



## **RESEARCH REPORT**

# **A STUDY OF LEARNING SATISFACTION VIA E-LEARNING USING LEARNING MANAGEMENT SYSTEM (LMS)**

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## ABSTRACT

E-learning is the computer and network-enabled transfer of skills and knowledge. In e-learning systems, even though few researches on such systems have investigated learner emotions. Research has proposed systems that provide functions to analyze such learner emotions as boredom, interest, or sadness. Unlike previous work, we propose a new e-learning system that considers attention, motivation, satisfaction, enjoyment, interest, anxiety, frustration, scare and tiring. We designed and implemented a prototype experimentally evaluated it, and confirmed that emotional aspects are important in e-learning.

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## 1. INTRODUCTION

E-learning is an innovation technology that provide a strategy to improve the quality of teaching and learning anytime and anywhere. It has becomes heavily learner-centered and emphasizes pervasive and personalized learning technologies. As more and more technological tools become available for online education, interest will increase among educators and other professionals in their application in online courses [1].

E-learning provides many benefits. During recessions, its case becomes even stronger. Key benefits include low cost, fast delivery, self-paced, reduced travel time, personalized and convenient scheduling, and lower environmental impact.

Previous e-learning studies not only generated good learning outcomes but also more fully engaged learners in the learning process [2]. The importance of emotions in education has been illustrated and researched in many ways through traditional classroom teaching. In engaged learning perspectives, engaged learners are behaviorally, intellectually, and emotionally involved in their learning tasks. In e-learning systems, emotions are important for instructors to create a positive, emotionally safe classroom environment to provide optimal learning. Learning how to manage feelings and relationships constitutes a kind of emotional intelligence that nourishes success [3]. Therefore, how emotions evolve during the learning process and the emotion feedback that was returned to learners can be used to improve learning experiences.

Many higher education institutions have implemented learning management systems (LMSs) to manage online learning and teaching. Providing varying levels of support to staff and students improves the speed and the effectiveness of educational processes and communication among learners as well as among staff and students [1].

In this study, we focused on the emotional aspects of e-learning system. We experimentally designed, implemented, and evaluated a learning environment and a tool that avoids ineffective affective states, such as boredom, anxiety, or anger.

## 2. LITERATURE REVIEW

Goleman, the author of *Emotional Intelligence*, argues that emotional quotient (EQ) is more important than intelligence quotient (IQ) [4]. Therefore, the issue for e-learning is to recommend ways to keep it from being boring. We recognize that e-learning is different from face-to-face instruction because it lacks a trainer who addresses the emotional component. We provide sensible advice for keeping e-learning relevant.

Khan developed a framework for e-learning that contained the following eight dimensions [5]:

- E-learning's pedagogical dimension, which refers to teaching and learning, addresses issues concerning content, audience, goal, and media analyses, design approach, organization and methods, and strategies of e-learning environments.

- The technological dimension of the e-learning framework examines the technology infrastructure issue in e-learning environments. This includes infrastructure planning, hardware and software.
- The interface design refers to the overall look and feel of the e-learning programs. This dimension encompasses the page and site designs, the content design, navigation, and usability testing.
- E-learning evaluation assesses both learners and the instruction and learning environments.
- E-learning management maintains the learning environment and distributes information.
- The resource support dimension of the e-learning framework examines the online support and resources required to foster meaningful learning environments.
- E-learning's ethical considerations are related to social and political influence, bias, cultural, geographical, and learner diversity, information accessibility, etiquette, and legal issues.
- The institutional dimension is concerned with issues of administrative affairs, academic affairs, and student services related to e-learning.

This framework provides a new e-learning system.

As identified by different researches, Kittanakere et al. summarized the main goals of e-learning systems [6]:

- Focus on active learning.
- Accommodate various learning styles.
- Explicitly place the responsibility for learning on the students themselves.
- Develop written and oral communication skills.
- Clarify the teacher's role as facilitator and mentor.
- Provide better coverage of class material.
- Develop a sense of self-confidence and independence in students.
- Encourage peer review.
- Develop interpersonal communication skills when students are geographically distant.
- Support the entire educational process when students are separated both geographically and temporally.
- Teach time management, especially meeting deadlines.

Kittanakere et al. introduced an emotion sensitive e-learning system that emphasizes the complete learning process and is very cost effective. It categorizes a learner's emotional state as happy, neutral, or sad. This stimulates thought about incorporating emotional aspects of teaching in e-learning systems to make them more intelligent. An intelligent e-learning system should be able to adapt to the knowledge, learning abilities, and needs of each learner. Such flexibility offers the feeling of individual care, which supports in the learning process.

Russell developed this circumplex model to describe a user's emotion space [7]. The basic set includes the most important and frequently occurring emotions during learning: interest, engagement, confusion, frustration, boredom, hopefulness, satisfaction, and disappointment. We used this model to analyze learner emotions.

Kaiser and Oertel also integrated an emotion recognition sensor system (EREC) into an e-learning system [8]. Their system uses EREC, which was developed at the Institute of Genetics and Development of Rennes (IGD-R), to detect emotions by affective components that consist of a sensor glove, a chest belt, and a data collection unit. The affective components are based on Russell's circumplex model of emotion, which is a dimensional approach for classifying emotions.

Hu also integrated an e-learning performance evaluation system [9], which included two technology platforms for blog and online testing systems. The blog system evaluates learning processes to motivate learning awareness and provides real-time feedback of evaluation information. The online testing system evaluates the learning result of a certain period to help students summarize what they have learned and experienced in the learning process.

Joanne et al. formally evaluated the module's phase using the outcome levels of Kirkpatrick's framework [10]:

- Level one: assessment of learner satisfaction with educational intervention. This involves a courseware evaluation survey (CES) developed to evaluate participant satisfaction based on five variables.
- Level two: student learning. This involves a multicenter randomized controlled study using pre and post-test knowledge before and after residents used the module.
- Level three: assessment of training transfer. This involves a retrospective pre and post questionnaires, which are commonly used for quantitative analysis in medical education research.
- Level four: outcomes, which examined the effects on the environment resulting from the application of training.

Chin-Yeh et al. also designed two kinds of humorous performances that were learning-relevant to help students remember [11]. One appeared at the end of every learning video, and the other appeared when the students expressed emotions. They used paper-and-pencil materials that consisted of a pre-test, a post-test, and a questionnaire. The computerized materials consisted of a multimedia computer program for teaching Chinese history.

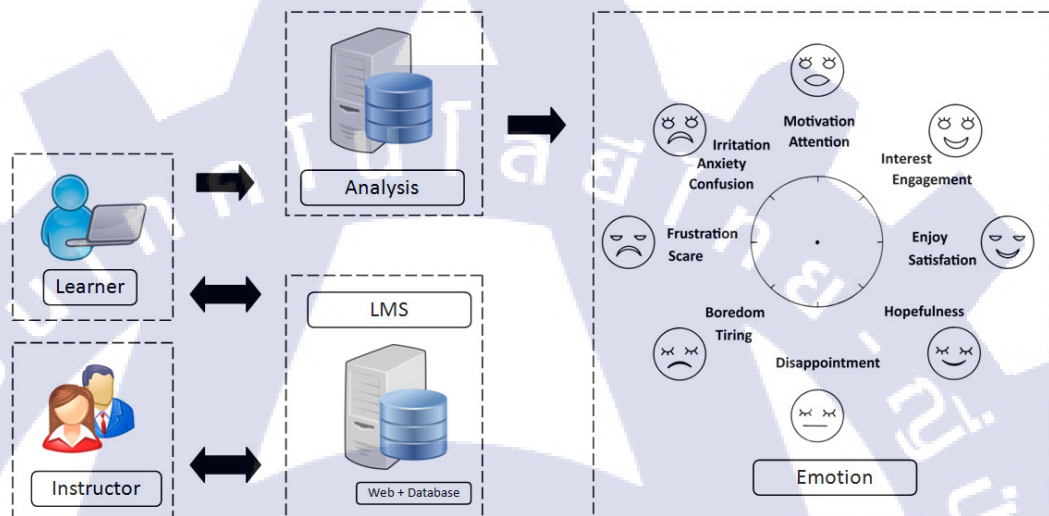
Based on these literature reviews, we designed a new e-learning system that focuses on learner emotions using questionnaires. Our learning system helps learners deal with negative emotions such as boredom, anxiety, or anger and to keep their attention and enhance their learning motivation, interest, and performance.

### **3. DESIGN OF NEW E-LEARNING SYSTEM**

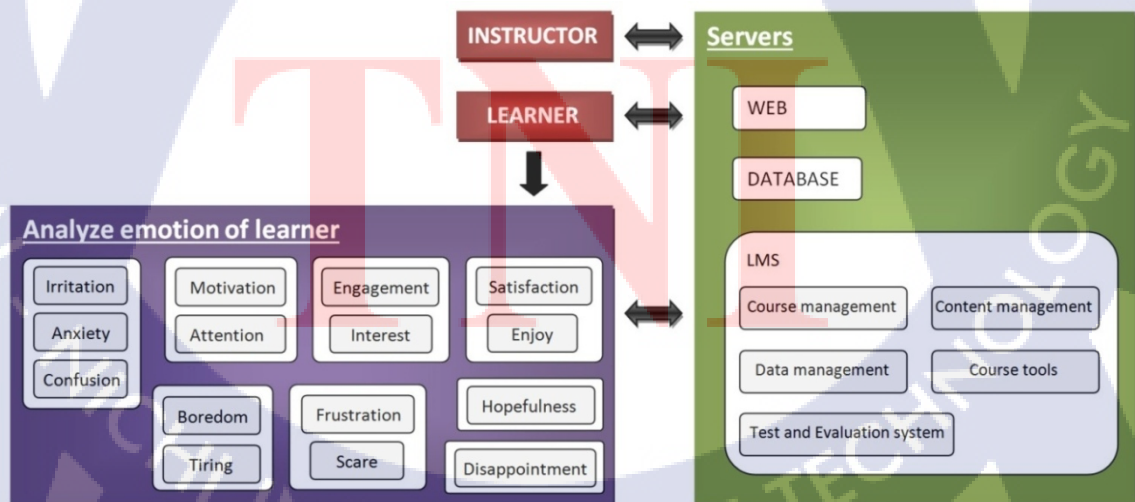
We used an e-learning framework [5] with the eight dimensions described in Section 2. These dimensions encompass various online learning aspects, including pedagogical,

technological, interface design, evaluation, management, resource support, ethical, and institutional issues. Various factors discussed in the framework's eight dimensions can provide guidance in the design, development, delivery, and evaluation of flexibility.

Our system uses an LMS for delivering, tracking, and managing education and a web server that provides users with easy access by a web browser on a personal computer (Figures 1 and 2).



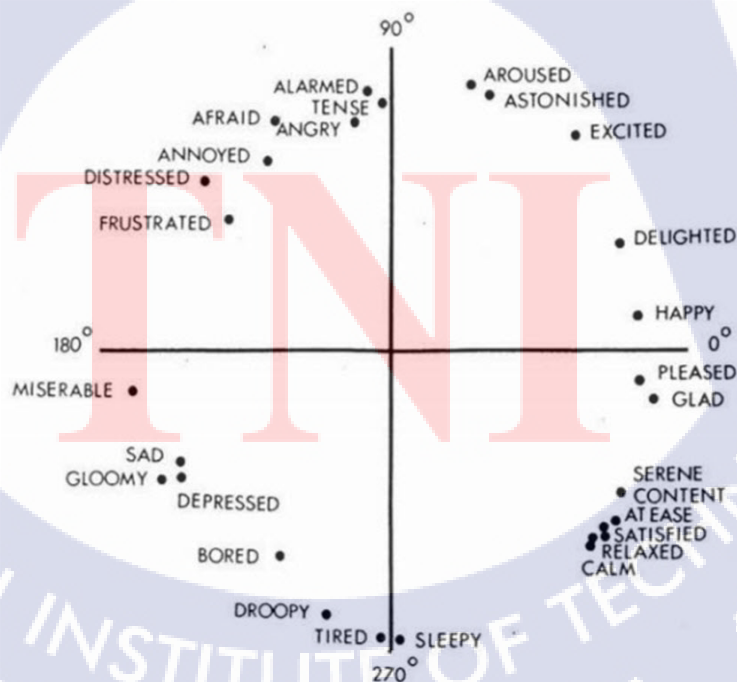
**Figure 1:** Proposed e-learning system



**Figure 2:** Framework design

The design of our new e-learning system consists of four modules: learners, instructors, servers, and analysis of learner emotions (Figure 1). The details are described below:

1. Learners: individuals who register for takes up e-learning by the e-learning system and can choose any of the courses provided by the LMS
2. Instructors: a critical element of this system. They create and design courses, content, tests, quizzes, and evaluations in LMS.
3. Servers: web, LMS, and database. The details are described below:
  - a) Web server dispenses web pages as they are requested from the LMS.
  - b) Database server provides database services to the LMS.
  - c) The LMS is a web-based technology that plans, implements, and assesses a specific learning process. Typically, it provides an instructor with a way to create and deliver content, monitor student participation, and assess performance. An LMS consists of the following five parts (Figure 2):
    - Course management helps store, organize, and communicate a course's information. It consists of two user groups, learners and instructors, that can access the system anytime and anywhere.
    - Content management includes tools for creating and supporting the content.
    - The test and evaluation system manages exams, interactive quizzes, and integrated tests in the database system to evaluate the learners.
    - Course tools are used to help and guide each user.
    - The data management system manages the files and folders of each user.
4. Analysis of learner's emotion. We devised this system to understand how learner emotions evolve during the learning process to develop learning systems that recognize and respond appropriately to their emotional changes. We used a questionnaire design [11] and Russell's circumplex model to describe the learner's emotion space [7, 8] (Figure 3).



**Figure 3:** Russell's circumplex model [7]

## 4. EXPERIMENT

### 4.1. Experiment Method

Based on previous research [9, 10, 11], we built a prototype of our new e-learning system, which consists of a series of lessons, pre-tests, post-tests, and questionnaires for teaching C programming for control. We prepared two lesson patterns (Table 1). The process of each is shown in Figure 4, and the details are described below:

- Pattern I: the learners study C programming for control in lesson 1 by power point (PPT) and in lesson 2 by video.
- Pattern II: they learn C programming for control in lesson 1 by video and in lesson 2 by PPT.

The PPT and video designs are shown in Table 2 and described below:

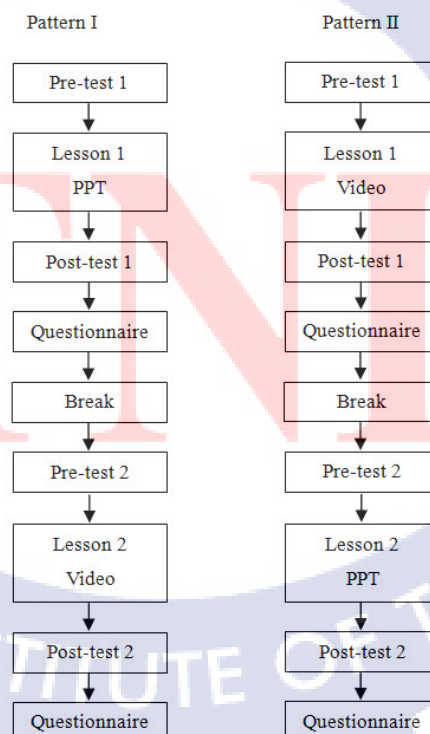
- The PPT design includes text and cartoon. Learners can control the content flow by pushing the enter button.
- The video design runs automatically and includes text, cartoon, and voice.

The content of lesson 1 introduces C programming for control and covers the following two topics:

- 1) Introduction to C programming for control
- 2) Programming style

**Table 1:** Lesson patterns

Lesson	Pattern I	Pattern II
1	PPT	Video
2	Video	PPT



**Figure 4:** Process of our learning system

**Table 2:** Design details of PPT and video

Design Detail	PPT	Video
Cartoon	Static	With movement
Voice	None	Yes
Control	Push enter button	Automatic

The content of lesson 2 is basic of C programming for control and covers the following three topics:

- 1) Structure of a C program
- 2) Developing a small program in C
- 3) Inputting data and printing the results obtained from a C program for control.

The content of lesson 2 is more difficult than lesson 1.

Examples of pre and post-test questions for lesson 1 are shown in Tables 3 and 4. Since both consist of ten questions and each question has one point, the highest score is ten.

**Table 3:** Examples of pre-test questions for lesson 1 (in Thai).

Lesson 1 pre-test	
Q#	Content
1.	Which is a low level language? a. Cobalt b. Assembly c. Pascal d. Basic
2.	What language can computers understand? a. All languages b. High-level languages c. Machine languages d. Low-level languages
3.	What is the function of the Arithmetic and Logic Unit as part of the processor? a. Collection of various commands. b. Calculation and comparison. c. Results. d. Controls.
4.	What is a program command called that compiles a high-level language into a machine language? a. Object program b. Compiled program c. Source program d. Computer program
5.	What should be stored as a start command for a computer system in any part of the computer system? a. ALU b. CPU c. RAM d. ROM

**Table 4:** Examples of post-test questions for lesson 1 (in Thai).

Lesson 1 post-test	
1.	What is computer programming? a. Convincing your computer to never freeze b. Speeding up your computer c. Setting the alarm on a computer d. Telling your computer what to do through a special set of instructions
2.	Which of the following is NOT a software language? a. C b. C++ c. Visual Basic d. HTML
3.	If you were to look at a machine language program, you would see _____. a. Source code b. A stream of binary numbers c. English words d. Circuits
4.	Which of the following is NOT a web language a. C++ b. PHP c. Javascript d. HTML
5.	Every C program begins execution at function _____. a. main() b. #include c. Void d. Compiler

Q# : Question number

Our system uses servers and links to the Internet by such common web browsers as Internet Explorer, Chrome, and Firefox [12] (Figures 5 to 8). The procedures are described below:

1. Learners register when they first log onto the e-learning system. After logging in, personalized e-learning starts.
2. They take a pre-test within ten minutes before lesson 1 starts.
3. They learn lesson 1 of pattern I only one time. If they do not understand it, they can repeat lesson 1 to get additional explanation of the text content.
4. After finishing lesson 1, they take a post-test.
5. They answer a questionnaire.
6. They take a 10 minutes break.
7. They take a pre-test before lesson 2 starts.
8. They learn lesson 2 of pattern I only one time. If they do not understand, they can repeat lesson 2 to get additional explanation of the text content.
9. After finishing lesson 2, they take a post-test.
10. They answer a questionnaire.

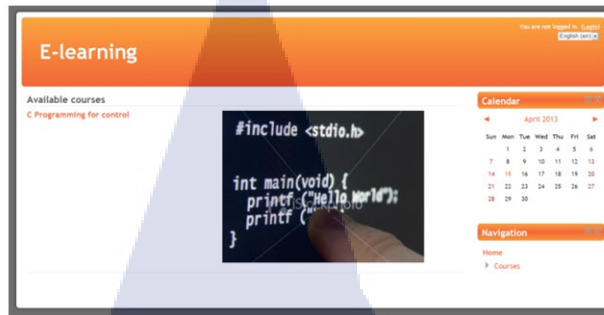


Figure 5: Example of interface design for first page

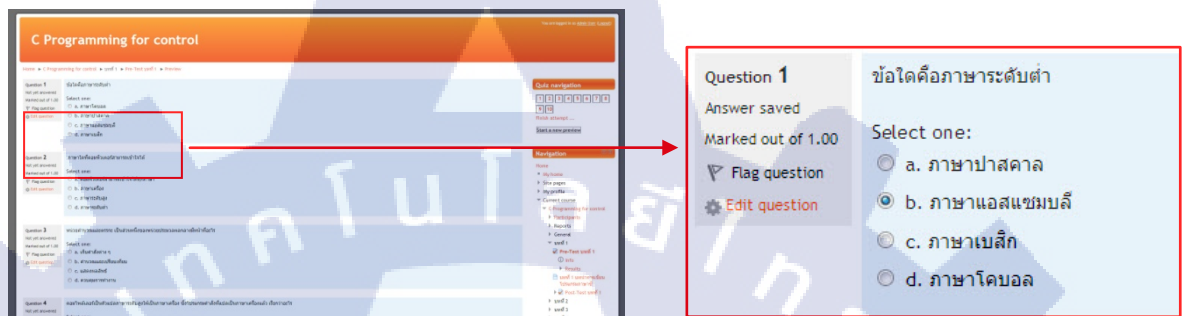


Figure 6: Example of interface design for pre-tests, post-tests and questionnaires.

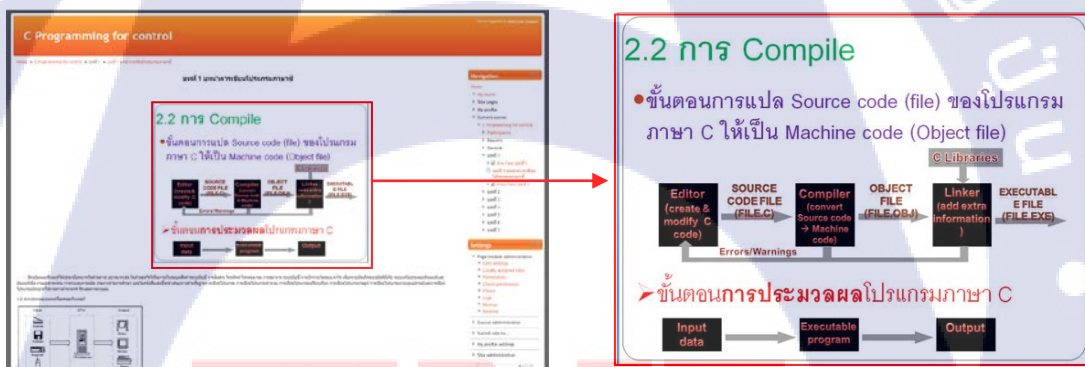


Figure 7: Example of interface design for PPT

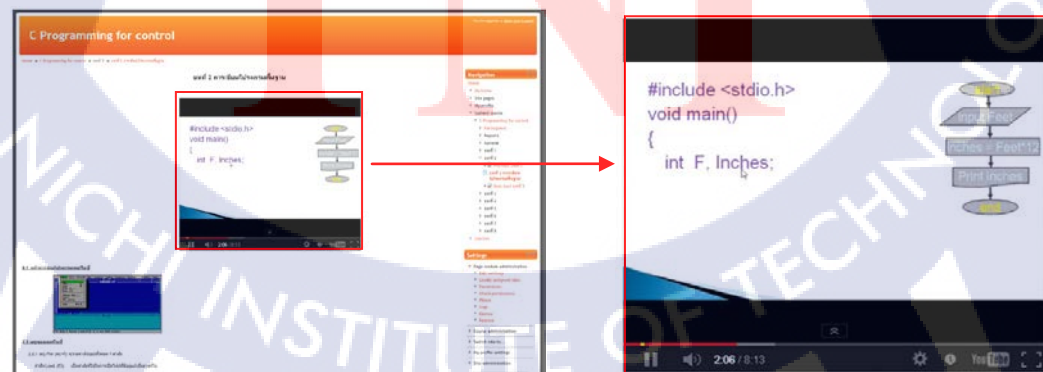


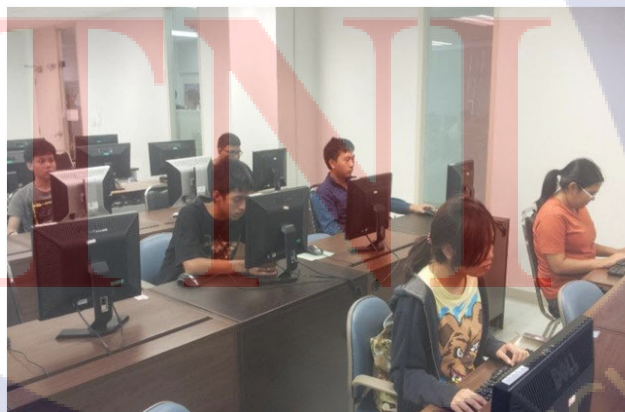
Figure 8: Example of interface design for video

Our questionnaires asked 15 questions related to learner emotions in e-learning systems [11]. Participants answered on a 5-points Likert scale [13] (Table 5).

**Table 5:** Questionnaire items on 5-point Likert scale (in Thai).

Q#	Content	Related emotion
1	The learning process increased my learning attention.	Attention
2	Putting a multimedia performance into the learning system motivated me to use it.	Motivation
3	The learning system helped me learn better.	Satisfaction
4	I reduced my negative emotions after interacting with the learning system.	Negative emotion
5	Interacting with the learning system increased my positive emotions.	Positive emotion
6	E-learning made my course more enjoyable.	Enjoy
7	From time to time the courses were interesting.	Interest
8	E-learning is satisfying.	Satisfaction
9	Studying e-learning courses was often fun.	Enjoy
10	I felt proud after finishing an e-learning course.	Satisfaction
11	Some feature of e-learning were stressful.	Anxiety
12	The e-learning courses were frustrating.	Frustration
13	Using the e-learning courses was irritating.	Irritation
14	Starting the e-learning course was scares me.	Scare
15	Using the e-learning system was sometimes tiring.	Tiring

Q# : Question number



**Figure 9:** Experiment scene.

## 4.2. Experiment Results and Discussion

We conducted our experiments by equally dividing 60 Thai-Nichi Institute of Technology students into two groups for patterns I and II. Figure 9 shows a scene of the experiment.

### 4.2.1. Pre-test and post-test results

The results of the pre and post-test scores for learning lessons 1 and 2 are summarized in Table 6. From the statistical analysis results, the mean difference between the post and pre-test results of lesson 1's PPT (2.90) was significantly higher than that of its video (2.63) ( $p < .01$ ).

The mean difference between the post and pre-test results of lesson 2's video (3.37) was significantly higher than that of its PPT (3.17) ( $p < .01$ ).

### 4.2.2. Lesson 1 results

We conducted an independent-samples t-test to compare the results for learning lesson 1 between the PPT in Pattern I and the video in Pattern II for the questionnaire shown in (Table 7). We found the following significant difference in the scores for questions 11 to 15 between the PPT and the video at a 1% level:

- Q#11: E-learning with PPT has features that caused more anxiety than e-learning with video.
- Q#12: E-learning courses caused more learner frustration with PPT more than with video.
- Q#13: Using the e-learning courses is more irritating with PPT than with video.
- Q#14: Learners are more scared when starting an e-learning course with PPT than with video.
- Q#15: Using the e-learning system was at times more tiring with PPT than with video.

On the other hand, we found no significant differences in the scores for questions 1 to 10.

**Table 6:** Pre and post-test results.

Lesson	Design	Pre-test		Post-test		Differences between Post-Pre tests		t-test	
		Mean	SD.	Mean	SD.	Mean	SD.	t	P-Value
1	PPT	4.63	1.82	7.53	1.27	2.90	1.80	11.919	.000**
	Video	4.80	1.29	7.43	1.22	2.63	1.81		
2	PPT	4.83	1.68	8.00	1.36	3.17	1.80	38.980	.000**
	Video	4.27	1.23	7.63	1.52	3.37	1.81		

\*\* :  $p < .01$

**Table 7:** Learning lesson 1 results.

Q.#	PPT		Video		t	P-Value
	Mean	SD.	Mean	SD.		
1	3.67	.606	3.47	.776	1.112	.271
2	2.90	.548	3.20	.805	-1.687	.098
3	3.57	.504	3.50	.630	.453	.652
4	3.17	.913	3.37	.890	-.859	.394
5	3.30	.596	3.37	.669	-.408	.685
6	2.87	.730	2.97	.765	-.518	.606
7	2.93	.868	3.17	.950	-.993	.325
8	3.43	.568	3.37	.615	.436	.664
9	3.07	.583	3.20	.484	-.963	.339
10	3.97	.669	3.73	.740	1.282	.205
11	3.30	.988	2.07	1.143	4.472	.000**
12	2.63	.490	1.90	.885	3.971	.000**
13	2.40	.814	1.57	.774	4.065	.000**
14	3.83	.648	2.17	1.440	5.780	.000**
15	3.27	.907	1.93	1.230	4.779	.000**

\*\* : p&lt;.01

Q# : Question number

**Table 8:** Learning lesson 2 results.

Q.#	PPT		Video		t	P-Value
	Mean	SD.	Mean	SD.		
1	2.47	.571	3.97	.809	-8.297	.000**
2	2.63	.556	3.70	.837	-5.816	.000**
3	3.30	.915	3.17	.699	.634	.529
4	3.30	.596	3.77	.728	-2.717	.009**
5	2.83	.699	3.67	.802	-4.290	.000**
6	2.00	.743	2.40	1.070	-1.682	.099
7	1.50	.630	2.23	.817	-3.893	.000**
8	2.10	.803	1.87	.571	1.297	.200
9	2.60	1.248	2.20	.714	1.523	.135
10	1.93	.640	2.40	1.102	-2.006	.051
11	3.10	.923	3.50	.974	-1.633	.108
12	3.60	1.003	3.27	.521	1.615	.114
13	4.17	.747	3.13	.434	6.553	.000**
14	4.40	.770	3.57	.679	4.446	.000**
15	2.03	.765	2.50	.630	-2.580	.012*

\* : p&lt;.05

\*\* : p&lt;.01

Q# : Question number

#### 4.2.3. Lesson 2 results

We conducted an independent-samples t-test to compare the results for learning lesson 2 between PPT in Pattern II and video in Pattern I for the questionnaires shown in Table 8. We found a significant difference in the scores for questions 1, 2, 4, 5, 7, 13, and 14

between PPT and video at a 1% level. In addition, we found a significant difference in the scores for question 15 between PPT and video at a 5% level:

- Q#1: The learning process increased the learning attention more with video than with PPT.
- Q#2: Putting the multimedia performance on video motivated learners to use the system more than with PPT.
- Q#4 and #5: Video interaction increased their positive emotions and lowered their negative emotions more in the learning system than with PPT.
- Q#7: Sometimes the course was more interesting with video than with PPT.
- Q#13: Using the e-learning course was more irritating with PPT than with video.
- Q#14: Learners are more scared when starting an e-learning course with PPT than with video.
- Q#15: Using the e-learning system was at times more tiring with video than with PPT.

#### 4.2.4. Comparison of lessons 1 and 2

We obtained the following from the results in Tables 7 and 8:

- Q#1: The learning process with video increased the learning attention more than PPT in lesson 2. This may reflect that automatically running lesson2's video required learners to pay more attention than in lesson 1, because lesson 2's content was more difficult than lesson 1, as we already noted.
- Q#2: In lesson 2, putting the multimedia performance into the learning system motivated learners more with video than with PPT. Future work will investigate which attributes in Table 2 affect motivation.
- Q#4 and #5: Interaction with the learning system with video increased learner positive emotions and lowered their negative emotions more with PPT in lesson 2. Future work will investigate which attributes affect positive and negative emotions.
- Q#7: The course with video is more interesting than with PPT in lesson 2. Future work will investigate which attributes affect interest.
- Q#11 and #12: PPT caused more anxiety and frustration than the video in lesson 1. Future work will investigate which attributes affect anxiety and frustration.
- Q#13 and #14: Using the e-learning course is more irritating with PPT than with the video both in lessons 1 and 2. Starting the e-learning course with PPT is more scared than with the video both in lessons 1 and 2. Future work will investigate which attributes affect irritation and scare.
- Q#15: Using the e-learning system was more tiring with the video than with the PPT in lesson 2. Perhaps automatically running the video is more tiring than PPT where the learners can proceed to the next slide by themselves. Perhaps the cause is the fact that lesson 2's content was more difficult than lesson 1 as we already described.

#### 4.2.5. Relation between test and questionnaire results

We obtained the following from the results of Tables 6, 7, and 8:

- Lesson 1: The scores and emotions do not match. This may be because lesson 1's content was more easier than lesson 2's.

- Lesson 2: The learner emotions directly reflect the test scores because lesson 2's content was more difficult than lesson 1's.

These results show the importance of the emotional aspects of e-learning systems.

## 5. CONCLUSION

We designed a new prototype e-learning system and tools to avoid inefficient affective states, such as boredom or anxiety. Our new e-learning system consists of four modules: learners, instructors, servers, and analysis of learner emotions. We analyzed learner emotions based on Russell's circumplex model to describe the user's emotion space.

We built a prototype of an e-learning system and experimentally evaluated it by pre and post-test scores and questionnaires about learner emotions.

We obtained the following results by comparing the test scores and the questionnaire results.

- For lesson 1, the PPT scores are higher than the video scores. However, PPT induces more anxiety, frustration irritation, scared, tiring during learning. We do not conclude that PPT is better than video.
- For lesson 2, its video scores are higher than PPT. It also increases attention, motivation, and interest more than PPT. We conclude that video is more effective than PPT.
- Emotional aspects are important in e-learning.

In general, an e-learning system's effect is measured by such scores as the differences between pre and post-tests. However, our experimental results suggest that we should consider account emotional aspects in the design interfaces or the contents of e-learning systems.

In future work, we will design a new e-learning system with the following features:

- Sending feedback to an LMS based on learner emotions.
- Detection of learner emotions using biological signals.

We want to evaluate learner emotions by biological signals instead of questionnaires because we cannot detect learner emotions in real-time.

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APPENDIX

TNI

**Table 9:** Pre, Post-test questions for lesson 1 (in Thai).

Q#	Content
1.	Which is a low level language? a. Cobalt b. Assembly c. Pascal d. Basic
2.	What is computer programming? a. Setting the alarm on a computer b. Speeding up your computer c. Convincing your computer to never freeze d. Telling your computer what to do through a special set of instructions
3.	Which of the following is NOT a software language? a. Visual Basic b. HTML c. C d. C++
4.	What language can computers understand? a. All languages b. High-level languages c. Machine languages d. Low-level languages
5.	What is the function of the Arithmetic and Logic Unit as part of the processor? a. Collection of various commands. b. Calculation and comparison. c. Results. d. Controls.
6.	If you were to look at a machine language program, you would see _____. a. A stream of binary numbers b. Circuits c. English words d. Source code
7.	What is a program command called that compiles a high-level language into a machine language? a. Object program b. Compiled program c. Source program d. Computer program
8.	Which of the following is NOT a web language a. C++ b. PHP c. Javascript d. HTML

**Table 9:** Pre, Post-test questions for lesson 1 (in Thai). (Continues)

Q#	Content
9.	What should be stored as a start command for a computer system in any part of the computer system? a. ALU b. CPU c. RAM d. ROM
10.	Every C program begins execution at function _____. a. #include b. Void c. main() d. Compiler



**Table 10** : Pre, post-test questions for lesson 2 (in Thai).

Q.#	Content
1.	<p>What is the final value of x when the code is run?</p> <pre>int x; for(x=0; x&lt;10; x++) { };</pre> <ol style="list-style-type: none"> <li>10</li> <li>9</li> <li>0</li> <li>1</li> </ol>
2.	<p>When does the code block following while(x&lt;100) execute?</p> <ol style="list-style-type: none"> <li>When x is less than one hundred.</li> <li>When x is greater than one hundred.</li> <li>When x is equal to one hundred.</li> <li>While it wishes.</li> </ol>
3.	<p>Which is not a loop structure?</p> <ol style="list-style-type: none"> <li>For</li> <li>Do while</li> <li>While</li> <li>Repeat Until</li> </ol>
4.	<p>What is wrong?</p> <pre>for (int k = 2, k &lt;=12, k++)</pre> <ol style="list-style-type: none"> <li>The increment should always be ++k.</li> <li>The variable must always be the letter i when using a for loop.</li> <li>There should be a semicolon at the end of the statement.</li> <li>The commas should be semicolons.</li> </ol>
5.	<p>If there is more than one statement in the block of a for loop, which of the following must be placed at the beginning and the ending of the loop block?</p> <ol style="list-style-type: none"> <li>parentheses ( )</li> <li>braces { }</li> <li>brackets [ ] There should be a semicolon at the end of the statement.</li> <li>arrows &lt; &gt;</li> </ol>
6.	<p>How many times is a do while loop guaranteed to loop?</p> <ol style="list-style-type: none"> <li>0</li> <li>Infinitely</li> <li>1</li> <li>Variable</li> </ol>

**Table 10** : Pre, post-test questions for lesson 2 (in Thai). (Continues)

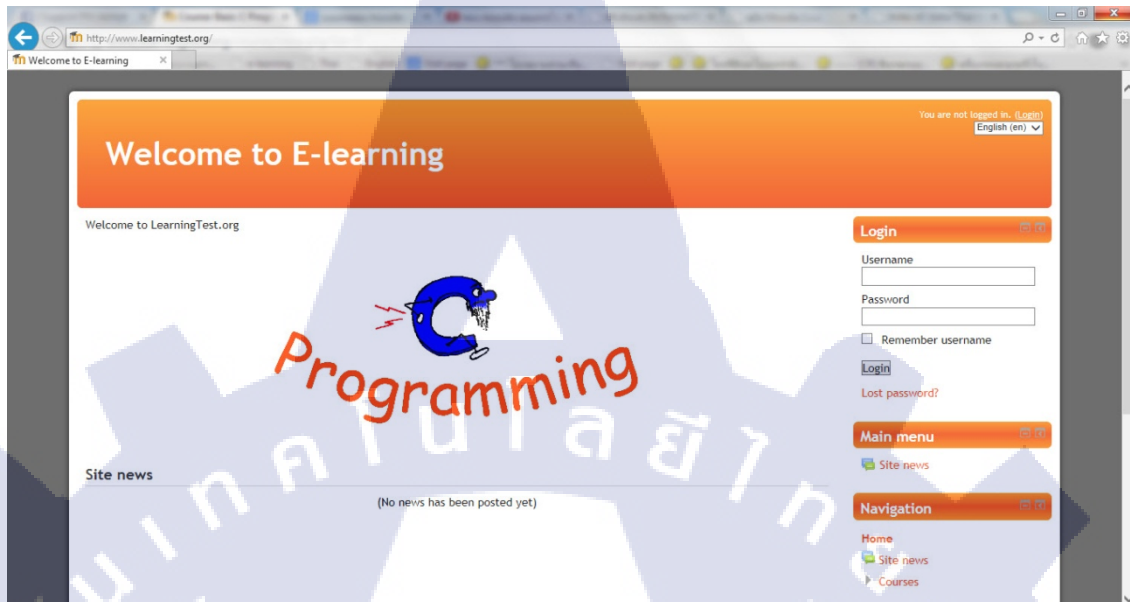
Q.#	Content
7.	<pre>#include&lt;stdio.h&gt;  int main() {     int n;     for (n = 9; n!=0; n--)         printf("n = %d", n--);     return 0; }</pre> <p>What is the output of this program?</p> <ol style="list-style-type: none"> <li>9 7 5 3 1</li> <li>9 8 7 6 5 4 3 2 1</li> <li>Infinite Loop</li> <li>9 7 5 3</li> </ol>
8.	<p>Which of the following for headers is not valid?</p> <ol style="list-style-type: none"> <li>for ( int i = 0; i &lt; 10; i++ )</li> <li>int i = 0; for ( ; i &lt; 10; i++ )</li> <li>for ( int i = 0; int j = 5; ; i++ )</li> <li>for ( int i = 0; i &lt; 10; i+=1 )</li> </ol>
9.	<pre>main( ) {     int x = 1 ;     while ( x == 1 )     {         x=x-1;         printf ( "%n%d", x ) ;     } }</pre> <p>What is the output of this program?</p> <ol style="list-style-type: none"> <li>0</li> <li>1</li> <li>2</li> <li>3</li> </ol>

**Table 10** : Pre, post-test questions for lesson 2 (in Thai). (Continues)

Q.#	Content
10.	<p>How many * this code will print of this program?</p> <pre> main() { int i,j; for (i =1; i&lt;=5;i++)     for(j=i;j&lt;=5;j++)         printf("*"); } </pre> <p>a. 25 b. 20 c. 15 d. 10</p>

## MANUAL

.1First page



**Figure 10:** Example of interface design for first page

2. Login

**Login**

Username  
tni98

Password  
•••••

☐ Remember username

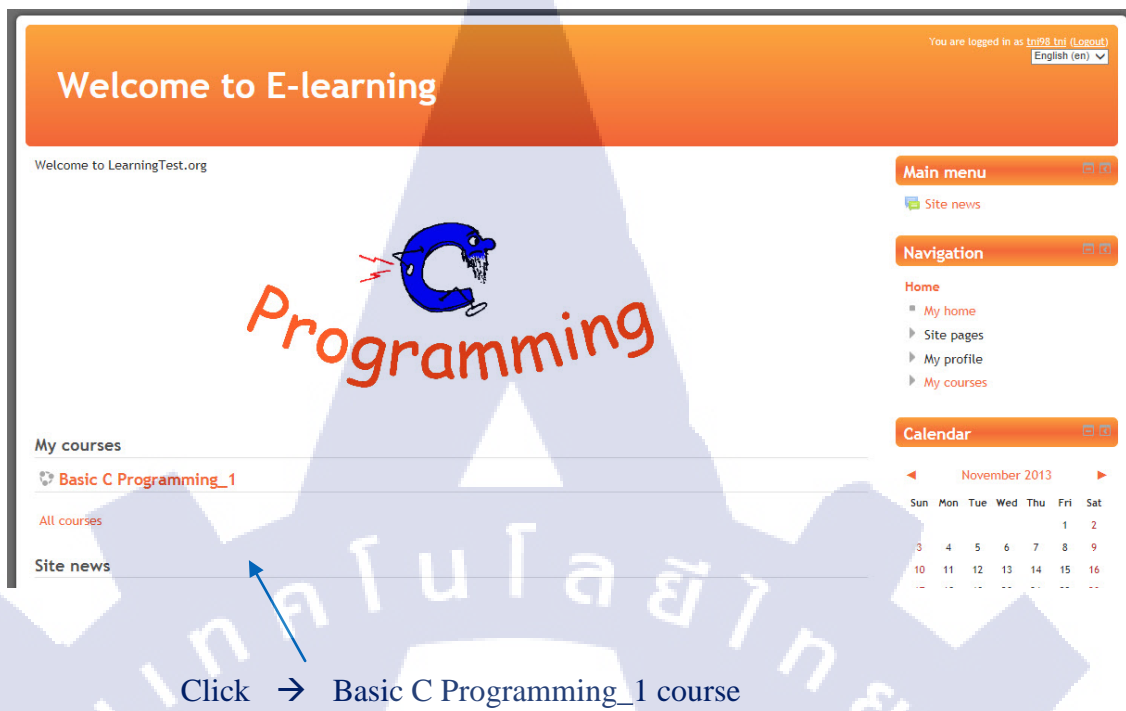
[Login](#)

[Lost password?](#)

← eman resu, password

**Figure 11:** Example of interface design for login

## 3. Personal page



**Figure 12:** Example of interface design for first page of personalized e-learning starts after logging in.

The screenshot displays a web-based e-learning platform interface. At the top, an orange header bar contains the title "Introduction to C Programming". Below this, a breadcrumb trail shows "Home > My courses > Jishu > C Programming".

The main content area is divided into two sections. The upper section, titled "Introduction to C Programming", provides a welcome message and a list of procedures:
 

1. You take a pre-test 1 before content 1 starts.
2. You learn content 1.
3. After finishing content 1, you take a post-test 1.
4. You answer a questionnaire 1.
- finished content 1 -----
5. You take a pre-test 2 before content 2 starts.
6. You learn content 2.
7. After finishing content 2, you take a post-test 2.
8. You answer a questionnaire 2.
- finished content 2 -----

The lower section, titled "Content 1", shows the progress of "Loop in C Programming Language". It includes a "Pre-test\_1" icon, a "Start Pre-test 1" button with a cartoon character holding a sign, a "C programming" logo, and the text "Chapter 1". Below this, there is a "Post-test\_1" icon and another "Start Post Test 1" button with a cartoon character.

The "Content 2" section follows, titled "Decision Making Statement in C Programming Language". It includes a "Pre-test\_2" icon, a "Start Pre-test 2" button with a cartoon character, a "C programming" logo, and the text "Chapter 2". Below this, there is a "Post-test\_2" icon and another "Start Post Test 2" button with a cartoon character.

On the right side, a sidebar contains several widgets:
 

- Search forums**: A search bar with a "Go" button and a link to "Advanced search".
- Latest news**: A section stating "No news has been posted yet".
- Upcoming events**: A section stating "There are no upcoming events" with links to "Go to calendar..." and "New event...".
- Recent activity**: A section showing activity since Sunday, 22 December 2013, 5:16 AM, with a link to "Full report of recent activity..." and a note "Nothing new since your last login".
- Navigation**: A list of links including "Home", "My home", "Site pages", "My profile", "Current course", "C Programming", "Participants", "Badges", "Introduction to C Programming", "Content 1", "Content 2", and "My courses".
- Administration**: A section with links for "Course administration", "Grades", and "My profile settings".

At the bottom of the page, a status bar indicates "You are logged in as [User Name] (Logout)".

**Figure 13:** Example of interface design for personalized e-learning starts after logging in.

### 3. Pre-test 1 step

Home ► My courses ► THAI ► Basic C ► Program Flowchart ► Pre-Test 1

#### Pre-Test 1



This quiz opened at Sunday, 24 November 2013, 9:10 AM

This quiz will close at Tuesday, 26 November 2013, 9:10 AM

Time limit: 1 hour

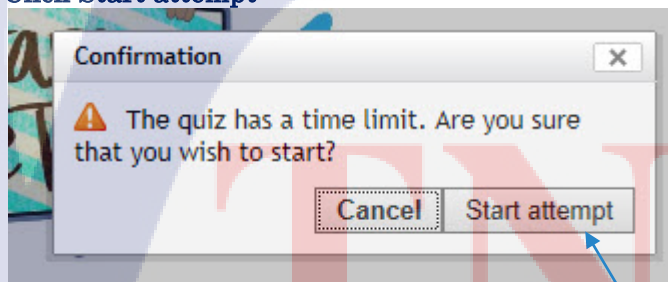
Grading method: Highest grade

[Attempt quiz now](#)

Click the Attempt quiz now button

**Figure 14:** Example of interface design for pre-test 1

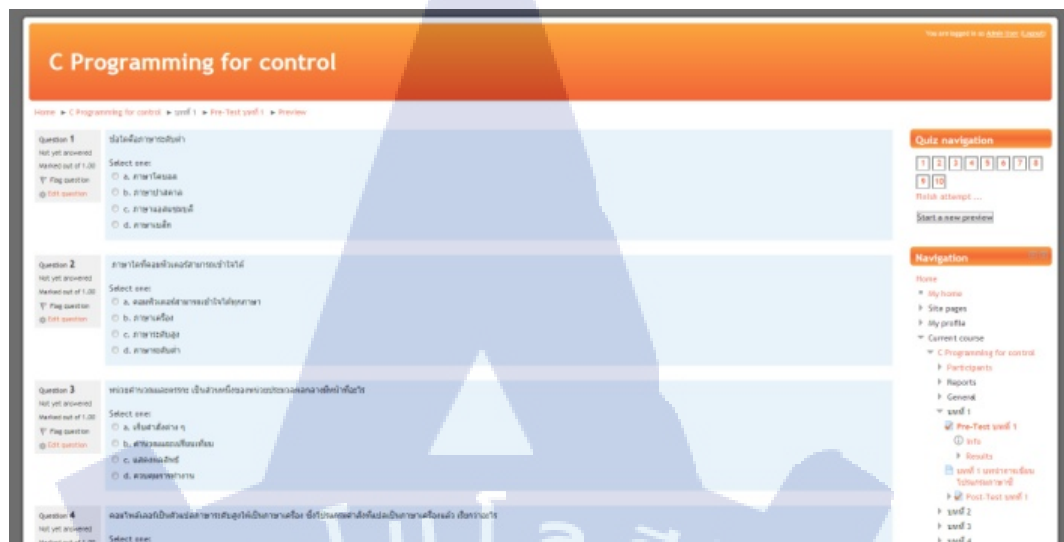
Click Start attempt



Click the Start attempt button for start pre-test 1

**Figure 15:** Example of interface design for pre-test 1

pre-test 1 will be start



**Figure 16:** Example of interface design for pre-test 1

After finished et-erpst 1 will be show in figure

### Pre-Test 1

#### Summary of attempt

Question	Status
1	Answer saved
2	Answer saved
3	Answer saved
4	Answer saved
5	Answer saved
6	Answer saved
7	Answer saved
8	Answer saved
9	Answer saved
10	Answer saved

[Return to attempt](#)

Time left 0:59:25

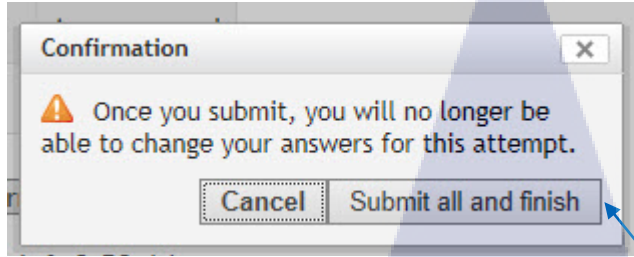
This attempt must be submitted by Sunday, 24 November 2013, 12:11 PM.

[Submit all and finish](#)

Click Submit all and finish button for submitted pre-test 1

**Figure 17:** Example of interface design for submit pre-test 1

Click Submit all and finish



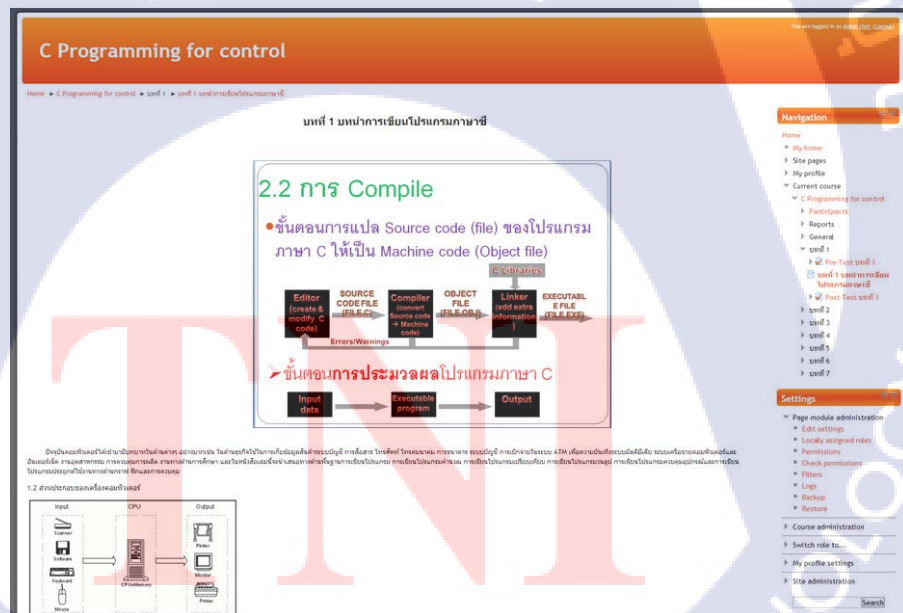
Click Submit all and finish button for confirm submit pre-test 1

**Figure 18:** Example of interface design for submit pre-test 1

#### 4. Learning lesson 1 step

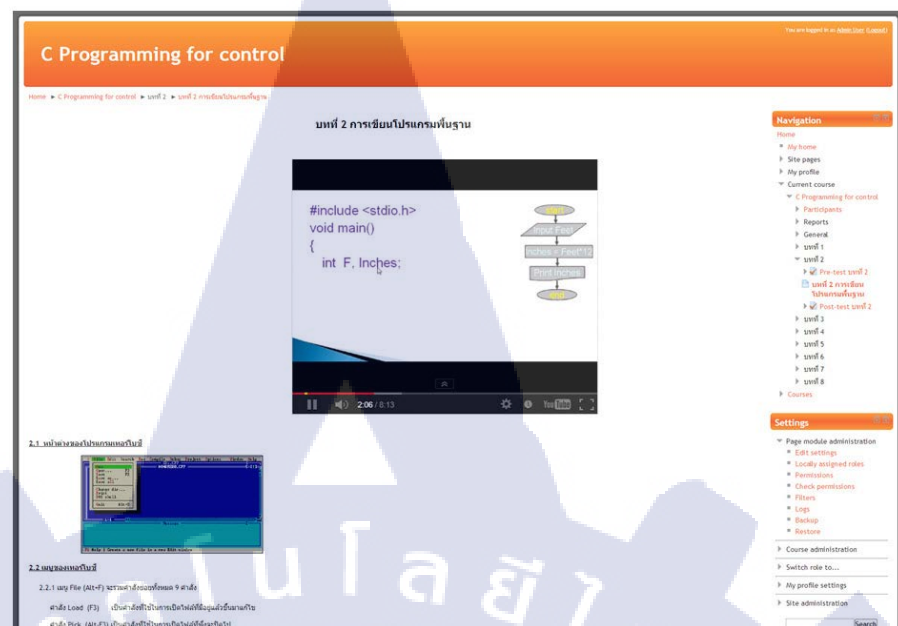
Learner learn lessons 1 or 2 only one time. If they do not understand it, they can repeat lessons 1 or 2 to get additional explanation of the text content.

Example : Learner learn lessons 1 or 2 by PPT



**Figure 19:** Example of interface design for lesson 1 by PPT

Example : Learner learn lessons 1 or 2 by Video



**Figure 20:** Example of interface design for lesson 1 by video



**Figure 21:** Example of interface design for questionnaires.