

การพัฒนาความสามารถในการแก้ปัญหาและผลสัมฤทธิ์ทางการเรียนวิชาเคมีของนักเรียน ชั้นมัธยมศึกษาปีที่ 6

The Development of Problem-solving Ability and Learning Achievement in Chemistry Subject of Mathayomsuksa 6 Students

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บทคัดย่อ

การวิจัยเชิงปฏิบัติการมีจุดมุ่งหมายเพื่อ 1) พัฒนาความสามารถในการแก้ปัญหาให้ผ่านเกณฑ์ร้อยละ 70 ของคะแนนเต็ม 2) ศึกษาผลสัมฤทธิ์ทางการเรียนวิชาเคมี กลุ่มเป้าหมายเป็นนักเรียนชั้นมัธยมศึกษาปีที่ 6 จำนวน 19 คน โดยการเลือกแบบเจาะจงจากผู้ที่มีความสามารถในการแก้ปัญหาวิจัยเชิงปฏิบัติการแบ่งออกเป็น 3 วงรอบ เครื่องมือมีทั้งสิ้น 7 เครื่องมือ ได้แก่ 1) แบบวัดความสามารถในการแก้ปัญหา แบบอัตนัย 2) แบบวัดผลสัมฤทธิ์ทางการเรียนวิชาเคมี แบบปรนัย 5 ตัวเลือก 3) แบบสังเกตพฤติกรรมในการแก้ปัญหาของผู้เรียน 4) แบบบันทึกกิจกรรมการเรียนรู้ 5) อนุทิน 6) แบบสัมภาษณ์ 7) แผนการจัดการเรียนรู้ ผลวิจัยพบว่า

1) วงรอบที่ 1 กิจกรรมการเรียนรู้โดยใช้ปัญหาเป็นฐาน พบว่าผู้เรียนมีคะแนนเฉลี่ยความสามารถในการแก้ปัญหาเท่ากับ 5.49 คิดเป็นร้อยละ 68.64 โดยมีผู้เรียนในกลุ่มเป้าหมายผ่านเกณฑ์ร้อยละ 70 ทั้งสิ้น 10 คน คิดเป็นร้อยละ 52.63 และคะแนนผลสัมฤทธิ์ทางการเรียนมีค่าเฉลี่ยเท่ากับ 8.05 คิดเป็นร้อยละ 80.53 2) วงรอบที่ 2 กิจกรรมการเรียนรู้โดยใช้ปัญหาเป็นฐานร่วมกับสื่อสังคมออนไลน์ พบว่า ผู้เรียนมีคะแนนเฉลี่ยความสามารถในการแก้ปัญหาเท่ากับ 5.49 คิดเป็นร้อยละ 68.64 โดยมีผู้เรียนในกลุ่มเป้าหมายผ่านเกณฑ์ร้อยละ 70 ทั้งสิ้น 14 คน คิดเป็นร้อยละ 73.68 และคะแนนผลสัมฤทธิ์ทางการเรียนมีค่าเฉลี่ยเท่ากับ 7.47 คิดเป็นร้อยละ 74.74 3) วงรอบที่ 3 กิจกรรมการเรียนรู้โดยใช้ปัญหาเป็นฐานร่วมกับเทคนิค KWL พบว่า ผู้เรียนมีคะแนนเฉลี่ยความสามารถในการแก้ปัญหาเท่ากับ 6.31 คิดเป็นร้อยละ 78.84 โดยมีผู้เรียนในกลุ่มเป้าหมายผ่านเกณฑ์ร้อยละ 70 ทั้งสิ้น 18 คน คิดเป็นร้อยละ 94.74 และคะแนนผลสัมฤทธิ์ทางการเรียนมีค่าเฉลี่ยเท่ากับ 12.58 คิดเป็นร้อยละ 83.86

คำสำคัญ : ความสามารถในการแก้ปัญหา, การใช้ปัญหาเป็นฐาน, สื่อสังคมออนไลน์

Abstract

The aims of this classroom action research were 1) to develop students' Problem Solving Ability in order to pass the criteria of 70% 2) to examine the learning achievement in chemistry subject. The sample group was selected by the purposive sampling with 19 students of Mathayomsuksa 6 who were considered as having limited in problem-solving ability. The purposive sampling was used to select the target group. The classroom action research consisted of 3 cycles. Furthermore, there were two participants

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in this study which were the chemistry co-teacher and the teacher in department of science. The instruments employed in this study were: 1) the problem-solving ability test 2) chemistry learning achievement test 3) problem solving observation form 4) Learning activity report 5) reflective 6) interview form 7) lesson plan. The results from classroom action research revealed that:

1) In phase 1, the students who learned by Problem-Based Learning had average score of Problem Solving Ability at 5.49 or 68.64%. There were 10 students from the sample group passed the criteria at a percentage of 70 which was 52.63%. Learning achievement score were 8.05 or 80.53%. 2) In phase 2, the students who learned by Problem-Based learning that cooperated with social media had average score of Problem Solving Ability at 5.49 or 68.64. There were 14 students from the sample group passed the criteria at a percentage of 70 which was 73.68%. Learning achievement score was 7.47 or 74.74%. 3) In phase 3, the students who learned by Problem-Based Learning cooperated with KWL technique had average score of Problem Solving Ability at 6.31 or 78.84%, There were 18 students passed the criteria at a percentage of 70 of total scores which was 94.74% The learning achievement score were 12.58 or 83.86%.

Keywords : Problem-solving ability, Problem-based Learning (PBL), Social network resource

Introduction

At present, our world has been rapidly changing in every aspect. Technology has an important role to our society and people have to adjust themselves to the current situation. Importantly, science and technology are the basic factors and important tools in our daily lives. People are required to be acquainted with science in order to have good-quality lives in the world of science (The Institute for the Promotion of Teaching Science and Technology, 2008 : 62). Moreover, constructing innovations is challenging people to be successful, which is one of the important factors in our lives. Therefore, the education aimed at thinking ability is necessary to the current changing world.

According to The Basic Education Core Curriculum, student-centered learning especially in science learning leads the students to learn by doing while the teachers who acts as facilitator monitors them. Due to the indicators and learning results of the curriculum, students are required to be able to have higher thinking process, problem-solving ability, and ability to handle with obstacles in order to acquire the learning outcomes, which students have to be considered about scientific minds with ethics and morals. In learning science, students learn about the nature of human by observing, exploring, checking and experimenting, and systematically organizing. According to the principle of National Education Act of B.E 2542 (1999), Section 22, all students are capable of learning and self-development, and are regarded as being most important. Students are also able to develop themselves at their own pace and to the best of their potentiality. The goal of learning science is focusing not only the knowledge content but also self-inquiry learning to solve problem (The Institute for the Promotion of Teaching Science and Technology, 2008, p.78). Chemistry, which is a branch of science learning, aims at learning

by doing and experimenting. In chemistry subject, the learning competence focuses on problem-solving which is relevant to the nature of the subject which students have to experiment, explore, analyze, and synthesize. Moreover, the expected outcome of the curriculum obligates students to develop themselves of the best of their potentiality.

In this study, the researcher formerly assessed student's problem-solving competence and found that students were evaluated as "very good" for 5 students, "good" for 12 students, and "moderate" for 9 students respectively. Due to the aforementioned problem which affected to learning management in chemistry subject, the researcher was interested in developing about problem-solving ability (Academic Department, Mattayomyangsisurat School, 2016 : 25). In addition, the researcher also interviewed the former chemistry teacher in the last semester and also observed learning activities in physics and biology subject. It is found that students mostly follow the teacher's instruction. In group activity, level of the students in each group was various. The "low-achieving" students preferred not to work in same group with "high-achieving" students. Mostly, the "low-achieving students didn't tend to work and not brave enough to express their opinion. When the students have to solve the problems, the "low-achieving" students stopped working and let the "high-achieving" students work instead. In addition, the researcher measured student's problem solving competence by using the objective test adapted from Siripmon Honghaem (Honghaem, 2008 : 32), which consisted of 5 situations. After being measured by the test, out of 26, the students passed the test in the criteria of 70% for 7 students and didn't pass the test in the criteria of 70% for 19 students. The procedures of measurement were divided into 4 phases. For phase 1, understanding the problems, students passed the test in the criteria of 70% for 10 students and didn't pass the test in the criteria of 70% for 16 students. For phase 2, planning to solve the problems, students passed the test in the criteria of 70% for 8 students and didn't pass the test in the criteria of 70% for 18 students. For phase 3, doing to solve the problems, students passed the test in the criteria of 70% for 7 students and didn't pass the test in the criteria of 70% for 19 students. For stage 4, finally, evaluating, students passed the test in the criteria of 70% for 7 students and didn't pass the test in the criteria of 70% for 19 students.

The researcher has studied about the learning techniques which focus on developing problem-solving ability to improve learning achievement in chemistry subject. There were tons of learning techniques such as problem-based learning, KWL (What you know - What you want to know -What you have learned) technique. Besides, there were also teaching tools which motivate students in learning such as social media. In each teaching method and technique, they are promoting problem-solving ability in a different way. In problem-based learning, social media also encourages students to solve the real-life situation by the process of inquiring, discovering, planning, hypothesizing, and deciding appropriate ways to solve the problem. Moreover, students are capable of taking part for evaluating themselves and their group. Teachers might lead the students into the real-world situation or might imitate the situation. In group activity, students can analyze and solve the problem together so that they will have a better understanding. Therefore, students will be able to be a self-exploring learners, systematic thinkers, and problem-solvers (Kammanee,

2008 : 137). In project-based learning, student-centered learning is the essence of this learning so that students will have life-long learning. Project-based learning also promotes students' self-inquiry and provides students' opportunity to learn by planning and doing by themselves which teachers' role is a facilitator. The progress of project-based learning is a discovering of science and technology focusing on problem-solving. The activities of project-based learning promotes about self-planning to solve the problems. In KWL technique, learning is promoted by activating students to analyze their prior knowledge, be self-planning on what they want, and synthesize prior knowledge and new knowledge with their own pace. It is assumed that KWL technique is consistent to students' problem as if the technique promotes them to solve the problem (Moonkam & Moonkam, 2001 : 92). In cooperative learning, students are encouraged in learning environment as a group which the members of each group are potentially different, and all students are participated in the activities (Kammanee, 2008 : 40). The cooperative learning persuades students to share, synthesize, and develop their knowledge in order to solve the problems in steps by steps. Lastly, social media effectively activates students in learning because it is one of communication channel to discuss what they learn. In short, several of teaching methods and techniques that researcher are interested develops student's problem-solving ability.

From the aforementioned problem, the researcher systematically thinks about how to develop students' problem-solving ability and gain more understanding of the lessons, so the researchers conducts action research focusing on problem-based learning to develop Mattayomsuksa 6 students at Mattayomyangsisurat school, Maha Sarakham Province in order to boost students to have a higher problem-solving ability as to be consistent to the Basic Education Core Curriculum B.E 2551 (2008) (revised Edition B.E. 2560 (2017)

Objectives

This research consisted of two objectives including:

1. To develop Mattayomsuksa 6 students' problem-solving ability who were studying at Mattayomyangsisurat school in order to pass in the criteria of 70%
2. To study learning achievement in chemistry subject topic "Petroleum and Polymer"

Research Methodology

1. Participants

The participants of this study were 19 student in MattayomSuksa 6 who studying at Mattayomyangsisurat School. They were selected by purposive sampling because their problem-solving ability was below the criteria of 70%.

2. Content of the Study

The content used in this study was from chemistry 5 subject topic "Petroleum and Polymer" based on The Basic Education Core Curriculum B.E 2551 (2008)

3. Time Duration of the Study

This research was conducted during 1st semester, academic year 2018. The times were taken for 14 hours using 7 lesson plans.

4. Data Collection

The researcher collected the data from action research, which was divided in to 3 phases as following:

4.1 For phase 1, the students were taught by problem-based learning using 2 lessons plan together with behavior observation form in problem-solving ability and learning achievement test in chemistry subject. After that, the outcome was concluded in order to make a guideline for problem-solving for phase 2.

4.2 For phase 2, the students were taught by problem-based learning cooperated with social media using 2 lesson plans together with behavior observation form in problem-solving ability and learning achievement test in chemistry subject. After that, the outcome was concluded in order to make a guideline for problem-solving for phase 3.

4.3 For phase 3, the students were taught by problem-based learning cooperated with social media using 2 lesson plans together with behavior observation form in problem-solving ability and learning achievement test in chemistry subject.

5. Data Analysis

The data was analyzed based on 7 instruments including

5.1 The problem-solving ability test with 8 items in order to measure students' problem-solving ability. Discrimination value of the problem-solving test in phase one was 0.33 to 0.75 accounting that all items were appropriate. Discrimination value of the problem-solving test in phase two was 0.33 to 0.75 accounting that all items were appropriate. Discrimination value of the problem-solving test in phase three was 0.67 to 0.75 accounting that all items were appropriate. For the item difficulty value, the value in phase one was 0.42 to 0.54 accounting that all items were appropriate. In phase 2, the value of item difficulty was 0.46 to 0.58 accounting that all items was appropriate. And for phase 3, the value of item difficulty was 0.25 to 0.71 accounting that all items were appropriate. The reliability calculated by using Cronbach's alpha applied to measure problem-solving ability in 3 phases. In phase 1, the reliability value was 0.88 which is acceptable. To measure problem-solving ability in phase 2, the reliability value was 0.85 which is acceptable. Besides, to measure problem-solving ability in phase 3, the reliability was 0.79 which is acceptable.

5.2 The achievement test in chemistry subject which evaluated by the experts found that the IOC value was 0.67 – 1.00 which is acceptable. The test contains 12 items in phase 1, 16 items in phase 2, and 24 items in phase 3 respectively. After that, the test was piloted to non-participants which their qualification was similar to the participants, which are 25 students who were studying in Mattayomsuksa 6/2.

5.3 Behavior observation form in problem-solving using to indicate behavioral appropriateness had the mean score of 4.33, which was considered as "good". Moreover, the mean scores of behavior observation form in problem-solving using to indicate the criterial appropriateness was 4.67,

which was considered as “very good”. Finally, the mean scores of behavior observation form in problem-solving using to indicate the appropriateness of language and form was 4.67, which was considered as “very good”

5.4 Learning activity report

5.5 reflective

5.6 interview form

5.7 lesson plans integrated with problem-based learning, problem-based learning cooperated with social media, and problem-based learning cooperated with KWL technique for 7 lessons. The mean scores of lesson plan, which was evaluated by the experts, were from 4.53 to 4.83. That was interpreted as “very appropriate” Furthermore, the experts suggested to have the more media and techniques used in learning. After being learnt, the researcher quantitatively analyzed the data in each phase including problem-solving ability and learning achievement in chemistry subject. Finally, the data was analyzed by each phase.

Research Results

The content of the lessons conducted in this study can be divided into 3 phases as following:

In phase 1, the content of the lesson was “Crude Oil Refining and Defining Natural Gas” using problem-based learning for 2 lessons plan

In phase 2, the content of the lesson was “Determining the Quality of Gasoline Diesel” using problem-based learning cooperated with social media such as Facebook and Google Drive for 2 lessons plan.

In phase 3, the content of the lesson was “Plastic, Fiber, and Rubber” using problem-based learning cooperated with KWL technique for 3 lessons plan.

1. Problem-solving Ability

The participants in this study were 19 students who took problem-solving test for 3 phases. The results are shown as following:

Table 1 Student's Problem-solving Ability

Participant No.	Problem-solving Ability									
	Phase 1			Phase 2			Phase 3			
	Score (Out of 8)	Percentage	Interpretation	Score (Out of 8)	Percentage	Interpretation	Score (Out of 8)	Percentage	Interpretation	
1	5.00	62.50	Failed	5.67	70.83	Passed	5.67	70.83	Passed	
2	5.67	70.83	Passed	6.00	75.00	Passed	5.67	70.83	Passed	
3	7.00	87.50	Passed	6.33	79.17	Passed	6.33	79.17	Passed	
4	5.33	66.67	Failed	7.67	95.83	Passed	6.00	75.00	Passed	
5	5.67	70.83	Passed	6.00	75.00	Passed	7.00	87.50	Passed	
6	5.67	70.83	Passed	5.67	70.83	Passed	6.33	79.17	Passed	
7	5.50	68.75	Failed	2.67	33.33	Failed	5.00	62.50	Failed	
8	5.00	62.50	Failed	3.67	45.83	Failed	7.17	89.58	Passed	
9	6.33	79.17	Passed	6.00	75.00	Passed	5.67	70.83	Passed	
10	6.00	75.00	Passed	6.00	75.00	Passed	7.00	87.50	Passed	
11	6.00	75.00	Passed	5.17	64.58	Failed	5.67	70.83	Passed	
12	6.83	85.42	Passed	5.67	70.83	Passed	6.00	75.00	Passed	
13	5.67	70.83	Passed	6.00	75.00	Passed	6.33	79.17	Passed	
14	4.50	56.25	Failed	3.17	39.58	Failed	6.50	81.25	Passed	
15	4.33	54.17	Failed	3.83	47.92	Failed	7.67	95.83	Passed	
16	4.00	50.00	Failed	5.83	72.92	Passed	6.33	79.17	Passed	
17	5.00	62.50	Failed	5.67	70.83	Passed	5.67	70.83	Passed	
18	5.67	70.83	Passed	7.67	95.83	Passed	7.00	87.50	Passed	
19	5.17	64.58	Failed	5.67	70.83	Passed	6.83	85.42	Passed	
\bar{x}	5.49	68.64	Failed	5.49	68.64	Failed	6.31	78.84	Passed	
Number of Passed Students			10				14			18

From the table 1, it is shown that

In phase 1, the overall mean scores was 5.49 or 68.64%. The number of students who passed the test in the criteria of 70% was 10 or 52.63% while the number of students who didn't passed the test in the criteria of 70% was 9 or 47.37.

In phase 2, the overall mean scores was 5.94 or 68.64%. The number of students who passed the test in the criteria of 70% was 14 or 73.68% but the number of students who didn't pass the test in the criteria of 70% was 5 or 26.32. There was one student who passed the test in phase 1 but didn't pass the test in phase 2.

In phase 3, the overall mean scores was 6.31 or 78.84%. The number of students who passed the test was 18 or 94.74%. However, the number of students who didn't pass the test was 1 or 5.26%.

The researcher collected the data from achievement test in chemistry subject by having students taken posttest after every 3 phases. In phase 1, the test about "Crude Oil Refining and Defining Natural Gas" consisted of 10 items. In phase 2, the test about "Determining the Quality of Gasoline Diesel" consisted of 10 items. Finally, in phase 3, the test about "Plastic, Fiber, and Rubber" consisted of 15 items. The results from the test were shown in the table 2.

Table 2 The Chemistry learning achievement

Participant No.	Learning Achievement in Chemistry's Subject					
	Phase 1		Phase 2		Phase 3	
	Score (Out of 10)	Percentage	Score (Out of 10)	Percentage	Score (Out of 15)	Percentage
1	7	70.00	6	60.00	11	73.33
2	7	70.00	6	60.00	13	86.67
3	9	90.00	7	70.00	12	80.00
4	8	80.00	7	70.00	14	93.33
5	7	70.00	7	70.00	14	93.33
6	8	80.00	7	70.00	13	86.67
7	9	90.00	7	70.00	12	80.00
8	8	80.00	9	90.00	13	86.67
9	8	80.00	8	80.00	14	93.33
10	9	90.00	8	80.00	12	80.00
11	9	90.00	9	90.00	12	80.00
12	8	80.00	8	80.00	10	66.67
13	8	80.00	8	80.00	13	86.67
14	8	80.00	7	70.00	14	93.33
15	9	90.00	8	80.00	12	80.00
16	8	80.00	8	80.00	13	86.67
17	8	80.00	7	70.00	13	86.67
18	7	70.00	8	80.00	12	80.00

Participant No.	Learning Achievement in Chemistry's Subject					
	Phase 1		Phase 2		Phase 3	
	Score (Out of 10)	Percentage	Score (Out of 10)	Percentage	Score (Out of 15)	Percentage
19	8	80.00	7	70.00	12	80.00
\bar{x}	8.05	80.53	7.47	74.74	12.58	83.86

The table 2 showed the results from learning achievement test using problem-based learning and techniques. The results can be divided into 3 phases which are:

In phase 1, the scores from achievement test were 8.05 or 80.53%

In phase 2, the scores from achievement test were 7.47 or 74.74%

In phase 3, the scores from achievement test were 12.58 or 83.86%

Conclusion

The students who were taught by problem-based learning cooperated with social media and KWL technique in order to develop their problem-solving ability found that there were 18 students or 94.74% considered as "passed" of all students. However, only 1 student or 5.65% Failed the test from the whole participants. If considering in each phase, it is found that:

In phase 1, the students were taught by problem-based learning. The results revealed that there were 10 students or 52.63% passing the test in the criteria of 70%.

In phase 2, the students were taught by problem-based learning cooperated with social media such as Facebook and Google Drive. The results revealed that there were 14 students or 73.68% passing the test in the criteria of 70%.

In phase 3, the students were taught by problem-based learning cooperated with KWL technique. The results revealed that there were 4 students or 94.74% passing the test in the criteria of 70%

In learning achievement, 19 students were required to take a learning achievement posttest after being learn by problem-based learning cooperated with social media and KWL technique. The results showed that learning achievement score was 8.05 or 80.53% in phrase 1. Moreover, in phrase 2, the learning achievement score was 7.47 or 74.74%. Finally, the learning achievement score in phrase 3 was 12.58 or 83.86%.

Discussion

Apart from researching on developing 19 students' problem-solving ability who were studying in Mattayomsuksa 6 by using problem-based learning cooperated with social media and KWL technique, the results indicated that 18 students or 94.74% out of 19 students were passed in the criteria of 70% after completing phase 3. From conducting this action research, the teacher applied systematic and reliable

process to discover the situation or context in the classroom, and directly solve the students' problem (Nuengchalerm, 2013 : 57). In addition, two researchers used problem-based learning cooperated with social media and KWL technique to authentically assess. It is assumed that assessment in problem-based learning was realistic and systematic because there were various ways in learning assessments (Eggen & Kauchak, 2001 : 256-259). For more details, it can be discussed that:

In phase 1, after students learnt by problem-based learning, the results revealed that students has developed their problem-solving ability and passed for the criteria of 70% accounted for 10 students or 52.63% of the whole students. It is because students were taught to think, practically do, and discuss, which leads students to share knowledge in the group together. After finishing lesson 1, the researcher integrated what is incomplete in lesson 1 to lesson 2 and 3 in terms of time, activity organization, and more interesting and real-life situation in order to be consistent with Thitsana (2008 : 137). She stated that problem-based learning is considered as a learning tool that students are activated to reach their goal, which teachers might lead the students to face in real-life situation or practical problems. Moreover, students are taught to analyze and the problems so that they clearly understand the problems. Students are able to identify problems from the challenging situation but they are not able to solve by themselves because they have to be guided by adults or friends who have more experience. Students are able to solve problem because of learning (Berk & Winsler, 1995 : 232; cited in Vygotsky, 1978). In some situation, the researcher as a teacher provided some real-life situations into the problems in order to guide the students to think and analyze the problem by themselves. As a result, the students will clearly understand those problems and point out the choices and method in many ways to solve problem. Students will be acquired of self-ambition, thinking process, and problem-solving process (Kammanee, 2008 : 137). For the 19 students who didn't pass the criteria, there might be some factors to impede the students' opportunity to express their opinion. For example, the students already knew the answer but they didn't have a chance to express what they know because the other students answer those before. Besides, when the teacher provided activity to work in various group, there only "high-achieving" students worked on it. Then, the "low-achieving" students as the participants had no chance to work. In summary, the teacher brought those problems to adjust in phase 2.

In phase 2, after students learnt by problem-based learning cooperated with social media, the results revealed that students has developed their problem-solving ability and passed for the criteria of 70% accounted for 14 students or 73.68% of the whole students. It is because students analyzed the problem one day before going to the class in order that students had more time to think more thoroughly. Students also had a chance to identify problems through social media. Resulting from students analyzing and discussing about the problems in classroom and social media, students gained more problem-solving ability which is consistent to (Torp, L., & Sage S, 1998 : 8-22), which he stated that problem-based learning cooperated with social media can develop problem-solving ability. Therefore, students were able to identify problems, share knowledge, and present their own information in the freedom way (Laothing, 2014 : 61-64). Moreover, students had more time in learning cooperated with social media especially in identifying, replacing

a formula to find the answer and giving the reasons. For the students who didn't passed the criteria, it is assumed that the students still had obstacles on analyzing problem level. The researcher brought the limitations in phase 2 to adjust in phase 3.

In phase 3, after students learnt by problem-based learning cooperated with KWL technique, the results revealed that students has developed their problem-solving ability and passed for the criteria of 70% accounted for 18 students or 94.74% of the whole students. It is because the teacher integrated what the students know, what the students want to know, and what the students learned. KWL technique motivates students' attention and interesting (Moonkam & Moonkam, 2001 : 88), which also develop student's problem-solving ability in planning stage. After finishing learning activity, students were able to apply knowledge to new or real-life situation. Students can be also brought what their learnt to plan in solving problems in other situation. Apart from the learning, students had knowledge in the situation and be able to determine the topic to study further together with discussing and sharing knowledge so that students gained enough knowledge to solve the problem of the situation in classroom. Moreover, students thoroughly check their knowledge, which is consistent to Suwit & Orathai (2001 : 88). They claimed that the objectives of KWL are to facilitate students to aware of the process of self-learning by planning, setting goal, checking understand, and effectively organizing knowledge, which is also consistent to Rungrawee (2018: 48-84). She studied about comparing analytical ability and learning achievement in department of science topic "acid and base" and investigated the attitudes towards chemistry subject of Mattayomsuksa 6 students who was taught by using 7E learning cycle model, KWL technique, and traditional method. The results indicated that students learning by KWL technique is improved their analytical ability better than learning by traditional method.

The current research results indicated that learning through problem-based learning was such learning activities to support student's to solve problem, which is consistent to Pramote (2017 : 77-79). He conducted a research about developing Mattayomsuksa 5 students' problem-solving ability using problem-based learning. His results found that the score of students' problem-based ability was improved from 62.22% to 84.56%. Moreover, problem-based learning cooperated with social media enhances students' in problem-solving ability and the right to express opinion, which is consistent to Pichittong (2016 : 89-91). He conducted a study about developing learning activity in physics subject using problem-based learning cooperated with social media to enhance learning achievement problem-solving ability, and student's putting effort persistently. His findings indicated that students' problem-based ability during taught by lesson 1-5 was in a high level ($\bar{x} = 2.7$, S.D = 0.34). Besides, cooperating KWL technique enriches learning in the planning level so that students had a chance to plan better. That caused students to have higher problem-solving ability, which is consistent to Sujitraporn (2014 : 77-84). She studied about learning achievement, thinking for problem-solving and learning satisfaction for Mattayomsuksa 4 students using 7E learning cycle model, 7E learning cycle model cooperated with KWL technique. Her research results revealed that there were 13 students or 86.67% out of 15 students passed the criteria of 75%.

Recommendation

The recommendation for the future research will be described as follow:

1. Students' problem-solving ability was individually different, so there should be flexible criteria based on students' individual difference.
2. Other kind of social media is suggested to cooperate in the learning in suitable and various ways.

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