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Teaching model focus utilising a student centred strategy for vocational students

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ABSTRACT: This research was aimed at developing a teaching strategy that emphasised a student centred approach in an electronic course named *Digital Clock Circuit*. Thirty-two students from Phetchaboon Technical College, Phetchaboon. Thailand, were randomly selected and equally divided into control and experimental groups. The experimental group was assigned to learn using the student centred technique, while the control group was assigned to learn utilising a traditional strategy. Both groups of students were tested before and after the experiment. Learning patterns that were emphasised in the student centred approach for the Digital Clock Circuit course involved BCD to Seven Segments Decodes, Asynchronous Frequency Counter and Frequency Divider. The strategy utilised knowledge construction theory involving three phases, namely: data observation, data analysis and knowledge conclusion; and the application of knowledge constructed, including a laboratory sheet, media and lesson plan. The experimental group obtained higher scores and exhibited a higher degree of enthusiasm in their learning. However, there was no significant difference with regard to the application abilities between the two groups.

INTRODUCTION

In order to become globally competitive in terms of manufacturing, a country must develop the quality of its products so that they will meet with international standards. This calls for improving the techniques and processes used in manufacturing products. Consideration should also be given to the quality of labour, technical knowledge, managerial skills, and business ethics. The 1995 Summit Meeting on Society Development was concerned with human and sustainable development, which are both a challenge for human society today. Thus, many countries have increased their focus on these two key areas of development [1].

Human resources should supply labour and meet its demand at various positional levels in industry. Since students are the most affected, the current crisis in the Thai educational system must be given attention. What they have learned in school is not useful in the real world as it is too centred on memorisation. As a result, students often get bored, lack the eagerness to learn, and experience stress. Some students even begin to develop a negative attitude towards school and learning. The problem mentioned earlier is linked directly to the education system.

Vocational education encompasses a tremendous number of programmes that are designed to prepare students for employment and for living; these include vocational instruction programmes, laboratory applications supervised work experience, and vocational student activities. It is believed that high performance workers must have fundamental skills, including basic literacy, computational skills, thinking skills and personal qualities that enable workers to become dedicated and trustworthy workers. Individual responsibility is also considered to be an important personal quality that future workers should have [2].

A study on the concurrence of the ability and characteristics of vocational school graduates with the demands of the labour market found that those who obtained vocational training lacked sufficient theoretical knowledge, while high school graduates lacked practical training. Vocational students who studied a 2-year college certificate level had practical training that was, however, irrelevant to their respective courses. Moreover, these graduates lacked adequate skills in the usage and maintenance of equipment [3].

New teaching strategies that emphasise student-centred techniques have been introduced through global trends. In utilising these strategies, students are encouraged to be involved in the learning processes and activities requiring intellectual participation. Students are free to choose the courses they prefer to take. Various sources of information, as well as hands-on training, are offered to students as knowledge that will be useful in the *real* world.

The teacher must learn these new teaching strategies, which provide students with the opportunity to construct their own knowledge. Eventually, students will enjoy learning. The importance of student-centred strategies was mentioned and made into regulation in the Thai National Act of 2000. Teachers were initially uncertain of these strategies, especially in the area of vocational education. It is envisaged that this research into these new teaching strategies will serve as an informative guide for staff and, in particular, will be helpful for educational management and staff at vocational colleges so that they will be able to develop highly qualified graduates.

PURPOSES OF THE STUDY

- To develop a learning strategy with a student-centred focus for an electronic course on *Digital Clock Circuits*.

- To compare students' achievements and their application skills between two groups: those taught using a student-centred teaching strategy and those instructed with the traditional strategy.
- To compare students' satisfaction levels between these two groups.

HYPOTHESES

1. The student-centred strategy group would obtain higher scores than the traditional strategy group.
2. The student-centred strategy group would achieve higher scores in application skills than the traditional strategy group.
3. The student-centred strategy group would be more satisfied with the learning strategy than the traditional strategy group.

RESEARCH METHODOLOGY

Sample

A class of 32 students enrolled in the higher certificated level at Phetchaboon Technical College, Phetchaboon. Thailand, in an electronic course was selected for this study. They were randomly divided into the control group and the experimental group. They were tested before and after the experiment.

Instruments

The following instruments were developed and used in this study, including a circuit maker program, such as:

- Four laboratory sheets, together with lesson plans that are focused on a student centred strategy;
- A digital clock circuit module;
- Achievement tests;
- Performance test;
- Questionnaires to gauge students' satisfaction.

Five experts approved these instruments. The index of concurrence was 1.00 for every item. The tests were tried out and analysed for their efficiency, which met standard criteria regarding difficulty and discrimination.

Procedure

The researchers analysed the content of the electronic course by technique of content, skill list and concept map, and then classroom curriculum. The new course, called *Digital Clock Circuit*, involved BCD to seven segments decoder, an asynchronous, frequency counter and a frequency divider, including a model plate of Digital Clock Circuit.

The theory and application of a student centred strategy was analysed. There can be many steps in constructing new knowledge. It was concluded that this strategy should be comprised of three main procedures, namely: observation and data collection; analysis and conclusion; and application. These main parts were actually created to be learning activities using laboratory sheets and lesson plans. Thus, four laboratory sheets and lesson plans were generated using the three main elements. In order to learn this new course, a new circuit module was also developed. This new module, with a new circuit, laboratory sheets and lesson plan, had to be designed in consideration of these three main procedures.

After testing this new circuit, the researchers designed a printed circuit and equipment layout for students to study. The various tools included a test of 20 items and a questionnaire covering students' satisfaction to monitor the effectiveness of the student-centred learning strategy. These tools were approved by the experts. The reliability of the developed test was 0.82.

This model of learning emphasised independence in hands-on activities and group working. Students were required to observe, plan themselves, experiment, conclude and apply their skills in a group setting. Students were able to used Circuit Maker as a tool to complement their skills. Students had to create and present their projects using various media to show their ability to apply themselves.

Both the control and experimental groups underwent certain tests before and after the experiment. The experiment required that the control group take a course on Digital Clock Circuits with the traditional teacher-led strategy, while the experiment group took the same course with a student-centred strategy that was designed for the experiment. A t-test was utilised to statistically analyse the test scores of both groups.

RESULTS

A student-centred strategy was composed of three activities, namely: observation; analysis, conclusion and knowledge construction; and application. Using the three procedures, the researchers developed the digital clock circuit module, laboratory sheets and lesson plan focus for the student centred strategy. It covered the important topics of the course on Digital Clock Circuits. The module plate of the Digital Clock Circuit and the instrument layout are illustrated in Figures 1 and 2, respectively.

For the experiment, the research developed lesson plan includes four experiment worksheets. Both groups took a pre-test. The average scores of the students were statistically analysed using the t-test. It was shown that there was no significant difference between those two groups with regard to the mean of the students' pre-test scores. After the experiment, the same test was conducted in order to compare the academic achievement of those in the control group and the experimental group. The results are shown in Table 1.

Table 1: Comparison of pre- and post-test scores between the control and experiment groups.

Test	Value	Experiment	Control	t
Pre-test	$\bar{X}$	5.63	5.63	0.00
	SD	3.22	1.96	
Post-test	$\bar{X}$	13.56	8.56	4.16**
	SD	3.61	3.37	

**$p < 0.01$

Table 1 shows that there was no significant difference in the pre-test scores. However, after the experiment, the value of the t-test was significantly different at the 0.01 level. Since the mean score of experimental group was higher than that of the control group, it indicates that the student-centred strategies had a significant impact on students in the experimental group.

The t- test was also utilised to analyse students' satisfaction. At the beginning, there was no significant difference between the two groups before the experiment with regard to satisfaction levels. However, there was a significant difference in satisfaction levels between the two groups after experiment, as listed in Table 2. Indeed, students' satisfaction levels differed at the 0.01 significance level, with the student centred group scoring higher than those who had learned through the traditional approach.

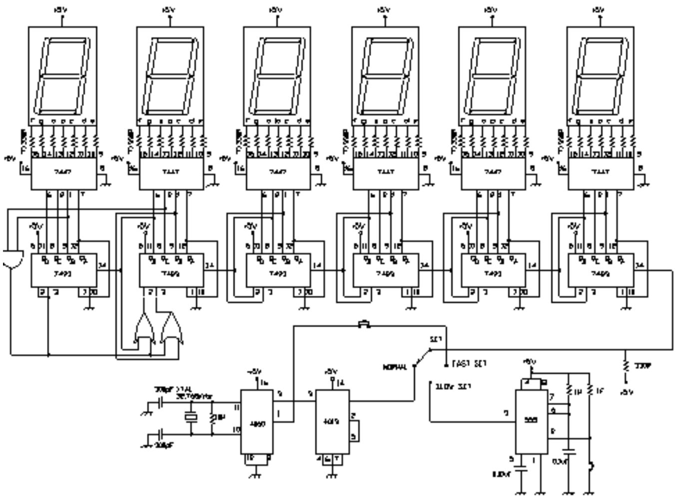

Figure 1: Module plate of digital clock circuit.

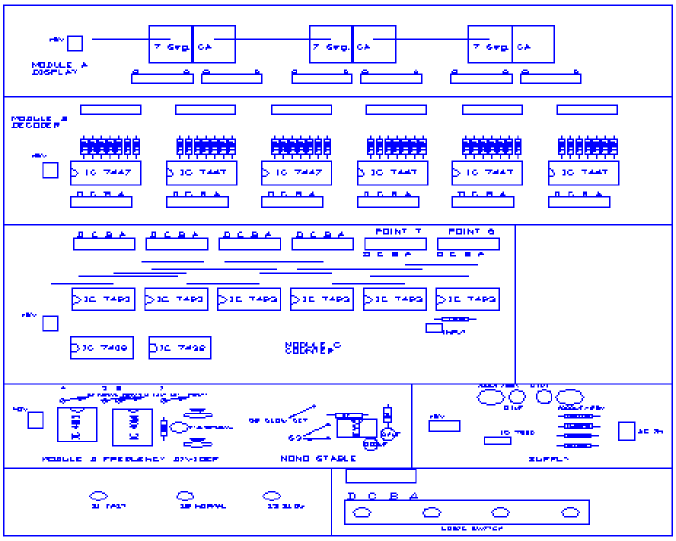

Figure 2: Instrument layout on plate of digital clock circuit.

Table 2: Comparison of students' satisfaction levels between the control and experiment groups.

Test	Value	Experiment	Control	t
Pre-test	$\bar{X}$	57.13	55.94	0.59
	SD	5.50	6.23	
Post-test	$\bar{X}$	61.12	55.10	3.16**
	SD	5.75	5.48	

**$p < 0.01$

A comparison of students' performance scores, with a focus on application skills, was carried out between the control and experiment groups. This is listed in Table 3.

Table 3 shows that there was no significant difference concerning the application skills of students in the control and experiment groups at the 0.01 level.

Table 3: Mean scores and t-test results of students' performance on application, control vs experiment groups.

Group	n	$\bar{X}$	SD	t
Experiment	16	12.75	4.67	1.99
Control	16	9.69	2.44	

$p > 0.01$

DISCUSSION AND RECOMMENDATIONS

From observations, it was found that students became more enthusiastic to learn when they participated in activities that challenged their skills and creativity. They became more interested when activities involved hands-on work and demonstration programs. When students had an active role in a certain learning process, they comprehended the lessons more thoroughly.

However, this learning strategy might not be effective in cases where there is no initiative to learn whatsoever on the students' part. Kaemani stated that the majority of students who were already used to traditional strategies would not immediately welcome, nor approve of, the new strategies [4].

At the start, students argued that hands-on activities of the new strategies were complex and required complicated mental work. This might make some students worried, which in turn would generate stress. When students' worries built up, they might even become insecure individuals. Moreover, students were required to interact with other people, with the environment and with various sources of information through their activities. All of these worries that students were exposed as a result of the new strategies contributed to their stress. However, students also became alert to learn after they became used to these new strategies.

This research found that students who learned through the student-centred strategy performed better than those who learned using the traditional teacher-led method. This result was in accordance with what the researchers expected. With the assignment of learning activities, the strategy involved intellectual participation, offering a challenge to students. These activities encouraged students to exercise their mental abilities. At the same time, they also enjoyed engaging in these activities. It gave students the opportunity to interact with other people, training them to find their place in society. These activities covered issues that directly concerned the students involved and their environment.

The most effective learning outcome was students' ability to take part in creating something that interested them and was meaningful to them. When students were allowed to choose and create something of their preference, they contributed more whole-heartedly to the activity. If students were able to relate with these hands-on experiences, they would also be able to assimilate the new things that they had learned with what they already knew.

The student centred strategy exposed students to various sources of information and gave them the opportunity to exercise the mental process of information filtering. They had to understand and digest the information independently in order to create their own individual pools of knowledge. These mental processes permitted students' knowledge acquisition to be meaningful to them, being effective with a higher probability of comprehension and retention of information.

One of the student centred strategies covered problem-solving activities. This gave students an advantage over those trained with non-problem solving activities. A study by Asawabunmee confirms this advantage for laboratory centres, specifically on a course for a Silicon Control Rectifier (SCR) and proposed a problem solving strategy, indicating that students in the experimental group generally performed better than the control group [5]. This showed that student-centred approach used in the experimental group was more effective than the traditional approach strategy used in the control group.

In this research, it was found that students who underwent the student-centred learning strategy displayed higher levels of satisfaction than those who underwent the traditional strategies. This may be attributed to students' participation in hands-on activities, which required more mental work. Students gained more experience, which leads to better retention and recall of information.

It has been said that self-development is a motive for most people to do a certain thing. Reasonable people develop an appetite for learning, leading them to become involved in activities of their interest. Through these involvements, they acquire knowledge that they were able to find useful later. Also, being involved in these activities enhances their chance to create something of their own. Their intellectual skills are challenged. They have the opportunity to exchange information with others. This interaction with other people, inside and outside of the four corners of the classroom, creates a harmonious environment when everyone has the eagerness to learn.

This study found that students who underwent the student centred learning strategy did not significantly differ from those who underwent the traditional learning strategies with regard to their application skills. This was in contrast with what the researchers had expected. Reasons for this difference may be that students might have not been able to transfer the learning that they had learned in a different setting and situation. This might be due to their lack of practical techniques and hands-on experience. Applications in various settings and situations require confidence in one's application skills through practice. Time was needed in order to analyse and search for adequate information that was unique in each setting and situation. Time was very limited for students in conducting the experiment for this study. Moreover, students were already in their higher years of vocational schooling, so their application skills had not been trained at an early stage, not since during their first years in school. The stage of application skills requires more time.

Since vocational students were very new to this learning strategy, they were not cautious in performing tasks. They did many mistakes in measuring data and in recording what they observed from the circuit experiment. Correcting these data wasted a lot of time, as they needed to be repeated again. Students also failed to read and follow instructions carefully. Thus, the tasks were not properly performed.

In the first experiment laboratory carried out by students, a lot of time was spent before students were able to digest the requisite knowledge. There was not enough time to finish the application part of the lesson, which was at the end of the lesson plan. The teachers had to observe and guide students to construct their knowledge within a limited amount of time. Buasri supported this idea regarding teachers' assistance when he mentioned that the teacher's role was important even within a student centred learning strategy [6]. Because this type of strategy was still something new to the students, teachers needed to guide them for it to be effective. Teachers had to familiarise themselves with the experiment by performing them beforehand. Teachers had be ready to guide students in case of any questions from them during classes.

When students failed to perform the experiments correctly, they sometimes lost their eagerness and enthusiasm to participate in the activities. This is one of the reasons why some students refused to cooperate properly in class. Teachers had to plan and limit the time for each step in an experiment and ensure that it was not too long. If too much time was spent on a particular step, students might not be able to complete the experiment in time.

Instruments and other materials should be prepared in advance [7]. In this case, students had to take some responsibility. There should be enough equipment for everyone to use and preserve spare in case of accidents or mistakes occurring during the experiment. Should there be delays, then students could get bored easily.

Another recommendation is that there should be proper grouping of students for each laboratory. When there are too many people in a group, there is a tendency that some members may be given a minor role or do not have an assignment at all. This causes students to feel excluded or left out, and then they may lose their interest in learning. Thus, the teacher has to assign proper group numbers for each task or laboratory.

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