Development of Learner-Centered Instructional Model in the Forth Learning Strand of Occupation and Technology (Information Technology) for the 10-12th grade Students under Maha Sarakham Educational Service Area Office 3

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์ **ประการแรก** เพื่อพัฒนารูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ กลุ่มสาระการเรียนรู้การงานอาชีพ และเทคโนโลยี สาระที่ 4 เทคโนโลยีสารสนเทศ สำหรับผู้เรียนช่วงชั้นที่ 4 สำนักงานเขตพื้นที่การศึกษามหาสารคาม **ประการที่สอง** พัฒนากิจกรรมการเรียนรู้ตามรูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญให้มีประสิทธิภาพตามเกณฑ์ E_1/E_2 **ประการที่สาม** เปรียบเทียบผลสัมฤทธิ์ทางการเรียนระหว่างผู้เรียนที่เรียนด้วยกิจกรรมการเรียนรู้ที่พัฒนาขึ้นตามรูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ และผู้เรียนที่เรียนแบบปกติ **ประการที่สี่** ศึกษาความคิดในเชิงสร้างสรรค์ชิ้นงานด้านคอมพิวเตอร์ของผู้เรียนที่เรียนด้วยกิจกรรมการเรียนรู้ที่พัฒนาขึ้นตามรูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ และ ประการที่ห้า ศึกษาความพึงพอใจของผู้เรียนที่เรียนด้วยกิจกรรมการเรียนรู้ที่พัฒนาขึ้นตามรูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ ประชากรที่ใช้ในการวิจัยครั้งนี้ เป็นผู้เรียนช่วงชั้นที่ 4 ของโรงเรียนระดับมัธยมศึกษา ในเขตจังหวัดมหาสารคาม จำนวน 37 โรงเรียนกลุ่มตัวอย่าง เป็นผู้เรียนชั้นมัธยมศึกษาปีที่ 5 ภาคเรียนที่ 1 ปีการศึกษา 2552 โรงเรียนเขื่อนพิทยาสรรค์ สังกัดสำนักงานเขตพื้นที่การศึกษามหาสารคาม เขต 3 คัดเลือกโดยวิธีเฉพาะเจาะจง เนื่องจากเป็นโรงเรียนมัธยมศึกษา ประจำตำบลขนาดเล็ก ที่มีจำนวนนักเรียนน้อยกว่า 500 คน จำนวน 2 ห้องเรียน จัดแบ่งเป็นกลุ่มทดลองและกลุ่มควบคุมด้วยวิธีการจับฉลาก ดังนี้ 1) กลุ่มทดลอง เป็นกลุ่มที่จัดการเรียนรู้ด้วยกิจกรรมการเรียนรู้ตามรูปแบบที่พัฒนาขึ้น จำนวน 34 คน 2) กลุ่มควบคุม เป็นกลุ่มที่จัดการเรียนรู้แบบปกติ จำนวน 28 คน เครื่องมือที่ใช้ ได้แก่ รูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ กลุ่มสาระการเรียนรู้การงานอาชีพ และเทคโนโลยี สาระที่ 4 เทคโนโลยีสารสนเทศ สำหรับผู้เรียนช่วงชั้นที่ 4 สำนักงานเขตพื้นที่การศึกษามหาสารคาม แบบประเมินความคิดเห็นของผู้เชี่ยวชาญที่มีต่อรูปแบบที่พัฒนาขึ้น กิจกรรมการเรียนรู้ แบบประเมินกิจกรรมการเรียนรู้ แบบทดสอบวัดผลสัมฤทธิ์ทางการเรียน แบบประเมินความพึงพอใจ ของนักเรียนกลุ่มทดลอง และแบบประเมินความคิดในเชิงสร้างสรรค์ชิ้นงานด้านคอมพิวเตอร์ สถิติที่ใช้ ได้แก่ ร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และค่าสถิติ t-test (Independent) ผลการวิจัยพบว่า

1. รูปแบบประกอบด้วยขั้นตอนการจัดการเรียนการสอนจำนวน 5 ขั้นตอน ได้แก่ ขั้นทบทวนความรู้ขั้นเรียนเนื้อหาใหม่ ขั้นสรุปความรู้/ฝึกปฏิบัติ ขั้นอภิปรายผล และขั้นการค้นคว้าเพิ่มเติม/การผลิตชิ้นงาน โดยผู้เชี่ยวชาญมีความเห็นต่อรูปแบบในระดับมากมาก

2. กิจกรรมการเรียนรู้ตามรูปแบบที่พัฒนาขึ้นผู้เชี่ยวชาญมีความคิดเห็นโดยรวมต่อคุณภาพกิจกรรมการเรียนรู้ในระดับมากที่สุด และมีประสิทธิภาพตามเกณฑ์ E_1/E_2 เท่ากับ 85.58/83.55

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3. ผลสัมฤทธิ์ทางการเรียนหลังเรียนระหว่างนักเรียนที่ได้รับการจัดการเรียนรู้ด้วยกิจกรรมการเรียนรู้ตามรูปแบบที่พัฒนาขึ้นแตกต่างจากผู้เรียนที่เรียนแบบปกติอย่างมีนัย สำคัญทางสถิติที่ระดับ .05

4. นักเรียนมีความคิดในเชิงสร้างสรรค์ ในระดับมากที่สุด และ

5. ความพึงพอใจของนักเรียนหลังจากได้รับการจัด การเรียนรู้ด้วยกิจกรรมการเรียนรู้ตามรูปแบบที่พัฒนาขึ้นอยู่ในระดับมากที่สุด

คำสำคัญ : รูปแบบการจัดการเรียนรู้ที่เน้นผู้เรียนเป็นสำคัญ กลุ่มสาระการเรียนรู้การงานอาชีพและเทคโนโลยี สาระที่ 4 เทคโนโลยีสารสนเทศ และนักเรียนช่วงชั้นที่ 4

ABSTRACT

The objectives of the research were to: firstly, develop a learner-centered instructional model of the fourth learning strand of occupation and technology (Information Technology) for the 10-12th grade level students under the Office of Maha Sarakham Educational Service Area, Thailand, secondly, develop the learning activities based on the standardized criteria efficiency (E_1/E_2), thirdly, compare the learning achievement between learner centered used instructional model classroom and normal classroom, fourthly, analyze the computer skills of the students for creative thinking and fifthly, investigate the satisfaction of the students with the learner-centered learning activities. The population was the fourth level students from 37 high schools in Maha Sarakham Province, Thailand. The subjects consisted of sixty two students of the 11th grade on the first semester of 2009 academic year at Khuean Pitayasan High School under Maha Sarakham Educational Service Area Office 3 by purposive sampling. They were split into two groups, selected through simple random sampling: 34 students was an experimental group and 28 students was a control group. The research instruments were: a learner-centered instructional model of the fourth learning strand (Information technology), an evaluation form for the instructional model, learning activities, learning activity evaluation form, an achievement test, a satisfaction evaluation form, and a creative thinking on computer tasks. The statistics used for analyzing data were percentage, mean, standard deviation, and t-test (Independent Sample). The results of the research were as follows:

1. The learner-centered instructional model consisted of 5 steps: review of previous knowledge, presentation of new knowledge, conclusion and practice, discussion, and further study or additional study. The average opinion of the experts towards the instructional model was at a high level.

2. The overall of the quality of the instructional model was at the highest level. The efficiency regarding the standardized criteria E_1/E_2 was at 85.58/83.55.

3. The average score of the students who studied with the learner-centered activities was significantly higher than those of the normal classroom at the .05 level.

4. The finding indicated that the average level of the creative thinking on computer tasks was the highest level.

5. Regarding the satisfaction, it showed that the average level of the satisfaction of the students with the instructional model was the highest level.

Keywords : Learner-Centered Instructional Model, the Fourth Learning Strand of Occupation and Technology (Information Technology), 10-12th grade Students

INTRODUCTION

Computer technology is currently important for various areas including education. Students have to learn about the modern innovation because computer technology is developing continuously and important for education including daily life. Therefore, the school curriculum should be reformed and modernized for students, especially the content. (Pornphan Pungprayoonpong, 2004 : 2).

The structure of basic education curriculum in Thailand is divided into 4 levels. The first level (Prathom 1-3), the second level (Prathom 4-6), the third level (Matayomsak 1-3), the forth level (Matayomsuksa 4-6) (Pornphan Pungprayoonpong, 2006:2)

The content of the forth level emphasizes on practice and self study for further levels (Sirilak Topol, 2002: 4). Therefore, the learning strand of Information Technology for the upper secondary education, the forth level, is very necessary for higher education. However, teacher-centered instruction is currently used for upper secondary education.

The teachers teach students the knowledge and computer skills, computer network programming, database management, data structure form the curriculum, then the students practice after the instruction. The teaching methodology provides students with knowledge and they can solve the problems in the classroom when the teachers help and guide them (Sirilak Topol, 2002:4).

There are three basic educational service offices in Maha Sarakham Province. The office of Educational Service Area 1 takes the responsibility for educational administration in 5 districts: Muang District, Kantrarawicahi, Kaedam, Borabue, and Kudrung. The office of Educational Service Area 2 takes the responsibility for educational administration in 6 districts: Waphiprathum, Nachuack, Nadoon, Phayakkaphumphisai and Yangsrisurat. The office of Educational Service Area 3 takes the responsibility for educational administration in 3 districts: Chiangyuen, Kosumphisai and Chuenchom

The policies of the three Educational Service Offices in Maha Sarakham Province emphasizes on the learning strand of Information Technology for all educational levels. The standard content depends on the different level, especially the standard content of Information Technology. The forth level focuses on knowledge and computer skills for higher education.

Regarding the previous study on the instructional management in the forth level of education, it indicates that the achievement of students in computer skills is low, and the students cannot do programming. The teaching methodology is a teacher-centered approach.

Therefore, We am interested in developing a learner-centered instructional model for students of the forth level in the learning strand of Information Technology based on the needs, the current situation and the educational reform in Thailand.

Objectives:

1. To develop a learner-centered instructional model of Occupation and Technology Learning Strand for the students of the forth level under the Office of Maha Sarakham Educational Service Area

2. To develop learner-centered learning activities based on the standardized criteria efficiency (E_1/E_2)

3. To compare the achievement of the students who learned with the learner-centered activities to the students who had a regular class

4. To analyze the computer skills of the students in creative works after learning with the learner-centered activities

5. To survey the satisfaction of the students with the learner-centered activities

Scope

1. Population and Samples

1.1 The population was students of the 10-12th grade from thirty five secondary schools in the second semester of 2007 under the Office of Maha Sarakham Educational Service Area

1.2 The samples were sixty two of the 11th grade students at Khuean pitayasan Secondary School under the Office of Maha Sarakham Educational Service Area 3. The students were divided into two groups: the experimental group of 34 students and the control group of 28 students. They were selected by purposive random sampling and simple random sampling.

2. Variables

2.1 Independent variables were an instructional model of learner-centered activities and a regular class

2.2 Dependent variables were an achievement, computer skills and satisfaction

3. Period of the research

The second semester of 2007 - the first semester of 2008

MATERIALS AND METHODS

1. Research Instruments

1.1 A learner-centered instructional model of Occupation and Technology Learning Strand for the forth level

1.2 Learner-centered learning activities

1.3 An evaluation form

1.4 An achievement test

1.5 A questionnaire

1.6 An assessment form of the computer skills

2. Research Methodology

2.1 A contextual study and analysis consisted of:

2.1.1 Study on the curriculum of Occupation and Technology Learning Strand for the forth level

2.1.2 Study on the principles, theories, method and model of learner-centered instruction/approach

2.1.3 Analysis of the instructional problems in Occupation and Technology Learning Strand for the forth level under the Office of Maha Sarakham Educational Service Area 1

2.2 Design of the instructional model consisted of:

2.2.1 Organizing the meeting with 20 teachers and educational personnel of Occupation and TechnologyLearning Strand for the forth level under the Office of Maha Sarakham Educational Service and other provinces about the model design

2.2.2 The learner-centered instructional model was assessed by 7 experts

2.2.3 Analysis of content, learning objectives, constructing and assessing an achievement test

2.2.4 Design of learning activities consisting of teaching materials, WBI Lessons, Worksheet, an achievement test and an evaluation form.

2.2.5 Design of the research instruments: a questionnaire, an observation form, an assessment form of the quality and an assessment form of the computer skills

2.3 Development of the model

2.3.1 Development of learning activities consisted of teaching materials, WBI Lessons, Worksheet, an achievement test and an evaluation form.

2.3.2 Assessment of learning activities and teaching material by experts

2.3.3 Development of the research instruments : a questionnaire, an assessment form of learning activities, a quality assessment form, and an assessment form of computer skills and an assessment form of the instrument quality

2.4 Implementation

2.4.1 Try-out the model with the target group

2.4.2 Data collection

2.5 Evaluation

2.5.1 Data analysis

2.5.2 Discussion, Conclusion and Dissemination

3. Data Analysis

3.1 Assessment of the learner-centered instructional model

The appropriateness of the model was assessed by experts with the rubric scale (Boonchom Srisa-ard, 2002 : 50-100). The average numbers represent:

4.51-5.00 = mostly appropriate

3.51-4.50 = very appropriate

2.51-3.50 = fairly appropriate

1.51-2.50 = inappropriate

1.00-13.50 = extremely inappropriate

3.2 Assessment of the learning activities efficiency

The efficiency of the learning activities was determined by the scores of the achievement test (E_1/E_2) based on the 80/80 standardized criteria, and compared with the standardized criteria (Pisutta Arreerard, 2006: 158). The percentage of the achievement score represents:

95-100% = excellent

90-94% = good

85-89% = fair good

80-84% = fair

0-79 = poor

3.3.Comparison of the learning achievement

Mean scores from the pre-test and post-test of the learning achievement were compared.

T-test was used to determine whether there was any significant difference between scores at the .05 level of the significance.

H_0 : The mean scores of the pre-test and the post-test are not different.

H_1 : The mean scores of the pre-test and the post-test are different.

3.4 Analysis of the computer skills in creative work

Mean and standard deviation were used for the analysis of the computer skills in the creative works based on the standardized criteria (Boonchom Srisa-ard, 2002: 50-100). The average numbers of the computer skills represent:

4.51-5.00 = mostly creative

3.51-4.50 = very creative

2.51-3.50 = fairly creative

1.51-2.50 = very uncreative

1.00-1.50 = extremely uncreative

3.5 Analysis of the satisfaction

The data were results of questionnaires on the satisfaction of the students with the learner-centered instructional model. Mean and standard deviation were used for the analysis of the satisfaction based on the standardized criteria (Boonchom Srisa-ard, 2002: 50-100). The average numbers of the satisfaction represent:

4.51-5.00 = mostly satisfied
3.51-4.50 = very satisfied
2.51-3.50 = fairly satisfied
1.51-2.50 = very unsatisfied
1.00-1.50 = extremely unsatisfied

4. RESULTS AND DISCUSSION

4.1 Model development

4.1.1 The learner-centered instructional model refers to the learning process of the learner-centered activities in Occupation and technology Learning Strand for the forth level of the basic education

4.1.2 The content consisted of the knowledge of principle and theories and the computer skills which was divided into 3 skills:

1) Computer programming
2) Multimedia design and development
3) Practice with Microsoft Office program

4.1.3 The learner-centered instructional model

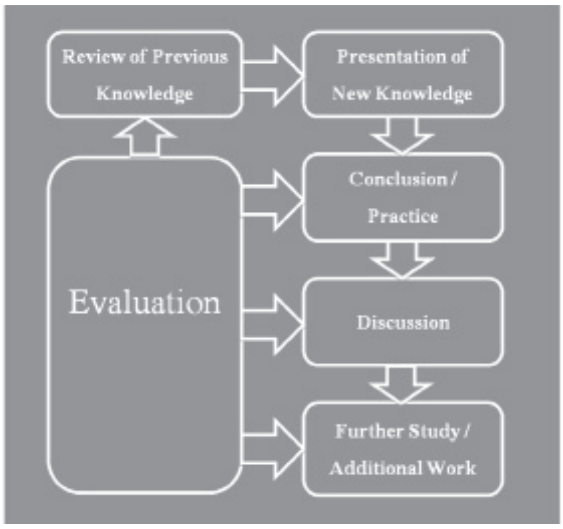

Diagram 1 The learner-centered instructional model

Diagram 2 Process of the learner-centered instructional model

The diagrams above illustrates five steps of the instructional model, which were summarized as follows:

1) Review of previous knowledge to assess the background knowledge of the students by completing exercises and worksheet.

2) Presentation of new knowledge: the principles of theories were presented through electronic media regarding the individual difference of students, the students were assessed by an electronic test. Regarding the practice, the teacher demonstrated the program operation, programming, program design and web base design, practice in classroom including teacher assessment by the students.

3) Conclusion and practice: the knowledge of the principles and theories was assessed by the outcomes of pair work. Regarding the practice, the teacher use the problem-based instruction to the class. Therefore, the practice of students was evaluated by the participation, the practice in classroom and work.

4) Discussion: the students summarized and presented their final work to the class. The students were assessed by participation, expressing idea and report.

5) Further study or additional study: the further study was assigned by teacher, and the work performance was assessed by worksheet or exercises. Regarding the practice, teacher assigned the project work for a group of 3-4- students, and the assessment of students were determined by their project work.

4.1.4 The appropriateness of the model. The model was assessed by 7 experts in education.

Table 1 Results of the model appropriateness

Items of Assessment	$\bar{X}$	SD	Interpretation
1. Model	**4.40**	**0.66**	**high**
1.1 Appropriateness of the model for:	**4.33**	**0.66**	**high**
1.1.1 The overall model	4.43	0.79	high
1.1.2 Five steps of the instructional process	4.43	0.79	high
1.1.3 Review of previous knowledge	4.29	0.76	high
1.1.4 Presentation of new knowledge	4.14	0.38	high
1.1.5 Conclusion and practice	4.43	0.53	high
1.1.6 Discussion	4.43	0.79	high
1.1.7 Further study/work	4.14	0.69	high
1.2. Appropriateness of model application for:	**4.57**	**0.63**	**Mostly high**
1.2.1 The forth learning strand of Occupation and Technology	4.57	0.79	Mostly high
1.2.2 Learner-centered instruction	4.57	0.53	Mostly high
1.2.3 Current computer technology	4.71	0.49	Mostly high
1.2.4 Current educational management	4.43	0.79	high
1.3 The application of computer technology for education	**4.29**	**0.76**	high
2. Activities/Materials/Evaluation of 3 steps (5 steps)	**4.34**	**0.64**	**high**
2.1. Review of the previous knowledge	4.14	0.38	high
2.2. Presentation of the new knowledge	4.43	0.53	high
2.3. Conclusion and practice	4.43	0.79	high
2.4. Discussion	4.14	0.69	high
2.5. Further study or additional study	**4.57**	**0.79**	**Mostly high**
Total	**4.39**	**0.65**	**high**

Table 1 indicates that the average opinion of the experts towards the appropriateness of the model was high ($\bar{X}$ = 4.39 and S.D. = 0.65). The highest-level appropriateness of the model was the instructional model ($\bar{X}$ = 4.40 and S.D. = 0.66). The average opinion of the experts towards the appropriateness of activities and teaching materials and the evaluation was high ($\bar{X}$ = 4.34 and S.D. = 0.64).

4.2 Results of the Learning activities development

4.2.1 The quality of the learning activities was assessed by seven experts.

Table 2 Result of the assessment of Activities quality

Items of Assessment	$\bar{X}$	SD	Interpretation
1. Relevance of the instructional model	**4.62**	**0.67**	**Mostly high**
1.1 Steps of learning activities	4.71	0.49	Mostly high
1.2 Teaching materials	4.71	0.76	Mostly high
1.3 Evaluation	4.43	0.79	high
2. Content	**4.33**	**0.73**	**high**
2.1 Relevance of the content to the level	4.14	0.69	high
2.2 Relevance of the content to the learning objectives	4.57	0.53	Mostly high
2.3 Accuracy of the content	4.29	0.95	high
3. Teaching materials	**4.52**	**0.60**	**Mostly high**
3.1 Appropriateness of electronic materials	4.43	0.53	high
3.2 Appropriateness of the worksheet	4.57	0.79	Mostly high
3.3 Appropriateness of the exercises	4.57	0.53	Mostly high
4. Evaluation	**4.57**	**0.65**	**Mostly high**
4.1 Appropriateness of an achievement test	4.71	0.49	Mostly high
4.2 Appropriateness of the criteria	4.43	0.79	high
Total	**4.51**	**0.66**	**Mostly high**

The results showed that the average level of the opinion of the experts towards the activity quality was mostly high ($\bar{X}$ = 4.51 และค่า S.D. = 0.66). The two highest-level-areas of the relevance was the instructional model and teaching materials ($\bar{X}$ = 4.62 and S.D. = 0.67) and ($\bar{X}$ = 4.52 and S.D. = 0.60) respectively. The values of the content and the evaluation were high ($\bar{X}$ = 4.33 and S.D. = 0.73) and ($\bar{X}$ = 4.57 and S.D. = 0.65) respectively.

4.2.2 The results of the efficiency assessment of the instructional model (E_1/E_2)

Table 3 The results of the efficiency assessment of the instructional model (E_1/E_2)

Criteria	Efficiency Value	Interpretation
E1	85.58	Good
E2	83.55	Fair

The results indicated that the efficiency value of the instructional model was 85.58 and 83.55, which was higher than the standardized criteria.

4.2.3. Comparison of the achievement between the experimental group and the control group

Table 4 Comparison of the achievement between the experimental group and the control group

Group	Number	Average Score	t-test Value	Sig.
Experimental group	34	83.55	9.789	.000*
Control group	28	72.82		

The results revealed that the average post-test score of the experimental group and the control group was significantly different at the .05 level. The average score of the experimental group was higher than the score of the control group.

4.2.4. The result of the computer skills of the students

The students were divided into groups of 3-4 students and carried on 4 computing projects. The computing projects were evaluated by a teacher of Information technology learning strand atKhuean-pitayasan High School.

Table 5 The results of computer skills of the students

Items of Assessment	$\bar{X}$	SD	Interpretation
1. Critical Thinking Skills	**4.56**	**0.57**	**Mostly high**
1.1 Problem analysis	4.55	0.50	Mostly high
1.2 Project planning	4.82	0.45	Mostly high
1.3 Participation in expressing opinion	4.57	0.59	Mostly high
1.4 Being on time	4.52	0.55	Mostly high
1.5 Validity of work	4.36	0.69	high
2. Fluent Thinking Skills	**4.44**	**0.57**	**high**
2.1 Immediate questioning	4.32	0.64	high
2.2 Rapidity of work conclusion	4.48	0.51	high
2.3 Rapidity of information retrieval	4.52	0.55	Mostly high
3. Flexible Thinking Skills	**4.55**	**0.53**	**Mostly high**
3.1 Sharing ideas	4.45	0.50	high
3.2 work improvement	4.57	0.50	Mostly high
3.3 various strategies of work possibility	4.61	0.58	Mostly high
4. Creative Thinking skills	**4.60**	**0.52**	**Mostly high**
4.1 Unique idea	4.68	0.47	Mostly high
4.2 Creative idea for new work	4.73	0.45	Mostly high
4.3 Analytical thinking skills based on the current situation	4.39	0.58	high
Mean	**4.54**	**0.55**	**Mostly high**

The results showed that the average level of the creative thinking skill was very high ($\bar{X}$ = 4.54 and S.D. = 0.55). The four highest-level areas of the computer skills were a critical thinking skill ($\bar{X}$ = 4.56 and S.D. = 0.57), a fluent thinking skill ($\bar{X}$ = 4.44 and S.D. = 0.57), a flexible thinking skill ($\bar{X}$ = 4.55 and S.D. = 0.53) and a creative thinking skill ($\bar{X}$ = 4.60 and S.D. = 0.52)

4.2.4 The satisfaction of the students with the developed learning activities

Table 6 The results of the satisfaction of the students with the learning activities

Items of Assessment	$\bar{X}$	SD	Interpretation
1. Overall of the learning activities	**4.67**	**0.47**	**Mostly high**
1.1 Steps of learning activities	4.50	0.51	Mostly high
1.2 Teaching materials	4.79	0.41	Mostly high
1.3 Evaluation	4.74	0.45	Mostly high
2. Management of learning activities	**4.45**	**0.61**	**High**
2.1 Activities of the project work and additional study	4.62	0.49	Mostly high
2.2 Collaborative learning activities	4.29	0.72	high
3. Electronic media	**4.52**	**0.52**	**Mostly high**
3.1 Clearness	4.44	0.61	high
3.2 Understanding	4.56	0.50	Extremely high
3.3 Memorizing	4.59	0.50	Mostly high
3.4 Interesting	4.53	0.51	Mostly high
Mean	**4.56**	**0.54**	**Mostly high**

The results showed that the average level of the satisfaction of the students with the learning activities was very high ($\bar{X}$ = 4.56 and S.D. = 0.54). The two mostly high° level areas of the satisfaction were the overall of the learning activities ($\bar{X}$ = 4.67 and S.D. = 0.47) and electronic media ($\bar{X}$ = 4.52 and S.D. = 0.52) . The high-level-area of the satisfaction was management of the learning activities ($\bar{X}$ = 4.45 and S.D. = 0.61).

4.3 Discussion

The research results indicated that the average level of opinion of the experts towards the learning activities consisting of five steps was high ($\bar{X}$ = 4.39 and S.D. = 0.65). The finding indicated that the average level of the opinion of the experts towards the quality of the learning activities was high ($\bar{X}$ = 4.51 and S.D. = 0.66) and the efficiency value of the learning activities based on the standardized criteria was 85.58/83.55. The post-test scores of the experimental group and the control group were significantly different at the .05 level. The average level of the creative thinking skills of the students was very high ($\bar{X}$ = 4.54 and S.D. = 0.55). The average level of the satisfaction of the students with the developed learning activities was very high ($\bar{X}$ = 4.56 and S.D. = 0.54). The results may be cause by the appropriate learning model, which the learner-centered instructional model was designed based on the needs and the participatory work of the high school teachers of Information Technology learning strand in Maha Sarakham province. The electronic instructional model consisted of WBI lessons, worksheet, exercises and an achievement test.

4.4 Conclusion

The instructional model is an effective and efficient model which is able to be used for the instructional purpose.

4.5 Suggestions

4.5.1 Application of the results

1) Study the handbook precisely before instruction

2) Practice the computer skills before using WBI

3) Replacing earphone for speakers

4.5.2 Further research

1) Application of the instructional model for other schools

2) Application of the instructional model with the new content of Information technology Learning Strand

3) Application of the instructional model to other learning strands

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