IRSTI 14.07.09 https://doi.org/10.26577/JES.2023.v74.i1.02

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IMPROVING CRITICAL THINKING SKILLS OF MASTER STUDENTS THROUGH PROBLEM-BASED LEARNING MODEL

Critical thinking is one of the most essential skills in the education system of modern society. In the field of education, many methods and techniques are used to develop this skill. In this regard, the problem-based learning method can be considered as the most effective of the various methods. It was investigated the efficiency of Problem-Based Learning (PBL) model as a useful strategy for improving English language learners' critical thinking skills. The participants of this study were 34 Master Students of Academic Writing program of Khoja Akhmet Yassawi International Kazakh-Turkish University. English language learners were separated into experimental and control groups. The author used pre and post tests as a data collection instrument. In order to analyze the test results a quantitative method and descriptive statistical analysis were applied. The test scores were measured according to the six indicators of Bloom's Taxonomy thinking levels. The study lasted five weeks and the experimental group was taught online via Google classroom platform. In this research, a mind mapping strategy was used as a brainstorming tool to define and solve problems. It can be noted that the experimental group's post-test scores and learning outcomes were significantly improved. The experimental group achieved high scores from understanding and evaluation indicators, scoring 79% and 76% higher than the average scores respectively. This means that they can understand and evaluate any information they read or hear. While the other indicators, namely memorization (65%), application (68%) creation (61%) and analysis (51%), were also higher than the previous test scores. The latest results of the study identified the problem-oriented learning (PBL) model as the most effective method for developing critical thinking and recommend its independent application in any educational institution. It was also found that the integrated application of the problem-based learning (PBL) model with the mind mapping strategy can improve English language learners' critical thinking skills.

Key words: critical thinking, Bloom's Taxonomy, problem-based learning (PBL), mind map, MindMeister.

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Проблемалық оқыту моделінің көмегімен магистранттардың сыни ойлау дағдыларын дамыту

Сыни тұрғыдан ойлау – қазіргі қоғамның білім беру жүйесіндегі маңызды дағдылардың бірі. Білім беру саласындағы бұл дағдыны дамытуда көптеген әдіс-тәсілдер қолданылып келеді. Осы орайда түрлі әдіс-тәсілдердің ішіндегі ең тиімдісі ретінде проблемалық оқыту әдісін қарастыруға болады. Мақалада ағылшын тілін үйренушілердің сыни ойлау дағдыларын жетілдірудің тиімді стратегиясы ретінде проблемалық оқыту моделінің тиімділігі зерттелді. Зерттеуге Қожа Ахмет Ясауи атындағы Халықаралық қазақ-түрік университетінің академиялық жазылым бағдарламасының 34 магистранты қатысты. Ағылшын тілін үйренушілер эксперименттік және бақылау топтарына бөлінді. Автор деректерді жинау құралы ретінде алдын-ала және кейінгі сынақтарды қолданды. Тестілеу нәтижелерін талдау үшін сандық әдіс және сипаттамалық статистикалық талдау пайдаланылды. Тестілеу ұпайлары Блум таксономиясының ойлау деңгейінің алты деңгейіне негізделе отырып бағаланды. Зерттеу бес аптаға созылды және тәжірибелік топ онлайн режимде Google classroom платформасы арқылы оқыды. Бұл эксперименттік зерттеуде ақыл-ойды көрсету стратегиясы проблемаларды анықтау және шешу үшін миға шабуыл құралы ретінде қолданылды. Тестілеуден кейінгі эксперименттік топтың нәтижелері мен оқу нәтижелері айтарлықтай жақсарғанын атап өтуге болады. Эксперименттік

топ түсіну және бағалау көрсеткіштері бойынша жоғары балл алды, сәйкесінше орташа баллдан 79% және 76% артық жинады. Бұл олар оқыған немесе естіген кез келген ақпаратты түсініп, бағалай алатындығын білдіреді. Басқа көрсеткіштер, атап айтқанда, есте сақтау (65%), қолдану (68%), құру (61%) және талдау (51%) тестілеуге дейінгі нәтижелерден жоғары болды. Зерттеудің соңғы нәтижелері проблемалық-бағытталған оқыту әдісін сыни ойлауды дамытудың ең тиімді әдісі ретінде анықтады және оны кез келген оқу орнында тәуелсіз қолдануды ұсынады. Сондай-ақ ақыл-ой картасы стратегиясымен проблемалық-бағытталған оқыту моделін кешенді қолдану ағылшын тілін үйренушілердің сыни ойлау қабілеттерін жақсарта алатындығы анықталды.

Түйін сөздер: сыни ойлау, Блум таксономиясы, проблемалық оқыту, ақыл-ой картасы, Mind-Meister.

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Развитие навыков критического мышления у магистрантов с помощью проблемно-ориентированной модели обучения

Критическое мышление является одним из важнейших навыков в системе образования современного общества. Для развития данного навыка используется множество методов и приемов обучения, в том числе метод проблемного обучения. В статье рассмотрена эффективность модели проблемного обучения как стратегии по улучшению навыков критического мышления у изучающих английский язык. Участниками этого исследования были 34 магистранта программы академического письма Международного Казахско-Турецкого университета имени Ходжи Ахмеда Ясави. Изучающие английский язык были разделены на экспериментальную и контрольную группы. Авторы использовали предварительные и последующие тесты в качестве инструмента сбора данных. Для анализа результатов тестирования были применены количественный метод и описательный статистический анализ. Результаты тестов были измерены в соответствии с шестью показателями уровня мышления таксономии Блума. Исследование длилось пять недель и экспериментальная группа обучалась онлайн через платформу Google classroom. В экспериментальном исследовании стратегия обучения использовалась в качестве инструмента мозгового штурма для определения и решения проблем. Можно отметить, что результаты экспериментальной группы после тестирования были значительно улучшены. Экспериментальная группа получила высокие баллы по показателям понимания и оценки, набрав на 79% и 76% больше средних баллов соответственно. Это означает, что они могут понимать и оценивать любую информацию, которую они читают или слышат. В то время как другие показатели, а именно запоминание (65%), применение (68%), создание (61%) и анализ (51%), также были выше, чем результаты предыдущих тестов. Полученные результаты исследования показали, что проблемно-ориентированный метод обучения является эффективным методом развития критического мышления, и метод рекомендуется для самостоятельного применения в любом учебном заведении. Также было обнаружено, что комплексное применение проблемно-ориентированной модели обучения со стратегией интеллектуальных карт может улучшить навыки критического мышления у изучающих английский язык.

Ключевые слова: критическое мышление, таксономия Блума, проблемное обучение, интеллект-карта, MindMeister.

Introduction

Currently, due to various changes taking place in the world, the process of globalization and the development of advanced information technologies in the education system, high demands are placed on English language learners. For this purpose in the conditions of a developed information society, there is a need to train future specialists, whose creative activity and moral nature are in harmony, who are able to think critically, who are able to use information correctly, who have formed information literacy and competence to work with information. As the head of State N. A. Nazarbayev noted in his speech to the people of Kazakhstan in order to become a competitive developed state, we must become a highly literate country (Nazarbaev, 2012a) [1]. Besides, 21st century demands learners to obtain a variety of skills that can help them succeed in life. Such 21st century skills "4C" are critical thinking, communication, collaboration, creativity, life, and career skills (National Education Association, 2012:2) [2].

In addition, in his address N. A. Nazarbayev emphasized the importance of improving the education system, and the need to focus on new training programs and the development of self – learning skills, as well as the importance of training future specialists with critical thinking and creative skills. (Nazarbaev, 2017b) [3].

In addition, students face a wide range of information in their academic life. Therefore, in order to understand such information critical thinking skills are needed. It is because critical thinking is logical, reflective thinking, and has prior knowledge related to the problems faced by students (Lestari, et al., 2021:2003) [4]. The aim of this research is to examine problem-based learning as an effective method of developing students' critical thinking skills, and through this method to adapt students to the ability to see the real problem, determine the cause of its occurrence, and find a solution to the problem so as to put it into practice in life. In order to implement this aim, following tasks were considered: to reveal the theoretical essence of critical thinking and problem-based learning, to determine the stages of PBL model, and to conduct experimental research among students using these stages, analyze the results and present conclusions and recommendations.

Therefore, the formation of students' skills of creative solution of social problems, the development of critical thinking and personal views, the ability to constantly enrich independent knowledge and adapt the acquired skills to constant creative use in life are considered as the main prerequisites for educational institutions of modern society.

Literature review

D.F. Halpern believes critical thinking is a deliberate meta-cognitive (thinking about thinking) and cognitive (thinking) action in which a person simultaneously reflects on the quality of the thinking process while making conclusions. He believes that a critical thinker has two equally important goals, that is, to come to a solution and improve the reasons for it (Halpern, 2013:5) [5].On the other hand, critical thinking is accurate and rational thinking, which also includes systematic thinking (Lau, 2011:7) [6].

Researchers have stated different definitions of critical thinking and problem-based learning. Although these two notions are defined in different ways, P21 provides the following definitions of critical thinking (Framework for 21st Century Learning Definitions, 2019:4) [7]. These definitions can be seen in Figure 1.

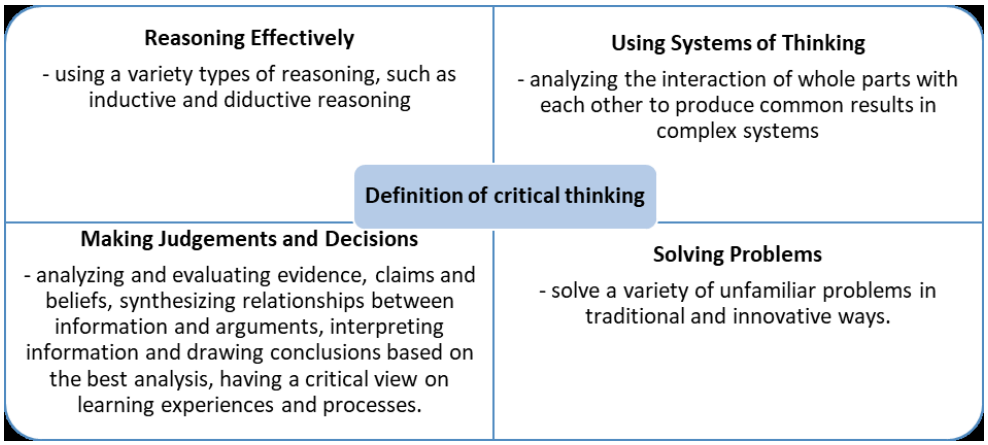

Figure 1 – Definitions of Critical Thinking by P21

The concept of critical thinking and the taxonomy of pedagogical goals were developed in 1956 under the leadership of the famous scientist, the American Psychologist of teaching methods, professor at the University of Chicago, the creator of the bloom taxonomy Benjamin Samuel Bloom, and a group of American psychologists and teachers (Bloom et al., 1956:18) [8]. B. Bloom identifies six categories of educational goals: 1. Knowledge. 2. Comprehension. 3. Application. 4. Analysis. 5. Synthesis. 6. Evaluation. However, these categories are then revised to be remembering, understanding, applying, analysing, evaluating, and creating (Krathwohl, & Anderson, 2010:9) [9]. In this article we used the revised version of Bloom's Taxonomy thinking levels, as indicated in Figure 1.

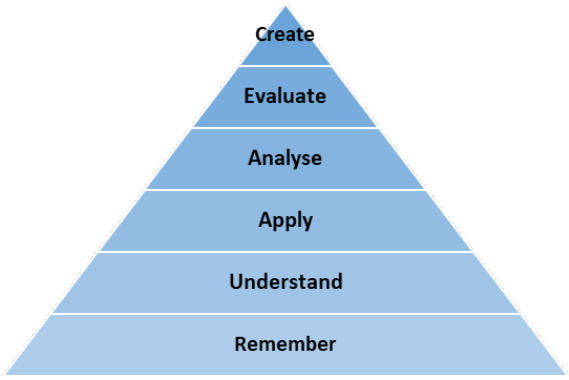

Figure 2 – The revised taxonomy by Anderson et al. (2001)

In addition, the levels of Bloom's thinking taxonomy are divided into two categories, namely lower-level thinking which consists of remembering and understanding, and higher-level thinking which comprises applying analysing, evaluating, and creating. (Magas et al., 2017:223) [10].

If we focus on six categories of educational goals, the student not only learns, but also understands the acquired knowledge, that is, answers questions about what he learned and why he learned. Having received answers to such questions, he should be able to put it into practice, that is, consciously apply the acquired knowledge at different stages of life, in different situations. However, today, with the rapid development of information technologies, useful and useless information of various directions has become widespread in society. This shows how important the fourth and fifth categories *(analysis and synthesis)* of Bloom's taxonomy are in this regard. It is not always possible to trust what you read or hear. Therefore, you need to analyze and synthesize in depth who received the information, how much you can trust this information and the person who wrote it, and for what purpose the information was written. At the final assessment stage, students study the received information in depth and draw conclusions about it. The student evaluates where and how to apply the acquired knowledge, what he learned from it, and expresses his views and suggestions on this issue. According to Facione, critical thinking helps students not only accumulate information, but also understand and analyze it, as well as acquire knowledge that leads to succeed in their personal and professional lives (Facione, 2015:15) [11]. It is for this reason that the last three stages of thinking are called high-level thinking or critical thinking. Therefore, we believe that critical thinkers should be the primary goal of all academic institutions (Paul, & Elder, 2019:18) [12].

By applying a variety of teaching methods which require students to be active during the learning process, various thinking skills of students can be enhanced. In such case, problem-based learning (PBL) model can be used to critical thinking skills development. This model represents learning objectives in the form of problems, which begins by observing an event, then looks for problems in the event, and solves the problem (Setiawan, & Islami, 2020:3) [13].

It is also believed that integrating PBL with *Mind maps* improves student learning performance and achievements (Hariyadi et al., 2018:80) [14]. According to Buzan, the mind map is a thinking tool that helps students process information, create new ideas, improve teaching methods, and increase their creative thinking through a diagram used in the hierarchical organization of information (Buzan, 2018:9) [15]. According to Ningsih and Said, when the mind map is used as a learning tool, students can score higher than those who study through a group discussion strategy (Ningsih, & Said, 2018:586) [16].

In addition, mind mapping has also become a web-based application of *MindMeister*, where students can easily customize the mind mapping by choosing the best structure, style and colors for effective learning, as it helps students capture, develop and share ideas on the internet in a visual and effective way. One of the advantages of this software is that students can add videos, images, and upload various files to the map (Hazaymeh, & Alomery, 2022:142) [17].

Research methods

Research Design

This experimental research employed a quantitative method. According to Rover and Fakiti, the quantitative method uses numbers, quantification, and statistics to answer research questions, which include measuring and quantifying language and language features of interest, in particular language proficiency, language skills, aptitudes, and motivation (Roever, & Phakiti, 2017:18) [18]. In this case, the researcher used the quantitative method to measure students' critical thinking skills.

Participants

The researcher conducted this study on March 2022 in the academic year 2021/2022 in Khoja

Akhmet Yassawi International Kazakh-Turkish University. The participants were 34 Master Students of Academic Writing program, ranging in age from 21 to 35 years, who were selected with the same academic abilities. Students were randomly assigned to an experimental group of 17 students who taught through Problem Based Learning (PBL) model with mind mapping as an effective strategy to increase their critical thinking abilities, and a control group of 17 students who taught using a traditional learning method. This experimental study conducted pretest and posttest observations to assess students' critical thinking, as well as to compare the results between participants to determine in which area critical thinking skills were improved. Students were taught online via Google classroom platform, and this helped them to manage with the learning materials. That is, the learning materials were uploaded twice a week, therefore, students were allowed to view and accomplish all the materials at a convenient time for them.

Research instruments and procedures

The pre and post tests were applied as a data collection instrument, and a quantitative method and descriptive statistical analysis were used to analyze the test results. Before teaching, students were given a preliminary test to test their thinking abilities.

Each of these tests was given a total of 100 points, and the test questions consisted of 30 multiple choice questions. Students were asked to read the instruction carefully, comprehend the questions, and select the best option that suited the question.

The researcher classified and measured the pretest and posttest scores based on the indicators of the revised version of Bloom's Taxonomy thinking levels. These indicators can be seen in Table 1.

Table 1 – Indicators of Critical Thinking Levels

Critical Thinking Levels	Critical Thinking Skills	Indicators of Critical Thinking Levels
Lower levels		
Remembering	define, memorize, repeat, state, list, describe	Recognizing and recalling facts
Understanding	explain, classify, describe, recognize, discuss, identify, locate	Understanding what the fact mean
Higher levels		
Applying	use, solve, implement, demonstrate, operate, interpret	Applying the rules, facts and ideas
Analyzing	differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test	Breaking down information into component parts
Evaluating	argue, defend, judge, select, support, value, critique, conclude	Judging the value of information or ideas
Creating	design, construct, develop, formulate, author, investigate, produce, plan	Combining parts to make a new whole

When analyzing the results of students, the authors used simple descriptive statistical analysis. The researcher used a simple formula to measure the average abilities of students (Neno, & Erfiani, 2018:176) [19]. The formula used to calculate the ability level of students in the entire class is as follows:

$$\bar{X} = \sum X/n$$

Where:

$\bar{X}$ = Mean / the average of students' score
$\sum X$ = The sum of every data / total score
n = The sum of data/ the number of students

The pretest and post-test total scores, average scores, maximum scores, minimum scores, and level of improvement were identified. The percentages of test results were assigned to three levels of value, namely 0-41% – below average (low value), 41-60% – average (good value), and 61-100% – above average (excellent value) and the six indicators of Critical Thinking Levels were scored as well.

This experimental study lasted five weeks. The first week of the study was devoted to preliminary testing of students' thinking abilities and identifying the areas where they have difficulties in critical thinking. The preliminary test was conducted to both groups (experimental and control) a week before the treatment. Similarly, the post-test was

carried out a week after the treatment. Having analyzed the preliminary test results, the necessary materials and teaching aids for the development of critical thinking have been developed. The remaining three weeks were devoted to the implementation of the problem-based learning (PBL) model to enhance critical thinking. The PBL model consists of six stages, namely recognizing a problem, defining a problem, focused observation, brainstorming with graphic organizers, setting goals and troubleshooting (Starkey, 2010:9) [20] as shown in Figure 2.

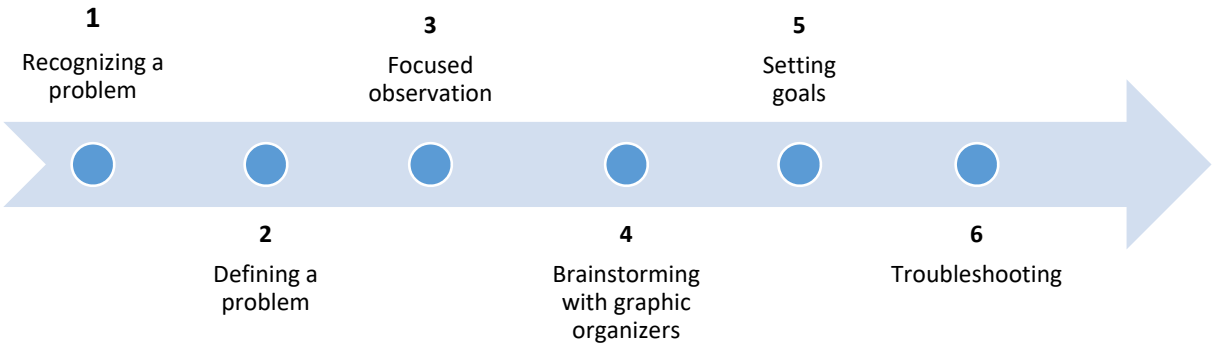

Figure 3 – PBL Model Stages

The experimental research classes were conducted on the Google classroom platform. The training materials were uploaded to Google classroom twice a week, and each stage consisted of training tools in the form of a Word document, a test, and you tube videos where the PBL model stages explained.

First stage was recognizing a problem which included types of problems (important and severe problems), barriers to recognizing a problem and practice tests and situational questions.

Second stage, defining a problem, provided information about what a real problem is, distinguishing between problems and their symptoms or consequences, avoiding making assumptions, roadblock to defining a problem, practice tests and specific questions to define a problem.

In the third stage, focused observation, the students taught how to make a close observation about a problem, how to gather information and much attention was paid to the importance of concentration, attentiveness and thoroughness, and practice tests to complete this stage.

Brainstorming with graphic organizers, such as concept maps, Venn diagram, and other graphic organizers used in the fourth stage to assist students brainstorm their ideas and find solutions to problems. Graphic organizers are a meaningful display of complex information, and it facilitates students to come up with solutions, gather information, and keep students focused on the problem.

In the fifth stage of the PBL model, students learnt how to make a plan, set a goal and resolve the problem. Students also got acquainted with SMART Goal Techniques, in other words, five qualities of a sound goal, namely S – specific, M – measured, A – achievable, R – relevant, and T – timed or deadline – oriented. This allowed students to concentrate on the most relevant information, set a specific, measurable and achievable goal, and reach this goal within the specified time frame.

The last stage, namely troubleshooting, ensured that students were ready to prevent any blocks or problems that might appear while making a plan. This stage was about anticipating and dealing with any obstacles even before they appeared.

Besides, the last three stages required students to have a high – level thinking, which is critical thinking, as well as creative thinking abilities. Thus, in order to develop students' critical and creative thinking skills, this study used a lot of graphic organizers, espesially mind maps. Therefore the MindMeister platform was applied to help students visually see the problem and ways to solve it, as well as to make the tasks more interesting and attractive. To do so, the experimental group students were taught how to create mind maps using MindMeister, and provided them with instructional video created by Tony Buzan, who is the inventor of mind maps.

Findings / Results

The test results were obtained using the quantitative method to achieve the research goal. Table 2 below represents the preliminary test results of the experimental and control groups.

The researcher used a simple formula to measure the average test scores of both groups. As shown in the table 2, the test results of the experimental group were relatively high compared to the control group. However, these were the total, average, maximum and minimum scores of each group. In order to obtain complete information from the pre-test, the results were analyzed in detail based on the thinking levels of Bloom's taxonomy, to determine the degree of thinking abilities of students, and the difficulties in thinking. The results can be seen in Table 3 below.

Table 2 – Experimental and Control group students' pre-test scores

Group	Number of Students	Total score	Mean/Average score	Maximum Score	Minimum Score
Experimental	17	965	55	70	40
Control	17	765	45	60	20

Table 3 – The Average Score of the Indicators of Critical Thinking (Pre-test)

Indicators of Critical Thinking Skills	Average Score of Experimental Group (Pre-test)	Criteria	Average Score of Control Group (Pre-test)	Criteria
Remember	45%	average (good value)	27%	below average (low value)
Understand	32%	below average (low value)	23%	below average (low value)
Apply	46%	average (good value)	43%	average (good value)
Analyze	49%	average (good value)	40%	below average (low value)
Evaluate	44%	average (good value)	28%	below average (low value)
Create	29%	below average (low value)	23%	below average (low value)

Table 3 presents the average values of experimental and control group students' thinking skills. According to the table, the experimental group received an average score of 49% from the analysis stage, and the lowest critical thinking skills were found in creation stage which scored 29% below average. While the other indicators were in the good value for remember, apply, and evaluate indicators (45%, 46% and 44%), and low value category for understand indicator (32%). While the control group scored 43% of the average score in application stage, and 23% below average in understanding and creating stages respectively. Based on the table above, it was found that students of both groups did not achieve high results. From the results of the preliminary test scores, it was also revealed that the students of both groups had the same difficulties in remembering and defining problems, since the test questions required students to find a real problem and determine its solutions. Therefore, it was difficult for students to correctly answer other test questions before determining the root cause of the problem.

Furthermore, Table 4 below demonstrates the post-test results of both groups.

Table 4 – Experimental and control group students' post-test scores

Group	Number of Students N	Total score	Mean/Average score	Maximum Score	Minimum Score
Experimental	17	1360	80	90	50
Control	17	870	51	60	30

Table 4 presented that the average score of the post-test obtained after teaching the experimental group were 80, which shows that teaching with a problem based learning method was much more effective than teaching with a traditional method. As can be seen from the table above, the experimental group students' final results were notably improved than the results of preliminary testing. To be more precise, in pre-test, the average score of students was 55%, and the post-test score was 80%, and the improvement rate of students after the pre-test was 25%. It is worth considering that the PBL model had a positive impact on the students' test results. It shows us that the experimental group students had got enough practice to find the main problem, make judgments and find solutions to the problem. While the control group students' test results were not higher, that is, the average percentage of pre-test results was 45%, whereas the post-test was 51%, and the level improvement was only 6%. This represents that test results were low, because they were not thoroughly taught through problem-based learning model, and the necessary skills, such as critical thinking, problem solving, analyzing and reasoning were still lacking.

In addition, learning outcomes of the experimental group students were remarkably enhanced, as indicated in Table 5.

Table 5 – The Average Score of the Indicators of Critical Thinking (Post-test)

Indicators of Critical Thinking Skills	Average Score of Experimental Group (Post-test)	Criteria	Average Score of Control Group (Post-test)	Criteria
Remember	65%	above average (excellent value)	35%	below average (low value)
Understand	79%	above average (excellent value)	42%	average (good value)
Apply	68%	above average (excellent value)	32%	below average (low value)
Analyze	51%	average (good value)	29%	below average (low value)
Evaluate	76%	above average (excellent value)	38%	below average (low value)
Create	61%	above average (excellent value)	46%	average (good value)

Furthermore, the experimental group achieved high scores from understanding and evaluation indicators, scoring 79% and 76% higher than the average scores respectively. Similarly, in the other three stages, namely remembering (65%), applying (68%) and creating (61%), students scored slightly the same scores. Nevertheless, significant increase was not found in the analysis indicator (51%) compared to the preliminary test result. This might be due to the lack of time to apply the PBL method and mind mapping strategy, as these techniques require a lot of dedication and time to learn and perform.

As for the final results, the control group students achieved slightly higher results in understanding (42%) and creating indicators. While the other indicators were in low value for memorization (35%), application (32%), analysis (29%), and evaluation (38%) respectively. This indicates that the comparison groups had low critical thinking skills and there were no significant changes in their results. However, the experimental group indicated

impressively higher results than the control group, as they often used the mind mapping strategy to perform critical thinking tasks. This helped them to clearly see each problem and find its solution. Based on the final test results above, the problematic teaching method has a significant impact on improving critical thinking skills.

Discussion

This study represents the experimental and control group students' test results, and the effectiveness of using Problem-Based learning model with mind mapping strategy. The experiment intended to investigate whether there was a significant difference in the results of the experimental and control groups. Based on the pre-test results, the mean scores of two groups were nearly similar, meaning their initial critical thinking skills before the post-test were almost identical. The mean scores of both groups were considerably different, that is, after final testing, the results of the experimental group exceeded the control groups. Compared to the traditional teaching method, the PBL learning model has had a remarkable impact on the critical thinking of students and improving their learning outcomes. The test questions were developed based on the Bloom's Taxonomy Thinking Levels, and PBL learning model. As, the levels of Bloom's thinking taxonomy, are divided into two categories, namely *low-level thinking (remembering and understanding)* and *high-level thinking (applying, analysing, evaluating, and creating)*. Therefore, the high-level thinking is also considered as the critical thinking.

Problem-Based learning model was chosen as one of the most efficient ways to improve students' critical thinking skills, as it not only represents real life problems, complex ideas and situations, but also instills students in the ability to make decisions in any different life situations, be ready for various changes, and think about and evaluate each problem in advance. In this case, this experimental research applied PBL learning model which consists of six stages, such as recognizing a problem, defining a problem, focused observation, brainstorming with graphic organizers, setting goals and troubleshooting. The first two stages of the PBL learning model, which are problem recognition and problem definition, coincide with the levels of Bloom's Taxonomy Thinking Levels, such as remembering and understanding. In addition, the other four stages of the PBL learning model are close to the higher-order thinking levels of Bloom's taxonomy in terms of their use. Therefore, the indicators of Bloom's Taxonomy thinking levels were used as a means of measurement and evaluation for both pre-and post-tests.

In addition to the PBL learning model, this study identifies mind mapping strategies as one of the useful ways of developing students' critical thinking skills, since mind mapping was an innovative form of note-taking combined with words and colors. Agreeing with the opinion of Tony Buzan, in order to capture students' interest and involve them in learning process, mind maps can be created on the MindMeister platform. One of the advantages of this platform is that, it can help learners brainstorm, organize, think deeply and critically to generate more relevant ideas, and share them online. Indeed, mind maps created by the experimental group students on the MindMeister platform, have helped them to score high in the post-test, in comparison with the control group.

Conclusion and Recommendations

This experimental research applied the Problem-Based Learning (PBL) model as one of the efficient methods for encouraging students to think critically. Before giving any treatment to students, the researcher conducted the pre-test to measure students' thinking skills and learning outcomes. This experimental research used quantitative method to measure students' thinking abilities. The results of the preliminary testing of both groups did not show a high level, which means that the results were almost identical, due to the lack of basic knowledge about problem-based learning method. Thus, the researcher developed the PBL learning model consisting of six stages, including problem recognition, problem identification, focused observation, brainstorming with graphic organizers, goal setting and troubleshooting. Each of these stages was chosen and applied by the author depending on the weaknesses of students in critical thinking. The experimental group was encouraged to participate in this learning model and learn the necessary knowledge through the Google classroom platform to enhance critical thinking skills. After participating in this PBL training model, the learning achievements of the students were noticeably improved. Besides, the experimental group students performed well and achieved good results in every learning activity, such as identifying a real problem, brainstorming its solutions, creating mind maps on

the MindMeister platform, setting goals for solving the problem and troubleshooting the problem. The post-test results revealed that the experimental group achieved significantly higher results in each critical thinking indicator than the control group. Thus, by applying PBL model, it is possible to increase students' thinking skills at a high level.

In order to enhance students' thinking abilities, it is recommended that English language teachers implement the PBL model as an effective teaching method. Additionally, incorporating the mind mapping strategy as a brainstorming tool into the teaching process can be the means of critical thinking and learning outcomes development.

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