JVER

Journal of Vocational Education Research

Current Editor: Dr. Joe Kotrlik kotrlik@lsu.edu

Volume 29, Issue 2 • 2004

A Comparison of Students' Achievement and Attitudes between Constructivist and Traditional Classroom Environments in Thailand Vocational Electronics Programs

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Abstract

The purpose of this quasi-experimental study was (a) to determine if there was a difference in knowledge achievement by Thailand's vocational students instructed using constructivist instruction (with open-end dialogue, problem-based learning, and cooperative learning) and using traditional instruction (with lectures, directed demonstrations, and scripted experiments); and (b) to identify whether Thai vocational students preferred instruction modeled upon constructivist philosophy rather than traditional instructional philosophy.

The target population consisted of students participating in electronics courses. The sample was students who attended the Electronics Measurement and Instrument course at two selected technical colleges in central Thailand. Two intact classes at each college received both treatments (counterbalanced design). There were 108 students used as the sample in the study.

An effect size and an ANCOVA were used to test the first research question. There was no statistical difference between the achievement scores of the students receiving constructivist instruction and those receiving traditionally instructed students. However, the constructivist-instructed students had higher scores on the posttest and the delayed posttest, compared to those of the traditionally instructed students.

The samples mean scores, standard deviation, percentages, and opinions on surveys were used to compare results for the second research question. The findings showed that there was a significant difference in student preferences. Students preferred constructivist instruction.

Introduction

For over three-quarters of a century, the implicit learning theory and pedagogy of vocational education has been behaviorism, but today the theory of constructivism has positive implications. Using a constructivist approach, teachers facilitate learning by encouraging active inquiry, guide learners to question their tacit assumptions, and coach them in the construction process. Doolittle and Camp (1999) stated teaching and learning that help the learner become involved and involve the teacher as a learning facilitator are opening the doors to knowledge development and application in both academic and vocational education.

Cognitive theorists believe the role of the teacher is to provide learners with opportunities and incentives to learn, holding that among other things:

1. all learning, except for simple rote memorization, requires the learner to actively construct meaning;
2. students' prior understandings and thoughts about a topic or concept before instruction exert a tremendous influence on what they learn during instruction;
3. the teacher's primary goal is to generate a change in the learner's cognitive structure or way of viewing and organizing the world; and
4. learning in cooperation with others is an important source of motivation, support, modeling, and coaching (Feden, 1994, p. 19).

The constructivist theory of learning supports cognitive pedagogy, proposing that humans have an innate sense of the world and this domain allows them to move from passive observers to active learners. Carlson (2003) supports a strong emphasis on identifying, building upon, and modifying the existing knowledge (prior knowledge) students bring to the classroom, rather than assuming they will automatically absorb and believe what they read in the textbook and are told in class.

Today, a major concern of adult, career, and vocational educators is the educational preparation of those entering the work force. In a workplace that is characterized by new management systems, production processes, and global competitiveness, employers are demanding their workers have cognitive skills in critical thinking, problem solving, and conflict negotiation, as well as high-level technical and basic academic skills (Applebaum

& Berg, 1999; Schmidt, 2000). Workers must be able to organize social and technological resources to acquire new knowledge, a "process that requires knowing how to identify the limits of one's own knowledge, how to ask germane questions, how to penetrate poor documentation, and how to identify sources of information" (Berryman, 1990, p. 8).

According to Billett (1996), the preparation of workers for entry-level jobs and advancement in the workplace requires educational programs that provide not only job skills, but also higher-order thinking, problem solving, and collaborative work skills. Doolittle and Camp (1999) indicated that traditional learning-teaching approaches in vocational education do not adequately address the latter kinds of learning, but constructivist theory does. In addition Doolittle and Camp added constructivist learning environments offer the potential for locating learning in the context of real-life situations and problems. Such environments offer a rationale for curriculum integration that connects learning with the workplace. Learning is facilitated through the design of classroom activities that guide students to work collaboratively with others, set their own sequences and pace of work, and actively engage in problem solving, critical thinking, and negotiation. It allows learners to move from passive observers to active learners who "construct knowledge by integrating new information and experiences into what they have previously come to understand, revising and reinterpreting old knowledge in order to reconcile it with the new" (Kerka, 1997, p. 1).

Need for the Study

Today in Thailand, the public is demanding the nation's schools provide effective education to keep pace with a rapidly changing world. Section 22 of the current National Educational Act (Office of the National Education Commission, 1999) states that:

> Education shall be based on the principle that all learners are capable of learning and self-development, and are regarded as being most important. The teaching-learning process shall aim at enabling the learners to develop themselves at their own pace and to the best of their potentiality. (p. 6)

This statement assures that each individual has the potential for learning and is regarded as the center of teaching-learning activities.

"Research supports the concept that most teachers teach the way they learn" (Stitt-Gohdes, 2001, p. 136). Brown (2003) indicated that typically these teachers are field independent, that is, they are more content-oriented and prefer to use more formal teaching methods. Research in education indicates that rote learning and multiple-choice type tests are not the best methodology for intelligence development. To reform the teaching-learning process, both teachers and learners must change their roles. Teachers must change from being a "dispenser" to a "facilitator," while learners must learn by themselves, learning where to get information and how to make use of it. Thai educators, teachers and administrators are searching for a new approach to help provide students with a learner-centered classroom environment.

In the constructivist-based classroom, teachers coach learners with appropriate scaffolds (instructions, physical aids and supporting materials), gradually decreasing assistance as the learner becomes more independent through continued practice. Learners internalize the process by constructing their own knowledge base and understanding. "Teachers must be cognizant of different learning styles, cultural experiences, and learning needs of the learners, and of the different social environments from which learners come" (McWhorter, Jarrard, Rhoades, & Wiltcher, 1996, p. 25). This type of classroom environment could assist Thai vocational educators in meeting the future needs of their students and of Thailand.

Research studies (Bettencourt, 1993; Cobb, 1994; Dubinsky, 1992) on the effectiveness of the constructivist approach focus on the fields of math, science, and social studies. Thailand's vocational education lacks this research base and there have been no studies investigating whether the constructivist approach is more effective in Thai vocational education when compared to the traditional instructional approach.

The goal of this study was to determine the effects of constructivist instruction on student understanding of electronics concepts. The study provided a systematic comparison of two types of instruction (constructivist and traditional instruction) through achievement measures on a pretest, posttest, and delayed posttest.

Purpose and Objectives

The purpose of this quasi-experimental study was (a) to determine if there was a difference in knowledge achievement by Thai vocational students instructed using constructivist instruction (with open-end dialogue, problem-based learning, and cooperative learning) and using traditional instruction (with lectures, directed demonstrations, and scripted experiments); and (b) to identify whether Thai vocational students preferred instruction modeled upon constructivist philosophy rather than traditional instructional philosophy.

To complete this purpose the following objectives were established:

1. Compare students' achievement of the constructivist approach in Thai vocational education as compared to that of a traditional instructional approach.
2. Determine if Thai vocational students prefer instruction modeled upon constructivist philosophy.

Research Question One

Is there a significant difference in students' knowledge of electronics concepts between Thai vocational students who are instructed using constructivist instruction and traditional instruction as measured by achievement on a pretest, a posttest, and a delayed posttest? In this study the criterion for statistical significance was the accepted $p \leq .05$.

Research Question Two

Do Thai vocational students prefer constructivist instruction to traditional instruction? It is hypothesized that Thai vocational students will prefer constructivist instruction.

Methodology

Setting and Subject Description

College Settings. The study was conducted in two public, technical colleges, located in central Thailand. The colleges were selected because they had electronics programs that met national standards for electronics and were recognized throughout Thailand as being programs that produce successful graduates (students going on for advanced education or students entering the job market). In addition, both colleges' administrators advocate the implementation of innovative teaching strategies that result in a positive impact on student achievement. Both colleges had electronics classrooms equipped with laboratory facilities, computer laboratories, and updated libraries.

Teacher Descriptions. The course used in this study was Electronics Instruments and Measurement. Both teachers used in the study were interested in improved teaching methods, recognized by their peers as excellent teachers, and each was an expert in teaching electronics. One of the participating teachers (Mr. Arun Junhom at Nakhon Pathom Technical College – teacher and college A) had been teaching electronics for 12 years and the other teacher (Mrs. Narumol Pimpak at Minburi Technical College – teacher and college B) had been teaching for 9 years.

Student Descriptions. Two classes of electronics students from each college representing cluster samples, were studied. The cluster samples were selected from a total of five electronics classes. Students in the classes were given the opportunity not to participate in the study. The initial convenience sample consisted of 108 students at the two colleges, along with their respective teachers (teacher A and teacher B). The sample included two intact groups (entire classes) in each college. All students in this study were in their first year at the diploma level of the electronics programs. The mean age (with standard deviations in parentheses) of the sample was 19.20 (0.49); 19.26 (0.78) for group 1A, 19.29 (0.86) for group 2A, 19.12 (0.61) for group 1B and 19.08 (0.49) for group 2B.

Variables

Independent Variable. The independent variable was classroom instruction, either a traditional or constructivist approach. The researcher ensuring the development of a constructivist approach with both teachers and its subsequent use in the classroom manipulated the independent variable. The two teachers agreed to follow guidelines for the study by designing their instructional activities to reflect the tenets of constructivism or traditional instruction.

Observations of the teachers were conducted during the study to assure that lesson plan objectives and teaching strategies were compliant with the study. Each teacher was observed three times during the study. The researcher observed each teacher two times when they taught using constructivist and the traditional instruction (one for each topic). A constructivist checklist and traditional checklist was used to collect information concerning fidelity of implementation of the treatment.

Dependent Variable. The dependent variables were students' achievement (or content knowledge) and their attitudes toward instruction. A pretest-posttest design was used to collect students' achievement data. All four groups of students were measured three times using the achievement tests. The first measurement (achievement test version 1) was given to the groups as a pretest before the treatments began. The test was used for gathering students' specific knowledge in electronics. Data from the pretest were used as a covariate in subsequent analysis. The second measurement (achievement test version 2) was given to the group as a posttest at the end of the treatments. The third measurement (achievement test version 3) was given to the group as a delayed-posttest three weeks after the treatment.

Design

A quasi-experimental pretest-posttest, nonequivalent control group design was used in the study. Due to the nature of the registration process and enrollment in the Electronics Department at both colleges, randomization was not used in this study.

Huck, Cormier, and Bounds (1974) stated: "Quasi-experimental designs can be used by researchers when true experimental designs are not possible or feasible" (p. 301). In a quasi-experimental design, the researcher does not randomly assign subjects to the treatment or control groups, completely control when the treatment is applied, or completely control when the observations are conducted as in a true experimental design. According to Huck et al., quasi-experimental designs need to "control one or two of following: when the observations are made, when the treatment or independent variable is applied, and which intact group receive treatment" (p. 301).

In this study the clusters were randomly selected to receive the treatment. The participants were not randomly assigned to the experimental and control groups, and both groups took a pretest and a posttest. The research design in this study was a nonequivalent control-group design. This study used a counterbalanced experimental design, which was diagrammed as shown in Table 1.

As diagrammed, O represented a series of measures: O1 represented the pretest 1, O2 represented the posttest 1, and O3 represented the delayed posttest 1. For the second topic, O4 represented the pretest 2, O5 represented the posttest 2, and O6 represented the delayed posttest 2. Also, X represented a series of instructions: Xc1 represented the constructivist instruction for the first topic, Xc2 represented the constructivist instruction for the second topic, Xt1 represented the traditional instruction for the first topic, and Xt2 represented the traditional instruction for the second topic.

Table 1
Nonequivalent Control-Group Design Used in the Study

Group	Pre1	Inst1	Post1	DPost1	Pre2	Inst2	Post2	Dpost2
1 (1B, 2A)	O1	Xc1	O2	O3	O4	Xt2	05	O6
2 (1A, 2B)	O1	Xt1	O2	O3	O4	Xc2	05	O6
	Bridge Topic				**Oscilloscope Topic**			
	(1^{st} — 4^{th}wk)-- -(4^{th}wk)- -(7^{th}wk)				(5^{th} — 8^{th}wk)-- -(8^{th}wk)- -(11^{th}wk)			

Note. O = A series of measurements, either a pretest, posttest, or delayed posttest. Xc1 represents constructivist instruction for the first topic. Xc2 = constructivist instruction for the second topic. Xt1 = traditional instruction for the first topic and Xt2 = traditional instruction for the second topic.

In this study, each participant (student) was administered both treatments (traditional and constructivist), but the order of administering the treatments was varied across student clusters to eliminate the possible confounding of order effects with treatment effects. The use of the ANCOVA addressed the pretest differences before the treatment. Students in each group were given both treatments.

Instruction

Constructivist Instruction (Xc1 and Xc2). The constructivist instruction was student-centered and provided opportunities for students to construct their own knowledge of the subject. The instruction occurred through a variety of methods including problem-based learning, tutoring, open-ended dialogue, collaborative and cooperative learning. In class, the instruction did not directly cover the textbook materials. Students did not receive specific "lecture" instruction in the subject. The tools used in the study included students working in pairs, students working in groups, a computer and software, reference materials, and the instructor. These tools were used for all groups during each constructivist instruction session.

Traditional Instruction (Xt1 and Xt2). According to Roth (1993), much current teaching is still grounded in an epistemology that is referred to as traditionalism. In the dominant paradigm of secondary science teaching (similar to teaching electronics concepts in Thai vocational education), information is transmitted to students, learning is equated with memorization, and the assessment is summative (Gallagher, 1993). Pedagogy reflecting traditional instruction is the predominant methodology in use today and was considered the control. The control groups of students received traditional instruction (that involved lengthy lectures, directed demonstrations, and scripted experiments). The delivery of instruction was primarily teacher centered, using a lecture format with emphasis on the course textbook.

Instrumentation

Achievement Tests. Two 15-item tests of achievement in understanding certain electronics concepts (version 1, one for the Bridge topic, another for the Oscilloscope topic) were given to the groups as a pretest before the study began. The achievement tests version 2, consisting of 15 items each, was used as a posttest at the end of each topic four weeks later, while the achievement version 3, containing 15 test items each, was used as a delayed posttest after three additional weeks (7^{th} week for the Bridge topic and 11^{th} week for the Oscilloscope topic). The delayed posttest measured the effects of instruction on the amount of information retained over time. Students are able to memorize much information for short periods of time without understanding it. A delayed posttest was used to answer the question of whether there was student memorization of facts and information or whether understanding of the electronic concepts taught by the teachers using different instructional methods affected retention.

The achievement tests were reviewed by the panel of experts which included teacher A and teacher B, two additional electronic teachers, and one professor from Utah State University. Teacher A and teacher B were the experts with knowledge in the content of the course (electronics instrument and measurement) and the electronic technical materials. The two electronics teachers were the experts with knowledge in teaching in vocational electronic programs. The professor was an expert with knowledge in test and curriculum development and educational assessment. Upon review by the panel of experts, slight changes were made for greater clarity.

Constructivist Learning Environment Survey (CLES). The revised CLES test measured student and teacher perception of constructivist attributes in the learning environment (Taylor, Fraser & White, 1994). This instrument was designed to enable researchers to measure constructivist approaches to teaching high school subjects. The results of this survey provided insights into a classroom environment.

The 30-item, 5-point Likert-type questionnaire identified student perceptions of the presence of characteristics of constructivism on five subscales, with six questions each: personal relevance, uncertainty, critical voice, shared control, and student negotiation. The five possible choices for each question and the associated points used for scoring were: "almost always" (5), "often" (4), "sometimes (3), "seldom" (2), and "almost never" (1). The mean scores of the perceived constructivism were used as data to determine a "low" or "high" degree of constructivism in the classroom environment.

The Attitude Scale. The attitude scale was used to assess students' perception and preferences on teaching approaches. The test was given to students at the same time as the posttest (at the end of the treatment-constructivist instruction). The attitude scale used in this study was adapted from the classroom evaluation form faculty and others, and has been in use for nine years at the university. In addition, forms used at other institutions were carefully studied. The form included items questioning students' enjoyment of and engagement in the activities in the classroom (part 1), students' opinion on quality of instruction, instructor, and materials and equipment (part 2 and 3), and students' opinion on choices of instruction they prefer in the future (part 4). Questions in part 1 had fixed-response options on a five-point Likert-type scale. Questions in part 2 had specific

response options on seven choices. In part 3, students responded by giving a short answer. In part 4, students responded by selecting a choice and giving a short explanation.

The Constructivist Checklist. The constructivist checklist was developed to serve as a simple instrument to guide observation in some of the ways in which the constructivist characteristics were presented in the classroom. The checklist was used during observation to determine if the constructivist approach was being translated into practice. These characteristics were based on constructivist theory of learning and epistemology. The checklist was developed by Murphy (1999) and consisted of 18 characteristics to be observed, which were checked among the choices of "supported," "not supported," and "not observed."

The Traditional Checklist. The traditional checklist was developed to serve as a simple instrument to guide observation during traditional classroom instruction (with lectures, directed demonstrations, and scripted experiments). The traditional method is typical in Thai vocational education programs. The checklist consisted of 12 characteristics to be observed, which were checked among the choices of "supported," "not supported," and "not observed."

Instrument Validity and Reliability

The content validity was established though the utilization of a panel of experts. The panel ensured the instruments reflected the various parts of the content domain in appropriate proportions. The reliability correlation values for the CLES and the Attitude Scales were obtained through the statistical application of Cronbach's homogeneity coefficient alpha. van den Bergh (1987) suggested that ". . . an alpha-value of at least more than 0.60 indicates a good reliability of scale" (p. 43). An alpha-value of at least 0.60 was the target number set as a goal for the acceptance of the instruments.

Through the large group study ($N = 108$) it was found that an overall alpha value of the CLES was 0.85, and an overall alpha value of the attitude scale was 0.92. Therefore, the content validity and the reliability of the CLES and the attitude scale were acceptable for use as an instrument to measure students' perceptions of constructivist attributes in the learning environment.

Validity of the Study

The study was examined for validity based on statistical conclusion validity, internal validity, and external validity.

Statistical Conclusion Validity. Statistical conclusion validity is concerned with the ability of the study to discern a difference between two variables. Investigation of the following concerns supported statistical conclusion validity.

1. Estimated statistical power was not low. The use of the ANCOVA for analysis increases power (Stevens, 1996, p. 92).
2. None of the assumptions of statistical tests was violated for the reported data.
3. Groups, instead of individuals, were used for the unit of analysis.
4. Homogeneity of the groups was increased statistically by using pretest scores as a covariate.

Internal Validity. Internal validity reflects answers to the question "if the two variables covary, is it plausibly causal from operational variable to the other or would the same relationship have been obtained in the absence of any treatment of any kind?" (Cook & Campbell, 1979, p. 39). In other words, to what degree would extraneous variables influence the results of the study, and therefore the conclusions of an investigation? This aspect of a study's validity is largely a function of its research design. The design of this study was such that generalizability was limited to the two participating colleges or institution very like them.

External validity. The subjects (students) were chosen in a nonrandom manner. They were the students of two electronics teachers from two different colleges who volunteered to work with the researcher. The use of a nonrandom sample of convenience somewhat limits the generalizability of this study's findings. The nature of this study limits its generalizations to regular vocational students in central Thailand.

Summary and Discussion

There were 108 students in the sample. The sample was representative of typical vocational education students in age and GPA. Table 2 presents the means of the ages and the grade point averages for the sample. All students in the sample were first year students at the diploma level of the electronics programs. The average age of the sample was 19.2 years old. The grade point average of the sample (with standard deviations in parentheses) was 2.52 (0.49). The sample showed a lack of representation in gender with only eight students being female. However, in the regular population of Thai vocational students in electronics programs, the ratio of female to male students is very low. The ratio can be determined through national records. At the time of this study, there were a total of 4,675 male students and 1,584 female students in the diploma level electronics.

Table 2
Mean Ages and Grade Point Averages for the Sample

	Sample	**Teacher A**		**Teacher B**	
		Group 1A	**Group 2A**	**Group 1B**	**Group 2B**
Age	19.20 (0.70)	19.26 (0.78)	19.29 (0.86)	19.12 (0.61)	19.08 (0.49)
GPA	2.52 (0.49)	2.70 (0.42)	2.58 (0.46)	2.32 (0.78)	2.40 (0.46)

Note. Standard deviations are in parentheses.

Summary Relevant to Research Question One

The first research question was to determine if there is a significant difference in students' knowledge of electronics concepts between Thai students who were instructed using the constructivist approach to teaching compared to that of the traditional instructional approach. As indicated in Table 3, students who were taught with the constructivist instruction (in group 1 for the first topic) had higher mean scores for both the posttest 1 and the delayed posttest 1. For topic 2, students in group 1, who were taught with constructivist instruction had the highest mean score for the posttest 2 (8.48, *SD* = 2.37) and the delayed posttest 2 (8.37, *SD* = 2.45). For pretest 2, students in group 1, who were taught with traditional instruction had the highest mean score (5.54, *SD* = 1.35). Overall, the lowest mean scores of all tests, except the pretest 1, belonged to the students in group 2, who were taught with traditional instruction.

Table 3 reports the means, standard deviations, and the effect size of the samples' pretest, posttest, and delayed posttest. The mean difference effect sizes (shown as Diff. in the table) were calculated using the formula:

$$ES = (Mean_{constructivist} - Mean_{tradition})/SD_{tradition}$$

As the results in Table 4 show, the differences between groups were not statistically significant. From Table 4, no *p* value was less than 0.05. The *p* values of the combined group (0.99 for pretest 1, 0.15 for posttest 1, 0.07 for delayed posttest 1, 0.84 for pretest 2, 0.42 for posttest 2, and 0.35 for delayed posttest 2) were greater than 0.05. There was no statistically significant difference in mean scores of the combined group's pretests, posttests, and delayed posttest between students provided with constructivist instruction and those students receiving traditional instruction. However, the mean scores of the posttest and the delayed posttest of students who were instructed by a constructivist instructional approach were higher, compared to their comparing group in the same college. This pattern or trend occurred at both colleges. Whereas statistical significance may or may not indicate practical significance, an argument might be made that the effect sizes, while less

Table 3
Mean, Standard Deviations, and ES of the Sample's Pretest, Posttest, and Delayed Posttest Scores

Tests	**Group 1 (*N* = 58)**		**Diff.**	**Group 2 (*N* = 48)**		**Diff.**
	Cont.	**Trad.**		**Cont.**	**Trad.**	
Topic 1 (Bridge)						
Pre 1	4.00 (1.38)	3.94 (1.63)	0.04	3.88 (1.42)	3.92 (1.26)	-0.03
Post 1	7.46 (2.67)	6.37 (2.48)	0.44	6.67 (2.90)	6.20 (2.99)	0.16
Delayed Post 1	7.33 (2.61)	6.08 (2.40)	0.52	6.46 (2.60)	5.88 (2.73)	0.21
Topic 2 (Scope)						

Pre 2	5.40 (1.61)	5.54 (1.35)	-0.10	5.04 (1.67)	4.83 (1.71)	0.12
Post 2	8.48 (2.37)	8.12 (3.09)	0.12	7.08 (2.61)	6.79 (3.05)	0.09
Delayed Post 2	8.37 (2.45)	7.79 (3.11)	0.19	6.72 (2.48)	6.54 (3.02)	0.06

Note. Standard deviations are in parentheses. Diff = Difference between means. ES (effect size) is indicated by Diff.

Table 4

Summary Table for the Analyses of Variance on Pretest, Posttest, and Delayed Posttest Scores from Group 1 and Group 2

Tests		**SS**	**df**	**MS**	**F**	**Sig.**	**ES**
Topic 1	**(Bridge)**						
Pre 1	Between	0.00	1	0.00	0.00	0.99	<0.001
	Within	218.55	106	2.06			
	Total (N)	218.55	107				
Post 1	Between	15.50	1	15.50	2.08	0.15	0.28
	Within	789.41	106	7.44			
	Total (N)	804.91	107				
Dpost 1	Between	21.40	1	21.40	3.24	0.07	0.35
	Within	698.48	106	6.59			
	Total (N)	719.88	107				
Topic 2	**(Scope)**						
Pre 2	Between	0.10	1	0.10	0.04	0.84	0.04
	Within	272.56	106	2.57			
	Total (N)	272.66	107				
Post 2	Between	5.20	1	5.20	0.66	0.42	0.14
	Within	839.32	106	7.92			
	Total (N)	844.52	107				
Dpost 2	Between	7.12	1	7.12	0.89	0.35	0.16
	Within	841.65	106	7.94			

	Total (N)	848.77	107				

that the criterion value of .6, do indicate some differences based on the treatment that may be of practical value.

Summary Relevant to Research Question Two

The second question addressed in this study was to identify whether Thai vocational students preferred constructivist instruction over traditional instruction. The students' responses from the attitude scale in relation to research question two showed that there was a difference in student preferences. Students preferred constructivist instruction. Table 5 presents the mean scores of the all groups of students who completed the attitude scale after they experienced constructivist instruction. The attitude scale included four sections of items questioning students' perceptions of the constructivist instruction they experienced.

Table 5
Students' Perceptions of Student Enjoyment and Teachers' Role in the Classroom

Item	**Description**	**Sample**	
		M	***SD***
	Student Enjoyment		
#1	Interest in lesson	3.89	0.79
#2	Willing to learn	4.10	0.79
#3	Importance of activities	4.09	0.77
#4	Try best	3.85	0.81
#5	Pay attention	3.65	0.74
#6	Enjoy the lesson	3.48	0.88
	Total	3.84	0.53
	Teachers' Role		
#7	Friendliness	3.96	0.87
#8	Helpfulness	3.60	0.93
#9	Interest in problems	3.74	1.14
#10	Goes out of their way	3.39	0.97
#11	Moves around	3.22	1.09
#12	Considers feelings	3.15	1.09
	Total	3.38	0.87

Note. Numbers are represented on a 5-point Likert Scale (5=Almost Always, 4=Often, 3= Sometimes, 2=Seldom, 1=Almost Never). The higher mean score the more positive the student response. $N = 108$.

The first six questions of the attitude scale assessed students' enjoyment of the activities in the classroom. The last six items questioned students' perceptions of their teacher's role in the classroom. The data reported in Table 5 showed that students who experienced the constructivist instruction had positive attitudes about their experience in the classroom and toward their teacher's role.

The total mean score of the teachers' role was 3.38 (0.87). Based on the total sample mean scores of section 1 in Table 5, students experienced enjoyment in the constructivist instruction and perceived the teachers' role positively. Student enjoyment is defined by the questions on the attitude scale (interest in lesson, willing to learn, importance of activities, try best, pay attention, enjoy the lesson). The mean scores of students on their opinion of quality of constructivist instruction, instructor, and materials and equipment (in section 2 and section 3 of the attitude scale) are reported in Tables 6 and 7.

Table 6
Sample Mean Scores of Student Opinions from Section 2 of the Attitude Scale

Item	**Description**	**Sample**	
		M	***SD***
#1	Overall quality of the lesson	3.90	0.53
#2	Teacher' effectiveness	4.04	0.79
#3	Clearness of lesson objectives	3.84	0.74
#4	Relevance of assignments to lesson	4.00	0.66
#5	Relevance of material to lesson	3.61a	0.72
#6	Appropriateness of workload	3.89	0.70
#7	Relevance of exams to lesson	3.89	0.60
#8	Clearness of students' responsibilities	3.64	0.70
#9	Helpfulness of assigned materials	3.97	0.81
#10	Helpfulness of lesson organization	3.97	0.67
#11	Helpfulness of teacher' explanations	4.25	0.74
#12	Teacher' s use of examples	4.06	0.83
#13	Teacher' use of class time	3.68	0.82
#14	Teacher' enthusiasm for lesson	4.13	0.72
#15	Teacher's helping in resolving questions	3.92	0.78
#16	Teacher was prepared	4.28b	0.73
#17	Opportunity to ask question	4.12	0.78
#18	Opportunity to make comments	3.89	0.89
#19	Availability of extra help	3.78	0.93
	Total	3.94	0.43

Note. The higher mean score the more positive the student response. Numbers are represented on a 5-point Likert Scale (5=Excellent, 4=Very Good, 3= Good, 2=Fair, 1=Poor). N = 108. [a]The lowest sample mean score. [b]The highest sample mean score.

From the data reported in Table 6, students' opinions on quality of instruction, instructor, and materials and equipment were positive, as the mean score of every item was greater than 3.0, "Good." Students rated all aspects of the quality of constructivist instruction, instructor, and materials and equipment from "good" to "very good." Their opinions on these aspects were positive.

In addition, students were asked to provide their opinions on what aspects of the instruction they perceived as positive and negative. The data shown in Table 7 presents the summary of the aspects and the percentage of students' opinion. Students' involvement (meaning that students had more opportunities to get involved in the classroom) was the aspect that most students perceived as a positive outcome of the constructivist instruction (39.7%). The second most important aspect was the understanding of the topics (27.4%). These results indicated that students participated in class and understood the concepts more in the constructivist instruction.

Table 7
Percentage of Students' (both groups) Opinions from Section 3 (Constructivist Instruction) of the Attitude Scale

Positive		**Negative**	
Aspects	**%**	**Aspects**	**%**
Students' involvement	39.7	Time constraint	38.7
Understanding of topics	27.4	Overwhelming information	27.4
Materials	12.3	Students' preparation	19.4
Instructional strategies	8.2	Objective clarification	8.1
Teacher effectiveness	6.8	Irrelevant material	3.2
Classroom environment	5.6	Students' pace	3.2

Note. *N* = 108.

Aspects (negative) that needed to be improved included: (a) time constraints, meaning that students needed more time to participate in the classroom activities (38.7%); and (b) overwhelming information, meaning that too much information was given by the teachers (27.4%). The third most negative aspect was students' preparation, meaning that students needed to prepare before the class (19.4%). These results indicated that students needed more time in class to complete activities, to prepare for the class, and to understand the provided information. Students' opinions on choice of instruction they preferred in the future (section 4) are reported in Table 8.

Table 8

Summary of Students' (both groups) Opinions on Choices of Instruction They Prefer in the Future from Section 4 of the Attitude Scale

Instructional Approach Selected	Reasons	%
Constructivist (73.3%)	More student involvement	46.2
	Increase students' motivation	19.2
	Easier to understand concept	17.3
	Building students' foundation	9.6
	More fun in class	7.7
Traditional (21.3%)	More students' familiarity	54.0
	Easier approach	26.0
	Less student preparation	20.0
Both approaches (5.4%)	More student involvement	50.0
	Better teacher helpfulness	25.0
	Better experiences	25.0

Note. N = 108.

When students in both groups had an opportunity to choose an instructional approach that they want to be given in the future, 73% of the students selected the constructivist instructional approach. The major reasons included (a) a better chance to participate, (b) more motivation, and (c) greater understanding of concepts. However, some students believed that mixing both approaches together would be beneficial.

Based on the data presented in tables 5, 6, 7 and 8, there was strong evidence that students preferred constructivist instruction to traditional instruction. They were more receptive of the constructivist instruction, compared to the traditional instruction.

Discussion of Findings Relative to Student Achievements

Previous researchers of a constructivist instructional approach (Saigo, 1999; White, 1999) concluded that the constructivist model has been found to slightly influence students' achievement in a positive way. The constructivist model is capable of getting students more involved in learning and is an approach that students prefer. The findings in this study appear to parallel White and Saigo's research. Generally, students in this study participated more in the classroom activities and gained in content knowledge when a constructivist approach was used as identified by the opinions of students provided in the attitude scale.

However, not all previous studies agree. In a research study that closely paralleled this study, Makanong (2000) reported no significant difference in achievement between

students in the two treatment groups. An additional point of agreement between this research study and another similar study (Gatlin, 1998) was that students' scores of those who received the constructivist approach showed a slight decrease on the delayed posttests, while students taught using the traditional approach showed a greater decrease. Students who received the constructivist instructional approach had higher retention over time. It can be said that students taught by traditional means, who rely on memorization to pass tests, over time often do not remember much of the information learned. Students exposed to conceptual teaching and who learn the main ideas process and remember information with better understanding over time (Kyle, 1984).

Although similarities were found between this study and other studies, they were in different fields. This study was in the field of vocational education, while other studies were in science and math. However, this could confirm that the concept of constructivist theory has influence across other fields of study. Among those studies, researchers found differing results. In some studies, no statistically significant difference was found between the mean scores of the sample's posttests in the two treatments groups. In others, there was a statistically significant difference for the sample's posttests where the students receiving the traditional pedagogy scored higher. The student achievement results for this research study parallels the first direction.

In relation to students' attitudes, White (1999) found no significant changes in attitudes over the course of the semester for students given constructivist vs. traditional instruction. There was a contrast between this study and White's study. The findings in this research study show that students preferred the constructivist instruction to the traditional instruction. When students in this study had an opportunity to select the instructional approach they preferred in the future, three out of four students indicated the constructivist instructional approach. The reasons why they selected the constructivist instruction were because of more involvement, motivation, and understanding of concepts.

Conclusions and Implications

Even though there is no significant difference for the constructivist instruction over traditional instruction, the students still preferred the constructivist approach by a 4 to 1 ratio. Students had a positive attitude toward the constructivist process in the classroom, and toward their teacher's role. Moreover, the results of this study show that in this setting, constructivist instruction is at least as good as the traditional approach. This is surprising because, given equal time on task for both methods, we would expect the more rigid and structured traditional approach to be superior in terms of posttest scores. For these reasons an argument can be made that constructivist instruction may be of value for teaching technical subjects in similar institutions in Thailand.

More research is needed in order to fully answer the many questions pertaining to the short- and long-term effects of constructivist instruction in Thai vocational education. Further studies in which the participating teacher is an expert constructivist teacher would

provide additional data on the effect of full implementation of constructivist instruction on student achievement.

In addition, a long-term study is needed to determine the effectiveness of constructivist instruction. At least a semester would be a proper time to determine if there are any effects of constructivist instruction on student achievement. With more time, students will have an opportunity to get involved in and get used to the constructivist approach to instruction. The results of a longer study will also be useful to Thai teachers to learn and practice constructivist methods.

The sample in this study showed a lack of representation in gender with only eight of the 108 students that participated being female. The male to female ratio in this study is typical in Thai vocational education. Additional research is needed to determine if there is a difference between how male and female students in Thailand respond to different teaching techniques.

Thai students' opinion on the quality of instruction, instructor, and material and equipment were positive toward the constructivist approach. This could be a result of the student engaging in and showing interest in a new learning method (constructivism) more than being a result of the constructivist teaching method.

Additionally, when students were asked to choose an instructional approach they wanted to be given in the future, three out of four students selected the constructivist instructional approach. An argument can be made that the constructivist approach is at least as effective as the traditional approach. It can be implied that since students enjoyed the constructivist approach to teaching that if a more qualified teacher was administering the process, students would benefit more from the instruction. It is also important that the students get to practice these methods, starting at a young age. This will make them confident in searching for their own knowledge and will make them learn how to ask questions that will give them valuable information. Hopefully, it can also lead to students learning to take responsibility for their own work. However, the teacher still plays an important role here. It's not just about leaving it up to the students to do all the work, the teacher also must take responsibility.

Qualitative studies that examine the complex student learning styles and cultural context need to be pursued. A strong qualitative component would have contributed additional data for the interpretation of the quantitative data in this study. A combination of qualitative and quantitative methods could enhance overall learning and understanding of students.

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