D., Nyakrura B., Saidi Mbalamula Y. Application of Participatory Teaching and Learning Approach in Teacher Training Colleges in Tanzania. *Journal of Scientific Research & Reports*. 2017; 16(6):1-10. (In Eng.) DOI: 10.9734/JSRR/2017/34417

21. Salgado Pereira N., Marques-Pinto A. Development of a Social and Emotional Learning Program Using Educational Dance: A Participatory Approach Aimed at Middle School Students. *Studies in Educational Evaluation*. 2018; 59:52-57. (In Eng.) DOI: 10.1016/j.stueduc.2018.03.003

22. Cini C.K. A Study on the Attitude of Students Towards Participator Learning at Graduate Level. *International Education and Research Journal*. 2018; 4(3):67-71. Available at: http://ierj.in/journal/index.php/ierj/article/view/1625/1544 (accessed 18.02.2019). (In Eng.)

23. Dorman P. Are the Modified "Simple Questions" a Valid and Reliable Measure of Health Related Quality of Life after Stroke? *Journal of Neurology, Neurosurgery & Psychiatry*. 2000; 69(4):487-493. (In Eng.) DOI: 10.1136/jnnp.69.4.487

24. Thomson K., Bell A., Hendry G. Higher Education Research & Development. *Informa UK (Taylor & Francis)*. 2015; 34(5):1060-1062. (In Eng.) DOI: 10.1080/07294360.2015.1034349

25. Hendry G.D., Bell A., Thomson K. Learning by Observing a Peer's Teaching Situation. *International Journal for Academic Development*. 2014; 19(4):318-329. (In Eng.) DOI: 10.1080/1360144X.2013.848806

26. Villar R. (Ricky). The Importance of English. *Journal of Hip Preservation Surgery*. 2018; 5(1):1-2. (In Eng.) DOI: 10.1093/jhps/hny002

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