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CONTENTS

	Page
Science and Technology (Oral Presentation)	1
A Career Path in The Regional Universities of Turkey for Sustainable Development : Lessons Learned İlhan Çağırğan	2
Life Cycle of <i>Papilio demoleus malayanus</i> Wallace, 1865 on Host Plant of Family Rutaceae in Minsu Environs in Kyaukse Township Khin Myat Kyu	3
Genetic Diversity of the Genus <i>Thunbergia</i> Using ISSR and SRAP Markers Natpakun Ampun Pheravut Wongsawad	11
Utilization of Yeast-Fermented Broken Rice as Native Chicken Feed Narumon Somkuna	20
Health Sciences (Oral Presentation)	21
Effect of Opaque Porcelain Firing Temperature and Holding Time upon Interfacial Fracture Toughness of Milling Metal-Ceramic Alloys Nuttida Rengpattanakij Niwut Juntavee	22
The Effect of Different Sintering Times and Temperatures on the Translucency of Monolithic Zirconia Chutikarn Jaralpong Niwut Juntavee	34
Effects of Walking Combined with Arms and Legs Weight Loading Exercise on Physical Performance in Elderly Women Wareerat kokittipong Pruchaya Chumvangvapee Piyawat Luesopha Cherdsak Kaewkamada Widsarut Sekaew Kittikoon Boonkate	46
Effects of High-intensity Interval Training on Obesity: A Mini Review Minjun Liang Yang Song Yaodong Gu	55
Pathological Effects on Biomechanical Function and Strategy Adjustments during Gait Termination: A Systematic Review Yuhuan He Xuanzhen Cen	62



CONTENTS (Continued)

	Page
Multilingualism and Its Impact in North-East India Irom Gambhir Singh	153
Attitudes towards Multilingualism at Secondary Schools in Bangladesh Sree Bidhan Chakraborty Himadri Sekhar Roy	154
Student Centred learning in the 21 st Century Willy A Renandya	155
The Role of Youngers for Global Sustainable Governance : The Implication for Higher Education Innovation Ted Yu-Chung Liu	156
The Role of Vocational Training in Myanmar Ni Ni Oo	157
A Synthesis Study of Writing Approaches Employed in the Researches on Teaching Writing Sittisak Pongpuehee Nawamin Prachanant Saowarot Ruangpaian	167
Effectiveness of Using an Outcome-based Approach to Design Contents of an In-service Training Program for Training secondary school English Teachers in Laos Lakaisone Saiyachit	176
The Effects of Using Padlet Application (PA) to Enhance Writing Ability of English-Majored Students at Savannakhet Teacher Training College, Lao PDR Phouangphet Sounthalavong Khonesak Keomaneevong	177
Learning Achievement and Satisfaction by Using Collaborative Learning in Information System Analysis Course Passakorn Chumpoonta	178
Improving Grade 3 Students' Vocabulary Knowledge through Communicative Activities Thidarat Klachiew Saowarot Ruangpaian Nawamin Prachanant	188
Administration Psychology Model of University in Thailand Nipa Pongvirut	200

CONTENTS *(Continued)*

	Page
Blended Learning During Pandemic Corona Virus: Teachers' and Students' Perceptions at Chaiyaphum Rajabhut University Ratchakorn Praseeratesung	201
A Synthesis Study of Assessing Learners' Pragmatic Competence Jansuda Boontree Nawamin Prachanant Saowarot Ruangpaisan	212
Study Abroad Opportunities and Intercultural Competencies of University Students in Myanmar Ni Ni Hlaing	223
A Need Analysis of Blended Learning to Enhance Chemistry Specialization Students' Metacognitive Skills and Attitudes Mya Thet Mon	225
University Students' Self-Efficacy, Attitudes, and Intentions toward Chemistry : Myanmar Context Mya Thet Mon	226
An Analysis of Illocutionary Acts in the Short Story <i>A Small Sacrifice for an Enormous Happiness</i> by Jai Chakrabarti Khin Hsu Thwe	227
The General Attitude of Students and Teachers towards Effectiveness of Using Short Stories in EFL Classrooms of Myanmar Mary Akkarapon Nuemaihom Kampeeraphab Intanoo	236
Benefits of Dramatic Play for Enhancing University Students' Understanding of Poetry Mary Akkarapon Nuemaihom Kampeeraphab Intanoo	237
Gender and Language Use in Myanmar Context Soe Moe Thu Wilai Phiwma	238
The Effect of Classroom Interaction on Developing the Learner's Speaking Skill : Myanmar Context Soe Moe Thu Wilai Phiwma	250
A Synthesis Study of literary Texts to Enhance EFL Students' Critical Reading Skills Siraprapha Ratanaruamkarn Surachai Piyanukool Akkarapon Nuemaihom	251

CONTENTS *(Continued)*

	Page
Building Students' Global Competency in English Language Classrooms at Undergraduate Level in Myanmar Yee Mon Cho Akkarapon Nuemaihom Kampeeraphab Intanoo	263
Implementation of Teaching Practices with Respect to the Integration of Global Citizenship : ELT Context Yee Mon Cho Akkarapon Nuemaihom Kampeeraphab Intanoo	264
ICT Skills and Challenges Faced by High School Teachers of Inle Lake Located in the Nyaungshwe Township of Shan State in Myanmar May Theint Thu	265
The 21 st Century Learning Needs of University Students: Teachers' Perception May Thein Thu	266
University Students' Perceptions on 21 st Century Learning Skills: Myanmar Context Khine Zin Thant Jasmine Kong-Yan Tang	267
Uses and Limitations of Questionnaires in Social Science Research Khine Zin Thant Jasmine Kong-Yan Tang	268
Foreign Language Anxiety and Test Anxiety of University Students : Myanmar Context Su Mon Aung	269
Foreign Language Classroom Anxiety and Reading Anxiety of EFL Students in Myanmar Su Mon Aung	270
An Error Analysis of Thai into English Translation of Second-Year English Majors Somyong Som-In kampeeaphab Intanoo Akkarapon Nuemaihom	271
Beliefs of University Teachers: Personal Skills of Teacher Leaders Zarni Mar Peng Qingyue Chang Woojin	282
Student Perception on Traditional English Language Testing in a Myanmar Context Aye Aye Mar	283
Teachers' Perceptions on the Effectiveness of Group Work and Pair Work towards CLT in ELT Classrooms Ohnmar Win Yee Mon Cho Nawamin Prachanant Saowarot Ruangpaisan	284

CONTENTS (Continued)

	Page
Professional Development Needs of Myanmar University Teachers of English Kyaw Sein	285
Culture Learning in Myanmar EFL Context Kyaw Sein	286
Assessment Practice of English Language Teachers in Myanmar Zarni Mar	287
Confucian Conception of Critical Thinking in Teaching English as a Foreign Language in Myanmar Soe Darli Wai	288
Challenges in Academic Research Experienced by Postgraduate Students in Myanmar Higher Education Context Soe Darli Wai	289
Effects of Virtual Classrooms on English Language Skills and Learning Aspects : Review of Recent Cases under COVID-19 Pandemic Yuttachak Lamjuanjit Nawamin Prachanant Chukiat Jarat	303
Quality Enhancement of Master's Supervision in Chemistry Specialization at Selected Universities in Myanmar Thinn Myat Nwe Tika Ram Pokharel	317
Successful Studying in Doctoral Education of Myanmar : Botany Specialization Nwe Nwe Hninn	318
The Effects of Captioned Videos on Vocabulary Learning : A Meta-analysis Aung Myo Hein	319
Teaching Professionals' Opinions and Views on Experiences of Attending Academic Conferences Than Than Win	320
Successful Leadership and Student Outcomes at Universities in Myanmar Khin Mar Mar	321
Study of Flipped Classroom Teaching Method together with Cyberspace Learning to Promote Chinese Contemporary Literature History Achievement of University Students Chang Yipeng Nitikorn Onyon Mesa Nuanstri	322

CONTENTS *(Continued)*

	Page
<p>The Effect of Learning Management Using Cooperative Learning together with Superstar Mobile Library Application to Enhance the Searching for Information Ability of University students Reviewer Regina Yuan Liangzhi Nitikorn Onyon Thitiporn Pichayakul</p>	333
<p>A Synthesis Study of Metacognitive Strategies Employed in the Researches on Teaching Reading Wiphaporn Dangsi Chookiat Jarat Nawamin Prachanant</p>	342
<p>The Effect of Aided-study Class Teaching Mode on Mathematics Achievement of Grade 4 Students in Primary Schools Zhang Ancheng Suwana Juithong Phithack Nilnopkoon</p>	356
<p>The Effect of Cooperative Learning Using STAD Technique on Mathematics Achievement of the Fourth Grade Students in Primary Schools Yang Pengfei Phithack Nilnopkoon Suwana Juithong</p>	363
<p>Effect of Learning Management by Using Davies Instructional Model on Ability of Automobile Engine Disassembly and Adjustment and Learning Achievement of Students in Jiangsu Electronic Information Vocational College Yin Yao Phithack Nilnopkoon Suwana Juithong</p>	370
<p>A Study of Dalcroze Music Teaching Method on Music Class to Promote Musical Literacy of Primary School Students Zhaoyi Phithack Nilnopkoon Kanreutai Klangphahol</p>	380
<p>Study of Case Study Method through Microteaching Method to Enhance Teaching Practice Skills of Students Majoring in Chinese Language and Literature Xiao Qianlin Sombat Kotchasit Angkana Karanyathikul</p>	387
<p>Effect of Learning Management Using Problem-Based Learning together with the Mobile Phone Application on Students' Learning Achievement and the Ability of Landscape Design of College Students Huangfu Zhounan Sombat Kotchasit Kanreutai Klangphahol</p>	396
<p>The Effect of BOPPPS Teaching Method on Learning Achievement and Dance Performance of University Students Zhu Fengling Sombat Kotchasit Wang Tiansong</p>	403

CONTENTS *(Continued)*

	Page
Effect of Problem-Based learning (PBL) on Music Teaching Scheme Design and Teaching Practice of Music Normal Students Feifei Guo Premjit Kajonpai Larsen Rekha Arunwong	411
International Practicum: What Students Gain and Are Challenged Bao Kham	420
Study of Problem-Based Learning Together with Questioning Technique to Promote Choreography Ability of Dance Students Wang Di Premjit Kajonpai Larsen Rekha Arunwong	421
Study of Problem-Based Learning Approach for Enhancing Learning Achievement and Students' Satisfaction Among the First Year Students on Fundamentals of Information Technology Course, Zhoukou Normal University Li Xiaofeng Lerlak Othakanon Danucha Saleewong	430
Study of State and Problems on Learning Management and Propose Guidelines on Ideological and Political Education Courses in Xinzhou Teachers University Dou Jiayu Lerlak Othakanon Wassaporn Jirojpan	439
Ambiguity Found in Advertisements Tin Moe Yi	455
Practicing Home Visit Program for School Resilience and School Effectiveness Amid the Covid-19 Pandemic Crisis : A case study of a primary school in Central Lombok, Indonesia. Zobi Mazhabi Yoyok Amirudin	466
Factors Influencing the Effectiveness of Quality Sub-District School Administration in Nakhonchaiburin Provinces Piyapat Klumgen Narumon Sakpakornkan Supatra Rukkarnsil	467
A Collocational Error Analysis in English Narrative Essay Written by English Major Students Thanakorn Kamolwet Chookiat Jarat Nawamin Prachanant	479
Educational Strategies Aimed to Improving Student Nurse's Medication Calculation Skills : A Systemic Review Nongnuch Homniam Siripinya Trakunram	489

CONTENTS *(Continued)*

	Page
On the Improvement Strategies of University Leaders' Literacy in Coping with Public Opinion Pressure Chen Jianping Kraphan Sri Ngan	501
Deepening the Integration of Production and Education to Boost Regional Economic Development Explore New Modes of School-enterprise Cooperation Jiang Renfeng Kraphan Sri Ngan	502
Exploring Student Engagement with Corpus Feedback on English Writing Nguyen Vu Quynh Nhu Nguyen Hoang Hanh An	503
Personal Narratives : A Pedagogical Intervention in Writing Christian Cudiamat Gandeza Ma. Jesusa Ridor-Unciano	516
Personal Growth Development of Students' Literary Appreciation Wendell A. Lived Ma. Jesusa Ridor-Unciano	528
Reviewers	542
Commentators	548
Editorial Board	551

Study of Problem-Based Learning Approach for Enhancing Learning Achievement and Students' Satisfaction Among the First Year Students on Fundamentals of Information Technology Course, Zhoukou Normal University

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Abstract

The purposes of this research were to 1) compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University before and after using Problem-Based Learning approach, 2) study learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent and 3) study the student's satisfaction toward with the Problem-Based Learning approach. The sample of this research were 66 students of the first year from Zhoukou Normal University and network engineering university which selected through cluster random sampling. The research instruments were: 1) the lesson plan 2) PBL pretest and posttest form, and 3) the satisfaction questionnaire. Data were analyzed by mean, standard deviation, IOC, and t-test.

The findings of the research revealed that: 1) post-learning of students was higher than their pre-learning with statistical significance at the level .05. 2) The learning achievement of students was 89 percent that higher than the standard criteria of 70 percent with statistical significance at the level .05. 3) The students' satisfaction after learning was at a highest level.

Keywords : Problem-Based Learning Approach, Learning Achievement, Students' Satisfaction

1. Introduction

In 2016, the Ministry of education of the people's Republic of China pointed out in the "Guiding Opinions of the Ministry of Education on Deepening Education and Teaching Reform in Colleges and Universities Affiliated to the Central Departments": in terms of the relationship between teaching and learning, we should establish the idea that students are the main body of teaching activities, and pay more attention to the cultivation of students' autonomous learning ability and

innovative spirit; It is proposed that the reform of teaching is to change the teaching approach, let students become the main body of the classroom, fully mobilize the enthusiasm of students, improve their innovative consciousness, change the traditional teaching approach, reform the teaching approach, and widely carry out heuristic, discussion and participation teaching. Let the students' study actively to improve their autonomous learning ability and academic performance. (Ministry of Education of the People's Republic of China, 2016)

In 2019, the Ministry of Education issued the "Opinions on Deepening the Reform of Undergraduate Education and Teaching and Comprehensively Improving the Quality of Talent Training", which clearly pointed out: to enhance the academic challenge, strengthen the quality requirements of talent training program, teaching process and teaching assessment, scientifically and reasonably set the total amount of credits and the number of courses, increase students' learning time, and improve their autonomous learning ability, Guide students to read more, think deeply, ask questions and practice frequently. (Ministry of Education of the People's Republic of China, 2019)

In August 2020, Zhoukou Normal University issued the "2020 Undergraduate Talent Training Program", which requires the graduates of network engineering major (Article 12) to have the awareness of autonomous learning and lifelong learning, and the ability to constantly learn and adapt to the rapid development of network technology. Credit requirements: students must complete 171 credits required by the professional talent training program and be allowed to graduate, which is a clear requirement for the academic performance of network engineering students. (Zhoukou Normal University, 2020)

Zhoukou Normal University network engineering major is an undergraduate specialty set up by the school in 2007. As a network engineering major established by local colleges and Universities under the provincial level, it is a "Comprehensive Reform Pilot of Henan Province" and "Pilot Project Education Professional Certification Pilot".

Talent training mode: "students as the main body, supported by school enterprise cooperation, international cooperation and production, learning and research cooperation, guided by advanced engineering education ideas, and with the cultivation of engineering application ability and innovation spirit as the core, the theory teaching, independent learning and practical teaching are integrated and promoted, and knowledge, ability and quality are comprehensively coordinated and developed."

The theoretical significance of this study is to determine the relationship between PBL and students' learning achievement and students' satisfaction, that is, students' learning process under the guidance of PBL. PBL has a positive driving relationship with students' learning achievement and students' satisfaction. Zhou, Du, Wang, & Zhang, 2019)

In view of the above reasons, PBL is a new teaching method in computer basic course. Whether PBL can also become a powerful tool in the teaching field of computer specialty is worth studying. (Zhou et. Al., 2015) The basic course of information technology is developed with the learning method of PBL teaching approach, to improve the learning effect of professional basic courses for undergraduates majoring in network engineering. This is also the process of opening new ideas for the exploration and research of information technology teaching. In addition, the results of this study will provide valuable enlightenment to the research of PBL in the whole curriculum teaching.

2. Research objectives

This research consisted of three objectives:

2.1 To compare learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University before and after using Problem-Based Learning approach.

2.2 To study learning achievements on Fundamentals of Information Technology course of the First Year Students at Zhoukou Normal University after using Problem-Based Learning approach with an expectation of passing with the criteria 70 percent.

2.3 To study the student's satisfaction toward with the Problem-Based Learning approach.

3. Research Methodology

3.1 Samples

The research population of this study was 399 students (5 classrooms) majoring in network engineering in Zhoukou Normal University, Henan Province, China.

The sample of this study were 66 students (1 classroom), from Zhoukou Normal University and network engineering university which selected through cluster random sampling.

3.2 Research Instruments

Research instruments consisted of the lesson plan, PBL pretest and posttest form, and the satisfaction questionnaire. Data were analyzed by mean, standard deviation, IOC, and t-test.

3.3 Data Collection

The following are the stages of data collection:

The development methods of research tools are as follows:

3.3.1 The samples are given the pretest by measuring learning achievements with constructed instruments. The PBL test consists of 30 items of multiple-choice questions, each of which has four alternatives with one correct answer. The PBL test items consisted of four types of cognitive domain: 1) knowledge, 2) comprehension, 3) application, and 4) analysis.

3.3.2 The samples are taught by using the Problem-Based Learning Approach. Based on PBL, students' learning process includes three main stages: 1. Define problem in this stage, students define problems; 2. PBL task. In this stage, students analyze problems, determine further learning needs, guide themselves, collect additional information, review what they have learned, put forward solutions and solve problems together; 3. Evaluation. At this stage, teachers and students jointly evaluate the impact of PBL process on students' autonomous learning ability and academic performance.

3.3.3 After finishing the instruction, the samples receive the posttest by using the same instrument which are used in the pretest.

3.3.4 Using the method of questionnaire, this research investigates the students' satisfaction with the sample: the questionnaire of PBL teaching purpose of fundamentals of information technology course.

3.4 Data Analysis

In this study, data analyze according to the research objectives.

3.4.1 Compare the learning achievements before and after receiving the Problem-Based Learning Approach by using t-test for dependent sample.

3.4.2 Compare the learning achievement with the determined criteria set at 70 percent by using t-test for one sample.

3.4.3 Study the student's satisfaction on the Problem-Based Learning Approach by using arithmetic mean and standard deviation.

To analyze the PBL pre-test and post-test, we tested 66 non sample students in Zhoukou Normal University, determined the difficulty index (P) of the PBL pre-test and post-test, and analyzed the difficulty of the scores. The results show that the PBL test difficulty index is between 0.25 and 0.35. For the calculation of the PBL test reliability, Kuder Richardson's KR-20 formula was applied. The reliability of the PBL test was 0.81. The contents validity of the PBL test was examined by three experts and had the IOC of 0.67-1.00. The contents validity of the lesson plan was examined by three experts and had the IOC of 0.67-1.00. The contents validity of the satisfaction form was also examined by three experts and possessed the IOC of 0.67-1.00. The statistics, mean and standard deviation, were employed to analyze the form to find the samples' levels of satisfaction with the Problem-Based Learning Approach.

4. Research Results

According to the research objectives, the results are presented as follows.

4.1 The results of compare learning achievements before and after receiving the Problem-Based Learning Approach

Table 1 The results of compare learning achievements before and after receiving the Problem-Based Learning Approach

Test	n	score	\bar{x}	S.D.	t	df	sig
before	66	30	17.21	2.02	37.37	65	.00
after	66	30	26.62	1.97			

The table above indicates that the learning achievements of students after received the Problem-Based Learning Approach was significantly higher than before learning at the level .05.

4.2 The results of compare learning achievement with the determined criteria set at 70 percent

Table 2 The results of compare learning achievement with the determined criteria set at 70 percent

Test	n	score	\bar{x}	criteria	S.D.	t	Sig.
learning achievement	66	30	26.62	70	2.00	23.23	.00

The table above indicates that the learning achievement of students was 89 percent that higher than the standard criteria of 70 percent with statistical significance at the level .05.

4.3 The result of student's satisfaction on the Problem-Based Learning Approach

Table 3 The result of student's satisfaction on the Problem-Based Learning Approach

Items	\bar{x}	S.D.	Levels of satisfaction
The formal difference between PBL teaching approach and traditional teaching approach	5.00	0.00	highest
Classroom atmosphere activity	5.00	0.00	highest
Students fully express their views	5.00	0.00	highest
Improve students' ability to solve problems	4.00	0.61	high
Improvement of students' learning enthusiasm	5.00	0.00	highest
Improvement of students' innovative thinking ability	4.55	0.50	highest
Classroom atmosphere created by PBL teaching approach	4.05	0.64	high
Students' mastery of classroom knowledge of fundamentals of information technology course	5.00	0.00	highest
Improve students' academic performance	5.00	0.00	highest
The change of teachers' role in the classroom	4.50	0.66	highest

Table 3 (Continue)

Items	\bar{x}	S.D.	Levels of satisfaction
Mutual help from team members	5.00	0.00	highest
Group cooperation mode can better promote the mastery of personal classroom knowledge	5.00	0.00	highest
Teaching effect of PBL teaching approach in fundamentals of information technology course	4.55	0.79	highest
Total	4.74	0.25	highest

The table above indicates that the student's satisfaction on the Problem-Based Learning Approach after learning was ranked at the highest level ($\bar{x} = 4.74$, S.D. = 0.25).

5. Discussion

According to the research results, the following points are discussed:

5.1 This paper studies the application of problem-based learning approach in the classroom of computer specialty in Zhoukou Normal University. By introducing problem-based learning approach into the classroom of "information technology foundation" of computer specialty course, this paper solves some existing problems, improves the teaching effect, and provides a certain reference for the future teaching reform.

5.2 In the research process, students actively use their brains to think, search learning information and learning resources through various channels, analyze and screen, explore independently, and actively practice solving problems; in practice, students can skillfully apply the basic theories and basic concepts learned to the production of works; group cooperation also improves the ability of team cooperation. As scholars have said, the purpose of PBL is to make students better participate in the classroom and become the main body of the classroom. By improving students' participation in the classroom, it can improve students' sense of achievement in the classroom, and then cultivate students' interest in learning. (Pan, 2020).

5.3 Problem-based learning approach has achieved good results in this teaching practice. On the one hand, it is due to the nature of problem-based learning approach itself, on the other hand, it is also related to students' characteristics, teachers' style, harmony of class atmosphere, teaching objectives, class arrangement, etc. Therefore, when problem-based learning approach is applied to other majors and other courses, these factors should be fully considered. This is also merging with the views of scholars: PBL is not a simple teaching method. PBL is a complex teaching method that needs to mobilize all elements of teaching. In the process of using it, it will glow with different brilliance according to different teachers, students, and teaching contents. (Liu, 2018).

5.4 Problem based learning model was not designed to help instructors provide as much information to students. It was developed to help students improve problem solving skills and their involvement in real experiences in the form of simulations, and become student-focused learning. The problem-based learning model is more challenging because learning begins with a real problem encountered in work (Pardimin, Arcana, & Supriadi, 2019). Problem based learning could improve the ability of problem solving while learning outcomes indicate that students use their tacit knowledge for problem solving (Chamidy, Degeng, & Ulfa, 2020).

5.5 The student's satisfaction on the Problem-Based Learning Approach after learning was ranked at the highest level ($\bar{x} = 4.74$, S.D. = 0.25), and the samples' satisfaction with the formal difference between PBL teaching approach and traditional teaching approach, classroom atmosphere activity, students fully express their views, improvement of students' learning enthusiasm, students' mastery of classroom knowledge of fundamentals of information technology course, improve students' academic performance, mutual help from team members, and group cooperation mode can better promote the mastery of personal classroom knowledge were also found at highest level ($\bar{x} = 5.00$, S.D. = 0.00). This is similar to the research results of the researcher who said that the samples were satisfied with the local innovation because it covered the needed contents, and was convenient to use (Sonam and Pema, 2021; Jiang et al., 2017).

6. Conclusion

After statistical analysis of student data, it is found that:

For the problem, creating a situation is its fundamental condition. Teachers combine the actual situation of teaching content and objectives to create relevant learning situations of interest to students, so that they are willing to explore. For the curriculum, students are the main body, give full play to students' subjective initiative, make students diligent in thinking and willing to cooperate, enable them to actively connect thinking and knowledge, and improve their application ability, to improve students' ability to understand and deal with problems.

Group cooperation, creative design of works, group members actively discuss, learn from each other, cooperate to complete the work display, which plays a positive role in promoting students' academic performance.

In the process of problem-based learning approach, teachers should pay attention to the problems of students in cooperative learning and solve them in time; Teachers should fully grasp the learning situation, correctly guide students and deal with the relationship between teachers and students. Therefore, in PBL teaching practice, students, teachers, and teaching environment should be fully considered to better improve students' academic performance and students' satisfaction.

7. Recommendations

7.1 In problem-based learning approach, teachers should timely guide students to the problems encountered in the discussion process. After teaching, teachers should evaluate the whole process and give targeted guidance to the problems in the process. In the process of group discussion and achievement display, teachers should also encourage students to ask questions boldly, and let students dare to make their own suggestions in the whole teaching process.

7.2 Through the research results, it is found that problem-based learning approach can be applied to computer professional courses, but the teaching mode is not perfect in computer professional courses. Therefore, we need to explore a set of problem-based learning approach that is more in line with the computer courses in colleges and universities in the application of this mode in combination with the characteristics of school students and the conditions of software and hardware facilities of the school itself. Finally, a more characteristic school-based model will be formed.

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