

ปฏิสัมพันธ์ระหว่างรูปแบบการคิดกับรูปแบบเทคนิคการช่วยเสริม
ศักยภาพที่มีต่อระดับทักษะการแก้โจทย์ปัญหาคณิตศาสตร์
ในการเรียนแบบผสมผสานที่ใช้เทคนิค KWDL บูรณาการ
กับเทคนิค SSCS สำหรับนักเรียนระดับชั้นมัธยมศึกษาตอนต้น

Interaction between Cognitive and Potential Enhancement
Styles (Scaffolding) on Mathematic Problem Solving Skills
in Blended Learning with KWDL Integrated with SSCS
for Junior High School

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บทคัดย่อ

การวิจัยครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาปฏิสัมพันธ์ระหว่างรูปแบบการคิดกับรูปแบบเทคนิคการช่วยเสริมศักยภาพที่มีต่อระดับทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ในการเรียนแบบ Blended Learning ที่ใช้เทคนิค KWDL บูรณาการกับเทคนิค SSCS ของนักเรียนระดับชั้นมัธยมศึกษาปีที่ 2 กลุ่มตัวอย่าง ได้แก่ นักเรียนที่เรียนรายวิชาคณิตศาสตร์ระดับชั้นมัธยมศึกษาปีที่ 2 จากโรงเรียนไพร่แก้ววิทยา สังกัดสำนักงานเขตพื้นที่การศึกษา

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มัธยมศึกษา เขต 33 ที่มีรูปแบบการคิดต่างกัน จำนวน 80 คน เครื่องมือที่ใช้ ได้แก่ กิจกรรมการจัดการเรียนรู้ด้วยเทคนิคช่วยเสริมศักยภาพ (Scaffolding) ที่เสริมด้วยเทคนิค KWDL บูรณาการกับเทคนิค SSCS จำนวนรูปแบบละ 17 กิจกรรม มีคะแนนเฉลี่ยความคิดเห็นของผู้เชี่ยวชาญอยู่ในระดับมากที่สุด ($\bar{X} = 4.51$, S.D. = 0.45) แบบทดสอบวัดผลสัมฤทธิ์ทางการเรียน แบบเลือกตอบ 4 ตัวเลือก จำนวน 30 ข้อ ซึ่งมีค่าความยากง่ายตั้งแต่ 0.281 ถึง 0.72 มีค่าอำนาจจำแนกตั้งแต่ 0.25 ถึง 0.65 และมีค่าความเที่ยงของแบบทดสอบทั้งฉบับเท่ากับ 0.83 แบบทดสอบวัดทักษะ ในการแก้โจทย์ปัญหาทางคณิตศาสตร์ จำนวน 3 ข้อ ซึ่งเป็นแบบทดสอบแบบเขียนตอบ โดยมีค่าความเที่ยงระหว่างผู้ตรวจ เท่ากับ 0.98 มีค่าความยากง่ายตั้งแต่ 0.47 ถึง 0.66 มีค่าอำนาจจำแนกตั้งแต่ 0.23 ถึง 0.30 มีค่าความเที่ยงของแบบทดสอบทั้งฉบับเท่ากับ 0.74 สถิติที่ใช้ในการทดสอบสมมติฐาน คือ Two Way ANOVA

ผลการวิจัยพบว่า

1. นักเรียนที่มีแบบการคิดต่างกัน เมื่อได้รับการฝึกด้วยเทคนิคการช่วยเสริมศักยภาพในการเรียนแบบผสมผสานที่ใช้เทคนิค KWDL บูรณาการกับเทคนิค SSCS แล้ว มีทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ไม่แตกต่างกัน อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05
2. นักเรียนที่มีรูปแบบการเรียนแบบผสมผสานที่ใช้เทคนิค KWDL บูรณาการกับเทคนิค SSCS เมื่อได้รับการฝึกด้วยเทคนิคการช่วยเสริมศักยภาพต่างกัน มีทักษะการแก้โจทย์ปัญหาคณิตศาสตร์แตกต่างกัน อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05
3. ไม่มีปฏิสัมพันธ์กันระหว่างรูปแบบการคิด และรูปแบบการเรียนแบบผสมผสานด้วยเทคนิค KWDL บูรณาการกับเทคนิค SSCS ที่ใช้เทคนิคการช่วยเสริมศักยภาพที่ต่างกัน ที่ส่งผลต่อทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ อย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05

Abstract

This research aims to study the interaction between cognitive and technical patterns in potential enhancement that affects the level of mathematical problem solving skills and Blended Learning which uses the

KWDL technique integrates with the SSCS technique with grade 8 students. The samples were 80 grade 8 students who have different cognitive styles and participate in mathematic classes at Saikaewwittaya School, Secondary Educational Service Area Office 33. There are 3 research tools. First are 17 learning management activities with Scaffolding method, which is enhanced by KWDL technique integrated with SSCS technique, for each style. The average score of experts' opinion is at the highest level ($\bar{X} = 4.51$, S.D. = 0.45). Second are 30 items of the achievement test with 4-choices whose difficulty, discrimination, and validity index are 0.28 - 0.72, 0.25 - 0.63, and 0.83, respectively. Third are 3 essay items of the mathematic problem solving skills test. This test has a difficulty and discrimination index at 0.47 - 0.66 and 0.23 - 0.30, respectively. In addition, the validity index of the examiners and the test are 0.98 and 0.74, respectively. The statistical methods for analyzing data consist of Arithmetic mean, Standard Deviation, Percentage average, and Two-Way ANOVA for statistical hypothesis testing.

The results were as follows:

1. The variance testing results of students who have different cognitive styles and were trained on technical patterns in potential enhancement and Blended Learning which uses KWDL technique integrated with SSCS technique on mathematic problem solving skills showed no significant difference at the 0.05 level.
2. The variance testing results of students who have a Blended Learning style which uses KWDL technique integrated with SSCS technique and were trained on different technical patterns in potential enhancement on mathematic problem solving skills were significantly different at the 0.05 level.
3. There were no significant Interactions at the 0.05 level between cognitive styles and Blended Learning style which used KWDL technique

integrated with SSCS technique on different technical patterns in potential enhancement on mathematic problem solving skills.

Introduction

The Basic Education Core Curriculum B.E. 2551 (A.D. 2008) defines that learning area of mathematics is a highly important area and useful to one's life and being a tool for learning other disciplines. Mathematics focus on practicing mathematical problem solving skills for developing necessary principle skills in problem solving and gaining good experiences related to problem solving based on each person's skills level. These conform to principle of directive of the Ministry of Education about development of national youth forward to 21th century by focusing on acquiring skills in creativity, logic, technology, and enables a person to live in harmony with others (Ministry of Education. B.E. 2008). However, the past mathematical learning management problem shown that learning achievement which evaluated from nationwide students tests and had average at low level. Programmed for international student assessment (PISA, 2011) is the Trends in International Mathematics Study Project. The result which compared Thailand with countries in Asia and 5 countries in ASEAN such as, Japan, South Korea, Hong Kong, Taiwan, and Singapore, is Thai is in the lowest level and has the score under average of international test. (Institute for the Promotion of Teaching Science and Technology. B.E. 2011 : 111 - 161)

According to the mathematics learning management, we have found that there are problems in case of the students were unable to achieve the learning goal by themselves. Helping when student facing the problem or requiring help during learning should be considerably realized. Considerable

method for solving this problem is applying scaffolding in learning activities. Therefore, this method is helping students working in various ways by focusing on independently achieve that operation by themselves. (Eggen and Kauchack. 1997 : 56) and stop helping when students are able to operate by themselves. Therefore, learning activities with scaffolding follows Social Constructivism which is theory of Lev (1978) and similar to intellectual development theory by Piaget. On the other hand, it focuses on outward to inside while Piaget (Cognitive Development Theory) is studying of the human inside, ages, and evolution step then apply to external situation which as known as Inside to Outward

The researcher who is a mathematics teacher interested in doing learning activities using Blended Learning with Scaffolding and KWDL which is integrated with SSCS. Therefore, the researcher proposed this method to properly develop mathematical problem solving skills.

Research objectives

To study interaction between cognitive styles and potential enhancement technical styles that affects level of mathematical problem solving skills in Blended Learning which uses KWDL technique integrates with SSCS technique for junior high school students.

Research hypothesis

1. Students who have different cognitive styles when they are practiced with the potential enhancement techniques in Blended Learning which uses KWDL technique integrated with SSCS technique, they would have different mathematical problem solving skills.

2. Students who have Blended learning style which uses KWDL technique integrates with SSCS technique when they are practiced with the different potential enhancement techniques, they would have different mathematical problem solving skills.

3. There are interaction between cognitive style and Blended learning style with KWDL technique integrated with SSCS technique which uses different potential enhancement techniques that affects level of mathematical problem solving skills.

Research Methodology

Population and Sample are 130 grade 8 students in mathematics class, Saikaewwittaya School, Secondary Educational Service Area 33, who are studying in second semester, academic year 2015.

The sample are 80 grade 8 students, the Basic Education Core Curriculum 2008 from Saikaewwittaya School, Secondary Educational Service Area 33. The researcher uses the The Group Embedded Figures Test (GEFT), a cognitive style test which developed by Witkin and Others (1971), to separate the students into 2 groups. The first group is the Field Dependent: FD (40 students) which is divided into 2 subgroups; the Sort Scaffolding (20 students) and the Hard Scaffolding (20 students). The second group is the Field Independent : FI (40 students) which is divided into 2 subgroups; the Sorf Scaffolding (20 students) and the Hard Scaffolding (20 students).

Research Tools

1. Learning activities of mathematical contents from the Basic Education Core Curriculum 2008 for grade 8 students in the topic, the Linear Equation with one variable using blended learning with Scaffolding and KWDL integrated with SSCS technique to create online learning activities courses which consist of Soft Scaffolding and Hard Scaffolding for 17 learning activities per each style.

Activity 1 Reading to problem analysis and planning to solve the problem 1 hour

Activity 2 and 3 Solving Problem Equations with number 2 hours

Activity 4 and 5 Solving Problem Equations with age 2 hours

Activity 6 and 7 Solving Problem Equations with trading 2 hours

Activity 8 and 9 Solving Problem Equations with money 2 hours

Activity 10 and 11 Solving Problem Equations with area 2 hours

Activity 12 and 13 Solving Problem Equations with fraction 2 hours

Activity 14 and 15 Solving Problem Equations with ratio 2 hours

Activity 16 and 17 Solving Problem Equations with percent 2 hours

2. Solving mathematic problem skill test for grad 8 students in the topic “the Linear Equation with one variable” it is written test and 3 questions.

3. The Group Embedded Figures Test (GEFT), a cognitive style test which developed by Witkin and Others (1971), is the test for classifying the cognitive style into Field Dependent (FD) and Field Independent (FI).

4. Learning Achievement test, the Linear Equation with one variable for solving mathematical problem, is an objective test with 4 choices for each of 30 questions. It was used for testing the basic knowledge before studying and applying the comparison of test results between Scaffolding style and

Cognitive style to confirm that these two samples have no different and the researcher can continue to do experimentation.

Experiment Procedures and Data Accumulation

The procedures were as follows

1. Doing solving mathematic problem skills Pre-Test using the solving problem skill test which is the 3 questions writing test developed from mathematics textbook for grade 8 of The Institute for the Promotion of Teaching Science and Technology follows the Basic Education Core Curriculum 2008 (Revise 2010).

2. Orientation, learning method descriptions, doing activities, learning period, objective, and assessment of learning.

3. The researcher performed the learning management follows the learning activities in each class.

4. Students had to do activities in each class which were provided in the course of Blended learning. They designed the course outline following the content of the course for teaching on Social networks such as Facebook. The group of course on Facebook uses the Soft Scaffolding and Hard Scaffolding technique and Face to Face for the teacher meets students in normal class.

4.1 Making the Learning Activity for Group 1 : Soft Scaffolding

The researcher describes the basic of agreement to students such as students work the assignment worksheet, if students have questions or do not understand about the equation problems, they can ask teacher or their friends. There are 4 steps of do the worksheets as follow :

Step 1 Search : S and K (What we know)

1) When teacher designs the equation problems, the students find out What the question want to know? What are there in the question?

2) When they find the definition of the question, the student answer What is the question want to know?

Step 2 Solve : S and W (What we want to know)

1) The students find out the relation that the question definition from Step 1. What is relevant knowledge? What is relevant in sign of mathematic knowledge? Such as the product of, the double of

2) The students ask the questions to teacher by post on comment box on Facebook in a group of course.

3) Friends can also ask other questions with other friends that talk with teacher in a group of course on Facebook.

Step 3 Create : C and D (What we do to find out) students practice the activities as follow :

1) The students use the result of finding the relation in step 2 to design the equation problems and solve them.

2) The teacher may suggest the students use the chart to support their work.

3) The students write a summary of method to design the equation from the assignment questions.

4) Solve the equations, find the answers and check the answers.

Step 4 Share : S and L (What we learned)

The teacher and the student find the answer together, check and give scores, discuss and comment and teacher may suggests the additional cognitive techniques to solve the problems.

4.2 Making the Learning Activity for Group 2 : Hard Scaffolding

The researcher describes the basic of agreement to students such as students work the assignment worksheet, students do not permission to ask questions with teacher or friends but they can learn the samples from links or VDO in a group on Facebook that assigned by teacher and using the samples as a guideline to do worksheet, students have to follow agreement strictly. There are 4 steps of do the worksheets as follow:

Step 1 Search : S and K (What we know)

1) When teacher designs the equation problems, the students find out What the question want to know? What are there in the question?

2) When they find the definition of the question, the student answer What is the question want to know?

Step 2 Solve : S and W (What we want to know)

1) The students find out the relation that the question definition from Step 1. What is relevant knowledge? What is relevant in sign of mathematic knowledge? such as the product of, the double of. If the students have problems, questions or do not understand they can learn from :

2) Keywords or the questions help the students find the answers that the teacher post on Facebook

3) The additional online learning resources such as VDO - online that the teacher provides them in comment box on Facebook.

Step 3 Create : C and D (What we do to find out) students practice the activities as follow :

1) The students use the result of finding the relation in step 2 to design the equation problems and solve them.

2) The teacher may suggest the students use the chart to support their work.

3) The students write a summary of step to design the equation from the assignment questions.

4) Solve the equations, find the answers and check the answers.

Step 4 Share : S and L (What we learned)

The teacher and the student find the answer together, check and give scores, discuss and comment and teacher may suggests the additional cognitive techniques to solve the problems.

5. After the samples already learned the course and joined the activities, the researcher tests the Post-test by using the Solving mathematic problem skill test. It is a written test and 3 questions which is an original test but switches the questions as a parallel test and analyzes results by Social Science program.

Results

1. The variance testing result of the mathematic problem solving skill scores after learned by the students, they have different cognitive styles with variance level of 2.517 and the significance level of 0.118. Concluded that the mathematic problem solving skill scores after learned by the students, they have different cognitive styles and significantly at the 0.05 level.

2. The variance testing result of the mathematic problem solving skill scores after learned by the students who practice with two different potential enhancement techniques styles with variance level of 12.399 and the significance level of 0.001. Concluded that the mathematic problem solving skill scores after learned by the students who practice with two different potential enhancement styles techniques with significance level of 0.05.

3. The analysis of the mathematic problem solving skill scores after learned by the students to find the interaction between different Cognitive styles and Blended Learning style which uses KWDL technique integrates with SSCS technique that affect the mathematic problem solving skill scores after learned by the students who practice with two different potential enhancement styles techniques with variance level of 1.092 and the significance level of 0.300. In conclusion, the post-test scores of mathematic problem solving skill between different cognitive styles and the student who practiced with two different potential enhancement styles techniques with significantly at the 0.05 level.

Conclusion and Discussion

1. Students who have different cognitive styles when they are practiced with the potential enhancement techniques in Blended Learning which used KWDL technique integrated with SSCS technique. It showed that the students have no different mathematical problem solving skills with the significance at 0.05 levels and did not match the hypothesis. The styles of cognitive students that did not affect the learning achievement may be because the researcher created the online activities and online course in Blended Learning which used the Scaffolding techniques and KWDL technique integrated with SSCS technique were multiple method teaching styles and the students have many opportunities to fully show their knowledge, talent and experiences. In addition, the online learning activities on Facebook helped inducing the students to be interested and active in learning and caused the results of learning achievement in students is higher.

2. The students who have Blended Learning using KWDL technique integrated with SSCS and different potential enhancement techniques, they will have different mathematical problem solving skills and match the hypothesis may be because the researcher used the different potential enhancement techniques. The Soft Scaffolding technique was following the learning management which used KWDL technique integrates with SSCS technique and there are systematic learning activities as follows; Step 1 Search : S and K (What we know) the students found the definition of the question and What is the question want to know? Then discuss on Facebook comment in course group. Step 2 Solve: S and W (What we want to know) the students were in a role to plan, processing to solve the problem in many methods, find the additional what they want to know in the question, find the relation of question and defined the method to solve the question. If the students have any problem, question and do not understand, the teacher can help them by talking with them on Chat room or posting on Facebook comment in course group. Step 3 Create: C and D (What we do to find out) the students were a main role to use the result of planning in step 2 to design the equation problems and solve the questions. In this step, the students can receive help from teacher on Chat room or post on Facebook comment in course group. Step 4 Share : S and L (What we learned), students and teacher have a joint role in answering, scoring, discussion, and teachers are able to suggest additional solving problem technique via posting a comment on each subject's facebook group.

3. Cognitive styles has no interaction with Blended Learning using KWDL technique integrated with SSCS and different potential enhancement techniques which affects solving mathematical problem skills with the significance at .05 levels. In order that the researcher had designed learning

management using Blended Learning which is the integration of confront learning, which each teacher is a leader, and online learning, which focusing on learners and using computer and communication technology, for the highest efficiency. The researcher adopted online learning activities and creating content to use with Blended Learning by using Scaffolding with KWDL integrated with SSCS in mathematics facebook group for students who use Soft Scaffolding and Hard Scaffolding, which are mixed various teaching. It is an opportunity for learners to fully show their knowledge, skills, and experiences. Therefore, Blended Learning is the learning that supports a good part and compensates for the limitation of media including flexibility in using many media that is suitable for teaching styles. Contents of learning, which is focusing on the result of learning evaluation, affects learners to have higher achievement and no interaction between cognitive styles and Blended Learning using KWDL technique integrated with SSCS and different potential enhancement techniques

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