

Science and Mathematics Education Centre

**Improving Student Learning in Health Science Classes:
A Case Study in Thailand**

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Doctor of Science Education
of
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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature. J

Date: May, 24, 2007

ABSTRACT

The main purpose of this classroom action research was to improve student learning in a Health Science class in Thailand by using the Constructivist Learning Environment Survey (CLES) and a constructivist learning approach. This study combined quantitative and qualitative data and was conducted over one semester in four stages: 1) assessing the students' perceptions of their constructivist learning environment and determining students' pre-instruction conceptions about AIDS; 2) constructing an intervention based on constructivism theory in order to improving learning environments and students' learning outcomes; 3) implementing the intervention; and 4) evaluating the success of the intervention by re-assessing with the CLES. The Attitude Towards AIDS Questionnaire (ATAQ) was used to assess students' attitudes about AIDS. The students' cognitive achievement was assessed with the Students' Knowledge of AIDS Test (SKAT). Qualitative data were obtained from informal observation, focus group discussions, and student journals.

The results indicated that the adapted Thai version of the CLES is appropriate for use in Health Science classes in Thailand's socio-cultural context because it was shown to be valid and reliable in both Actual and Preferred Forms. The results also revealed that the CLES and a constructivist learning approach can be used as effective tools in order to improve the learning environment of a Health Science class. This approach can improve students' knowledge and students' attitudes toward AIDS. The qualitative results supported the results from the questionnaires. This study suggests that teachers and health educators in Thailand can use the CLES to improve their learning environment and use a constructivist learning model to bring about improvement in students' achievement in their classes.

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

In Thailand, the Office of Educational Reform decided to make a major change and introduce and promote new teaching and learning strategies that emphasized student-centred methods and addressed the importance of suitable learning environments and effective learning strategies (Ministry of Education, 2000). As a result, today, constructivist teaching is a new strategy used frequently by Thai educators and teachers. In keeping with this new approach, the research described in this thesis was designed to improve student learning in Health Science classrooms in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire.

The topic AIDS in the Health curriculum was selected as the content area for an action research study. A sample of 20 fourth year undergraduate students were selected by using a purposive sampling technique. The action research process involved an attempt in five main stages to improve the learning environment and students' learning achievement. The first stage was a validation of the *Constructivist Learning Environment Survey* (CLES) (Taylor & Fraser, 1991) for use in Thailand. The second stage involved using the CLES for pre-assessment of students' actual and preferred perceptions of their Health Science classroom learning environments and using open-ended questions to determine students' pre-instruction concepts about AIDS. In the third stage, the participants developed intervention strategies based on the data from actual-preferred discrepancies and students' pre-instruction concepts about AIDS. The intervention strategies were implemented in the fourth stage in order to improve the learning environment and learning achievement. The final stage was concerned with evaluating the intervention.

The research used in this study combined quantitative and qualitative methods. The CLES, the *Attitude Towards AIDS Questionnaire* (ATAQ) and the *Students'*

Knowledge of AIDS Test (SKAT) were used for the collection of quantitative data. The statistical methods used for analysing the quantitative data consisted of means, standard deviations, paired t-tests. Qualitative data obtained from classroom observations, focus group discussions and students' journals were used to investigate aspects that might have been missed by the quantitative data and to confirm and support the findings from the questionnaires. Content analysis and categorizing information were used to analyse qualitative data in order to find patterns and generate assertions.

1.2 CONTEXT AND BACKGROUND OF THE STUDY

Today there are many problems in Thailand's education system. One of the greatest problems is that students in Thailand study very hard, but it seems that they are not really successful. When subjects and classes are finished, some students still have misconcepts on some aspects of topics because the most important goal of the learner was to pass the examination rather than to gain a better understanding of the topic. Students usually learn in a passive way and although some students finish the class with knowledge from the textbook or that received from their teacher, some still have misconcepts. As a result, after graduating some of them are not capable of independent analytical thought and lack other higher-order thinking skills. This teaching situation cannot result in a good learning environment and this has a negative effect on students' learning outcomes. Furthermore, some graduates cannot link the theory or the learning experience with what they have learned in real life. Consequently, some of them cannot solve problems that they face in their social lives. Some Thai educators regard this situation as a crisis in the educational system.

It is not surprising that today, Thai teachers and educators have many concerns about educational achievement and the quality of the Thai education system. For example; we talk about how teachers teach, how students learn, the factors which have an effect on students' learning outcomes, improving the learning environment and improving teaching and learning strategies in order to improve students' learning achievement. Also, what is an appropriate learning method that can develop students' understanding of content relevant to their real life is frequently discussed.

Thai educators and researchers consider that there are many causes of these problems. The first cause is related to the learning environment because students spend approximately 20,000 hours in the classroom by the time that they graduate from college (Fraser, 2001). Research in the past has shown that the classroom environment is an important factor affecting achievement and it has a strong influence on student learning outcomes (Fraser, 1998). Previous research studies conducted in Thailand have reported that the traditional classroom environment in Thailand is not enabling the learner to engage in active learning in Thai classrooms (Jeeravipoonwan, 2004; Klangprapan, 1996; Puacharearn & Fisher, 2004; Suwannasit, 1997; Wanpen & Fisher, 2004). Also, the Thai culture is another factor that has a huge influence on the learning environment because Thai students are accustomed to a passive learning behaviour. They are taught to be humble by strictly obeying what their elders say and not to ask questions neither in nor outside the classroom. Raising a voice in the classroom is a sign of disrespect to the authority of the teacher (Chuwattanakul, 2002). Research in the past shows that without questioning in the classroom the interaction between teachers and students will not be enough to create a two-way communication. Without two-way communication between students and teachers, a useful teaching-learning environment will not exist (Oliva, 1989).

The second cause is related to the learning activities themselves. Thai teachers have long emphasized a traditional teaching style with teachers at the centre of teaching-learning activities. The general nature of a Thai classroom is a six by six metre room packed with 40 to 50 students with only one teacher standing at the front of the class. This traditional teaching method seems to yield good results in controlling a large size class. Thus, the class is usually driven by “teacher talk” and is dependent on textbooks that follow the structure of the course curriculum. Also, teachers give assignments from textbooks to the students. As a result, there is a fixed body of knowledge that the students have to know. Only a few students initiate questions, have independent thoughts or engage in interactive learning since the role of the learner is to listen and accept the explanation of the teacher. Another problem is that the teachers’ believe that there is a lot of content in the curriculum which must be covered. Thus, in this situation, it is nearly impossible for a teacher to have enough times to give attention to each student for their individual benefit nor to determine the students’ pre-instruction

concepts before the start of a lesson on each new topic. Therefore, the teachers are unaware of what students are thinking and they may teach things that are not suitable, appropriate or relevant to the students' needs. In other words, the teacher may ignore crucial and important misconcepts, and not pay attention to students' opinions or understandings.

Recognizing the urgent need for education reform, the government, acting through the Office of the National Education Commission (ONEC) has formulated policies and plans to bring about necessary changes within the educational system. One of the first changes is a new Act named the *National Education Act B.E. 2542 (1999)*.

According to the *1999 National Education Act*, significant efforts are being made to reform Thailand's education system. This act has provided a new paradigm of learning which addresses the importance of learning environments and constructivist perspectives, as stated below;

Education shall be based on the principle that all learner are capable of learning and self development. The teaching-learning process shall aim to enabling the learner to develop their own pace and to the best to their potentiality. Learning should take place in an environment that provides learners with the opportunity to construct and interpret meaning by themselves.

Rung Kaewdang, one of the most well known Thai educators and the Minister of Education, described learning reform according to the act saying that:

In order to reform the educational, we should improve teaching and learning. Our students should learn in a good learning environment, which encourages the students to construct knowledge by themselves, so the students enjoy learning and they can link the learning experience to their real life.

(Rung Kaewdang, 2000, p. 4)

Keawdang (2000) also stated that Thai teachers in the new century should perform a wide variety of tasks, and conduct classroom action research in order to improving their instruction as one of the main tasks. Therefore, the Ministry of Education promotes new teaching and learning strategies that emphasize student-centered methods and other innovative strategies in attempts to achieve the goal of educational reform and develop the Thai education system. (Ministry of Education, 2000). As a result, today, the constructivist teaching approach is a new strategy used increasingly by Thai educators and teachers. This constructivist teaching approach is one strategy that can help teachers to solve the problems referred to earlier by encouraging students to construct their own knowledge.

Udonthani Rajabhat University has more than 5,000 students and provides several courses in four faculties. The Health Science Program is situated within the Department of Applied Science. The writer of this thesis works as a lecturer and mentor of undergraduate students who are enrolled in this Health Science course and has found that there are problems related to the learning environment and learning achievement of these students. The traditional teaching method has been used and although not entirely bad, there are many problems related to it, as referred to previously, and these problems have an influence on learning achievement. As instructors, we cannot deny our responsibility for the students' learning achievement and it is necessary to solve these problems. It is an interesting challenge as to whether teaching and learning can be improved by using a new teaching approach based on constructivism theory. Another motivation for conducting this research is that it is apparent in the literature on learning environments that almost all work been done in other countries and in the pure science classrooms, for example physics, chemistry or mathematics classrooms. Few research projects have been done in Thailand or in applied science classrooms and none of them refer to a Health Science class.

At the Rajabhat Universities in Thailand, the curriculum of the Bachelor of Science degree (Major in Health Education) provides many course units. For instance, communicative diseases, including, "Acquired Immune Deficiency Syndrome" which is an important and interesting topic, especially for undergraduate students who are in the late stages of adolescence. A previous research study about students' health

behaviour at the Udonthani Rajabhat University, Thailand found that some students have many misconcepts about AIDS. These misconcepts may result in high risk behaviour among the students in regard to HIV. In particular, these students who have misconcepts are not aware that their health behaviour puts them at risk of getting HIV (Jinvong, 2002). Today, the severity of the AIDS problem affects many people. There has been a sharp increase in the number of people with HIV and this trend is continuing, especially among young people. Undergraduate students are a high risk group because they want to know and learn about everything around them including exciting experiences and experimentation, for instance, sexual intercourse. Additionally, socio-economic changes in Thailand are enabling factors affecting these risk behaviours. Therefore, the topic “AIDS” was chosen for this research because AIDS is one of the most important health problems in Thailand.

Because of these reasons, it was decided to investigate how to improve students’ perception of learning environment and learning achievement in Health Sciences class in Thailand through the use of a constructivist approach to learning about the topic of AIDS.

1.3 PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

1.3.1 Purpose of the study

The purpose of this study was to improve student learning, particularly about AIDS, in Health Science classrooms in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire.

1.3.2 Objectives

The purpose of this research led to the following objectives that guided the research. The research objectives were:

1. to validate an adapted version of the CLES for use in Health Science students at university level in Thailand;
2. to create the model of a constructivist approach to learning in Health Science classroom at university level in Thailand;

3. to describe students' perception of Health Science classroom environments from a constructivist perspective;
4. to investigate differences between students' actual and preferred perceptions of constructivist classroom environments in Health Science classroom; and
5. to investigate differences between students' perceptions of constructivist classroom environment in Health Science classrooms before and after the implementation of particular intervention strategies

1.3.3 Research questions

The following research questions, to guide the research, were derived from these objectives.

Since, the Constructivist Learning Environment Survey and a constructivist approach to learning has not been used in Health Science classrooms in Thailand, the first two research questions were:

Research Question 1: Is the CLES a valid and reliable instrument for use in Health Science classrooms in Thailand?

Research Question 2: What are the characteristics of a constructivist approach to learning in Health Science classrooms in Thailand ?

As this is the first study to measure students' perceptions of a constructivist classroom environment in Health Science classrooms in Thailand, the focus of the next two research questions was on describing these classrooms.

Research Question 3: What are the students' perceptions of the constructivist classroom environment in a Health Science classroom in Thailand?

Research Question 4: Are there any differences in students' actual and preferred perceptions of constructivist classroom environments in Health Science classrooms?

Again, as this is the first study to attempt to improve student learning in Health Science classroom in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire, it is important to evaluate the intervention. This forms the focus of the final research questions:

Research Question 5: What changes occur in students' perceptions of the classroom environment in Health Science classrooms before and after the implementation of particular intervention strategies?

Research Question 6: What are the students' attitudes to learning about AIDS and their knowledge and understanding of AIDS?

1.4 OVERVIEW OF METHODOLOGY

The main aim of this thesis was to improve student learning environment and achievement in Health Science classrooms in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire. A sample of 20 fourth year undergraduate students was selected by using a purposive sampling technique. The Thai version of the CLES was validated with 100 undergraduate students in the Faculty of Science and Technology. The CLES was then modified in order to make it appropriate for use in the Thai socio-cultural context before it was used in an action research process. The action research process involved four main stages:

1. assessment of students' perceptions of the degree of the constructivism in actual and preferred classroom environments to identify actual–preferred differences, by used the CLES and students' pre-instruction concepts about AIDS by open-ended questions.
2. developing intervention strategies designed to bring about change in the learning environment.
3. actual implementation of the intervention strategies.
4. evaluation of the intervention.

The research combined quantitative and qualitative methods. The collection of quantitative data was achieved through the use of the CLES, the Attitude towards AIDS Questionnaire (ATAQ) and the Students' Knowledge of AIDS Test (SKAT). Relevant statistical methods such as means, standards deviations, and paired t-tests were used to analyse the quantitative data from the questionnaires. Qualitative data were obtained from classroom observations, focus group discussions and student journals and were analyzed by content analysis and categorized information to find patterns and generate assertions.

1.5 SIGNIFICANCE OF THE STUDY

This research is the first study of its kind in Thailand that uses learning environment instruments with undergraduate students who study applied science (majors in Health Education). Fraser (1998) has established that students' perceptions of their classroom environment can affect student achievement and attitude to class. It is important to determine if the CLES can be used to investigate the classroom environment and provide useful information for improving the Health Science classroom environment and improving teaching and learning in the Health Science classroom. Overall, the intervention which is developed on the basis of the data from the classroom environment instrument has an effect on students' attitudes, cognitive achievement and can solve problems of learning achievement of students. This research will combine quantitative and qualitative research methods. Therefore, there will be richness in the database as a whole and the study will have greater credibility. The action research phase has many advantages to all members of the class. First, the teacher as the researcher and the students who are involved in the process of the action research can learn and benefit from working through the research process. For example, they can learn about the action research cycle. This is an important basic skill for the teacher and also the students. Teachers must know how to conduct the research and how to use the research results for improving their work, for instance, improving teaching and learning in their classes. Second, this action research can encourage the students to be involved in the research process, especially the steps of reflection and discussion and implementing the intervention. This is a very useful activity for the students. They can learn how to work with others, so that they can develop their social skills and thinking skills. Also, this method can develop

empowerment in the students. Another advantage of this action research is for other teachers, educators or researchers who are interested in learning environments and constructivist approach to do classroom action research. They can apply this research method to other classes and at other levels.

1.6 OVERVIEW OF THE THESIS

Chapter 1 introduces this research study including the context of the study, the purpose, objectives, research questions, a summary of the research method, and the significance of the research.

Chapter 2 to 4 present a review of literature related to the implementation of a constructivist approach to improving students' perceptions of health science classroom learning environments and learning achievement. The related literature consists of: past studies of the learning environment; constructivism theory and past study of the use of a constructivist approach, the constructivist learning environment and previous studies about constructivist learning environments; and action research including examples of past studies using this method.

The fifth chapter provides information about how the research was conducted, including the research method, the research design, the sample for the study, the instruments (the CLES, the ATAQ, and the SKAT), the administration of these instruments and their scoring procedures, data collection, data analysis, methods of statistical analysis, and detail of the five stage process

Chapter 6 describes the method and results of the validation and determination of the reliability of the Thai version of Actual and Preferred Forms of the CLES for use in Health Science classrooms with a sample of 100 undergraduate students undertaking Health Science classes in the Faculty of Science and Technology at Udonthani Rajabhat University, Thailand. This chapter also describes the qualitative

information obtained from student interviews on how to adjust the questionnaire in order to make it more appropriate for use in Thailand.

Chapter 7 presents the results of the pre-assessment of students' perception of their classroom learning environment and the results of pre-assessment of students' knowledge about AIDS. This chapter also describes the results of focus group discussions used to determine intervention strategies.

The eighth chapter describes the details of the action research involving the use of the CLES and the constructivist teaching approach. This chapter contains the details of each stage of the intervention including the method of constructivist teaching, the use of instruments, and the results of formative assessment in the learning process.

Chapter 9 presents the assessment method and the results of the post-assessment of the constructivist teaching approach used to improve the students' learning environment and achievement assessed by the CLES, the ATAQ, and the SKAT. The in-depth qualitative data based on observations and focus group discussions and students' journals about the process and the results of the intervention are also discussed in this chapter.

The concluding chapter provides a summary of the overall major findings in this research. This chapter also presents a discussion about the process and the results of this action research attempt to use a constructivist teaching approach to develop a better learning environment and achievement. Suggestions based on this research, implications for further research, limitations of the study, and recommendations for teaching tertiary Health Science in Thailand are provided in this chapter.

CHAPTER 2

CLASSROOM LEARNING ENVIRONMENT

2.1 INTRODUCTION

This chapter describes a review of the literature related to classroom learning environments. The first section begins with a history of classroom learning environment research. The second section describes a method and the instruments used for assessing classroom environment. The next section discusses the issues related to learning environments in science education and the last section provides some examples of previous research studies about classroom learning environment and the use of learning environment instruments.

2.2 CLASSROOM LEARNING ENVIRONMENT

2.2.1 Introduction

Learning environment is a very important factor affecting students' learning achievement because students spend a huge amount of time at the school, college or university. Jackson's (1968) stated that students have spent 7,000 hours in school by the end of their primary school education, and Rutter, Maunghan, Mortimore, Outson, and Smith (1979) suggest that this figure rises to 15,000 hours by the completion of secondary school. Fraser (2001) has calculated that students have spent approximately 20,000 hours in the classroom by the time that they graduate from college. Furthermore, research in the past has indicated that the classroom learning environment has a significant association with students' learning achievement (Fraser 1994; Fraser, Giddings, & McRobbie, 1991; Goh & Fraser, 1998). The main aims of the research described in this thesis was to improve health science classroom learning environments. Therefore, the theory related to learning environments is described in this chapter. This section begins with a history of classroom environment research. The second part describes the methodology for assessing classroom environment while the next part describes the instruments used for assessing classroom learning

environment. The final section provides some examples of past classroom environment research including research in Thailand.

2.2.2 History of classroom learning environment research

The importance of the classroom learning environment has been increasingly recognized over the past 80 years. Learning environment research has its roots in the work of early social psychologists. The earliest recorded classroom climate research was conducted by Thomas in the 1920s in the USA. Thomas's work focused on the observation and recording of explicit classroom phenomena rather than the psychological meaning of events. (Thomas, cited in Chavez 1984).

This early work was improved by Lewin's (1936) who recognized the field theory which defined that both the environment and its interaction with personal characteristics of the individual are potent determinants of human behaviour. Lewin introduced the formula $B=f(P,E)$ to describe human behaviour (B) as a function of two interdependent influences, the person (P) and the environment (E).

Murray (1938), Stern, Stein, and Bloom (1956) and Pace and Stern (1958) extended Lewin's work to develop a *need-press* theory in which individuals are conceptualized in terms of their psychological needs and the environment in terms of its press. The term "personal needs" refers to motivational personality characteristics representing the tendency for an individual to move in the direction of a goal, whereas "the environmental press" is the external situational counterpart that either supports or frustrates the expression of internalized personality need (Fraser, 1998). Stern (1970) extended need-press theory to develop a theory in which the degree of person-environment congruence is related to student outcomes (Fraser 1986). This theory proposes that, when personal needs and environment press are more congruent, student outcomes are enhanced, and has been the basis for person-environment fit studies in which the congruence between actual and preferred environments is assessed and related to student outcomes (Fraser, 1994).

The modern era of learning environment research commenced in the late 1960s when Rudolf Moos and Herbert Walberg began independent lines of research on the conceptualization and assessment of psychosocial environments. Moos' (1987) social climate scales provided the impetus for studies in a diverse range of human environments including schools, university residences, groups and classrooms as well as hospitals, prisons, and other workplaces.

The theoretical importance of Moos' work has been continuing acceptance of his three dimensions of human environments: 1) Relationship (the nature and intensity of personal relationships within the environment), 2) Personal Development (basic directions along which personal growth and self-enhancement tend to occur) and 3) System Maintenance and System Change (the extent to which the environment is orderly, clear in expectations, maintains control and is responsive to change).

Walberg's (1968) involvement with the Harvard Project Physics curriculum required the evaluation of the learning environment and the study showed that students could make valid summary judgments about their classrooms, and that these perceptions could be used in learning environment research.

From the 1970s, research on the conceptualization and assessment of classroom environments has developed rapidly and the study of classroom environments has received increasing attention by researchers, teachers, and school administrators over the past 35 years.

2.2.3 Methodology for assessing classroom environment

The assessment of classroom learning environment is a useful source of information for teachers, providing student feedback, to guide them, on ways to improve teaching and learning. Various literature reviews (e.g., Chavez, 1984; Fraser & Walberg, 1991; Genn, 1984) suggest that there are many methods which can be used to assess learning environments, including 1) classroom observation - usually in terms of explicit phenomena recorded by trained observers in the classroom, 2) use of questionnaires - student and teacher perceptions about their learning environment are obtained through questionnaire administration, 3) interviews - involving the teacher and the student, and 4) focus group discussion - used to collect qualitative data. In general, methods of

assessing learning environment can use both quantitative and qualitative data collection, depending on the objectives of the study and the research design.

2.2.4 The instruments used for assessing classroom learning environment

Over the years, researchers have developed many instruments to assess students' perceptions of their classroom learning environments (Fraser, 1998). These instruments have been translated into various languages, and have been used in different fields, different countries and at different levels. Herbert Walberg's *Learning Environment Inventory* (Anderson & Walberg, 1968) and Rudolf Moos' *Classroom Environment Scale* (Moos & Houts, 1968; Moos & Trickett, 1974) were among the first instruments developed to assess students' perceptions of their learning environment. Since that time, the influence of the learning environment on the education process has received a great deal of attention. There has been much development in the conceptualization and assessment of learning environments, and numerous classroom environment instruments have been validated for use in educational research, especially in the field of science education (Fraser, 1994). The following part of this thesis summarizes the development of some of the learning environment instruments.

The LEI

The Learning Environment Inventory (LEI) was developed in the late 1960s in conjunction with the evaluation and research related to Harvard Project Physics (Fraser, Anderson, & Walberg, 1982; Walberg & Anderson, 1968). The final version of the LEI contained 105 items, with seven items in each of 15 scales. The scales of the LEI are Cohesiveness, Friction, Favouritism, Cliques, Satisfaction, Apathy, Speed, Difficulty, Competitiveness, Diversity, Formality, Material Environment, Goal Direction, Disorganisation, Democracy. There are four alternative responses to each item: Strongly Agree, Agree, Disagree, Strongly Disagree.

The CES

The Classroom Environment Scale (CES) was developed by Moos and Trickett (1968) and used in a program of research involving the measurement of human perceptions of the environments, which included hospitals, prisons, universities, and workplaces (Moos, 1974). The nine scales of the CES consisted of Involvement, Affiliation, Teacher Support, Task Orientation, Competition, Order and Organization, Rule Clarity, Teacher Control and Innovation. There are 90 items altogether (10 items per scale). The CES has Actual and Preferred Forms. The Actual Form assesses students' perceptions of their actual learning environments and the Preferred Form assesses the learning environments that students would prefer or consider ideal.

The MCI

The *My Class Inventory* (MCI) was developed by Fisher and Fraser (1981). This instrument was originally developed for use at the primary school level and was also seen to be useful in the lower secondary school. The MCI assesses the five classroom climate scales of Satisfaction, Friction, Difficulty, Cohesiveness, and Competitiveness. The final form of MCI contains 25 items, with five items in each scale. The two alternative responses are Yes and No.

The ICEQ

The *Individualized Classroom Environment Instrument* (ICEQ) assesses the dimensions which distinguish individual classrooms from conventional ones. The initial version was developed by Rentoul and Fraser (1979), and the final published version contains 50 items belonging to the five scales of Personalization, Participation, Independence, Investigation and Differentiation. Each item has five alternative responses: Almost Never, Seldom, Sometimes, Often, and Very Often (Fraser, 1990).

The SLEQ

The *Science Laboratory Environment Survey* (SLEQ) was developed by Fisher and Fraser (1990) in order to assess the important aspects of the school environments. The SLEQ consists of eight scales, two scales measure the Relationship Dimension (Student Support, Affiliation), one measures the Personal Development Dimension (Professional Interest), and four measure the System Maintenance and System Change Dimension (Staff Freedom, Participatory Decision Making, Innovation, and Resource Adequacy), while the last scale, which was added for a more complete the view of school environment is named Work Pressure. The SLEQ was designed in two forms, actual and preferred and with five alternative responses, Strongly Agree, Agree, Not Sure, Disagree, and Strongly Disagree.

The CUCEI

The *College and University Classroom Environment Inventory* (CUCEI) was developed by Fraser, Treagust, and Dennis (1986) specifically designed for use with small classes of about 30 students in upper secondary and tertiary levels, and where either seminar or tutorials were used as the mode of delivery. The seven-scale, 49-item instrument was designed with both student and instructor versions for the actual and preferred classroom environment. The seven scales in the CUCEI consists of Personalization, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, and Individualisation and there are four responses alternatives. The CUCEI has Actual and Preferred Forms.

The QTI

The original version of the *Questionnaire on Teacher Interaction* (QTI) was developed in the early 1980s in The Netherlands and contained 77 items (Wubbels, Creton and Hoomayers, 1985). The Australian version of the QTI developed by Fisher, Rickards, and Fraser (1996) has eight scales, namely, Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom, Uncertain, Dissatisfied, Admonishing and Strict Behaviour. Items are responded to on a five point scale: Never, Seldom, Sometimes, Usually, and Always.

The CLEI

The *Computer Laboratory Environment Inventory* (CLEI) was developed by Newby and Fisher (1997) in order to investigate students' perceptions of their computer laboratory learning environment. This instrument comprises five scales, which are Student Cohesiveness, Open-Endedness, Integration, Technology Adequacy, and Material Environment. The CLEI was designed in two forms, actual and preferred, and with five alternative responses, Strongly Agree, Agree, Not Sure, Disagree, Strongly Disagree.

The SLEI

The *Science Laboratory Environment Inventory* (SLEI) was developed by Fraser, Giddings, and McRobbie(1995), specifically for assessing students' perceptions on their science laboratory classes at the senior high school and higher education levels. There are seven items in each of five scales, Student Cohesiveness, Open-Endedness, Rule Clarity, Integration, and Material Environment and five alternative responses, Almost Never, Seldom, Sometimes, Often, and Very Often.

The CLES

The original version of the Constructivist Learning Environment Survey (CLES) was developed by Taylor and Fraser (1991), and consisted of four scales; Autonomy, Prior Knowledge, Negotiation, and Student-Centredness. In 1997, Taylor, Fraser, and Fisher redesigned the CLES to incorporate constructivist and critical theory perspectives on the cultural framing of the classroom learning environment. This new version has two forms, an Actual Form and a Preferred Form. The CLES contains 30 items in five scales with six items in each scale, and is designed to measure a student's individual perception of her or his constructivist classroom learning environment. The five scales are Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation. The response alternatives for each item are Almost Always, Often, Sometimes, Seldom, and Almost Never. This questionnaire is discussed in detail in the next chapter.

The USCLES

Fisher and Taylor (1997) developed the new learning environment instrument called the *University Social Constructivist Learning Environment Survey* (USCLES), a questionnaire designed for use by university teachers interested in transforming their teaching in accordance with a social constructivist perspective on learning. The USCLES combines scales adapted from two main instruments, the Constructivist Learning Environment Survey and the Questionnaire on Teacher Interaction. There are six scales: Relevance, Reflection, Negotiation, Leadership, Empathy, and Helpfulness.

The WIHIC

The *What is Happening in This Class* questionnaire (WIHIC) was developed by Fraser, Fisher, and McRobbie (1996) by combining the most salient scales from existing questionnaires with new dimensions of contemporary educational concern (e.g., equity and constructivism). The WIHIC has a separate Class Form (which assesses a student's perceptions of the class as a whole) and Personal Form (which assesses a student's perceptions of his or her role in a classroom). The original version of the WIHIC contained 90 items belonging to nine scales, and the final form of the WIHIC consists of 56 items belonging to seven scales. The seven scales of the WIHIC consist of Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation, and Equity.

Table 2.1 Summarises some of the instruments that have been used to study classroom environments throughout the world.

Table 2.1

An Overview of the Instruments Used for the Study of Classroom Environment.

Instrument	Level	Scales assessed by instrument	Reference
Learning Environment Inventory (LEI)	Secondary	Cohesiveness, Friction, Favouritism, Cliques, Satisfaction, Apathy, Speed, Difficulty, Competitiveness, Diversity, Formality, Material Environment, Goal Direction, Disorganisation, Democracy	Anderson, & Walberg (1968)
Classroom Environment Scale (CES)	Secondary	Involvement, Affiliation, Teacher Support, Task Orientation, Competition, Order & Organisation, Rule Clarity, Teacher Control, Innovation	Mooss & Trickett (1974)
My Class Inventory (MCI)	Primary	Student Cohesiveness, Friction, Satisfaction, Difficulty, Competitiveness	Fisher & Fraser (1981).
Individualised Classroom Environment Questionnaire (ICEQ)	Secondary	Personalisation, Participation, Independence, Investigation, Differentiation	Fraser (1990)
School Environment Level Survey (SLEQ)	Primary, Secondary, Tertiary	Student Support, Affiliation, Professional Interest, Staff Freedom, Participatory Decision Making, Innovation, Resource Adequacy, Work Pressure	Fisher & Fraser (1990).
College and University Classroom Environment Inventory (CUCEI)	Tertiary	Personalisation, Involvement, Student Cohesiveness, Satisfaction, Task Orientation, Innovation, Individualisation	Fraser, Treagust, & Dennis (1986).
Questionnaire on Teacher Interaction (QTI)	Primary, Secondary	Leadership, Helping/Friendly, Understanding, Student Responsibility/Freedom, Uncertain, Dissatisfied, Admonishing, Strict	Fisher, Rickards & Fraser (1996)
Computer Laboratory Environment Inventory (CLEI)	Secondary, Tertiary	Cohesiveness, Open-Endedness, Integration, Technology Adequacy, Material Environment	Newby & Fisher (1997)
Science Laboratory Environment Inventory (SLEI)	Secondary, Tertiary	Student Cohesiveness, Open-Endedness, Rule Clarity, Material Environment, Integration	Fraser, Giddings, & McRobbie (1995)
Constructivist Learning Environment Survey (CLES)	Secondary	Personal Relevance, Uncertainty, Critical Voice, Shared Control, Student Negotiation	Taylor, Fraser, & Fisher (1997)
The University Social Constructivist Learning Environment Survey (USCLES)	Tertiary	Relevance, Reflection, Negotiation, Leadership, Empathy, and Helpfulness.	Fisher & Taylor (1997)
What is Happening in this Class ? (WIHIC)	Secondary	Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation, Equity	Fraser, Fisher, & McRobbie (1996)

2.2.5 Learning environments in science education

National statements on science education often refer to the learning environment provided in science classes. For example, the National Standards for Science Education (NSES) in the USA indicate that time, space, and materials are critical components of an effective science education learning environment for developing students' understanding of science (NSES, 1996). In order to meet the need of students, creating an adequate environment for science teaching is a shared responsibility. Teachers lead the way in the design and use of the most appropriate materials and resources, but school administrators, students, parents, and community members must meet their responsibilities to ensure that the resources are available for use. Developing a schedule that allows time for science investigations needs the cooperation of all in the school; acquiring materials requires the appropriation of funds; maintaining scientific equipment is the shared responsibility of students and teacher; and designing appropriate use of the scientific institutions and resources in the local community requires the participation of the school, teacher and students.

The classroom is a limited environment. If science teachers lecture in the classroom, they should provide examples which relate to many other fields that have scientific aspects in the real world outside. On the other hand, the school science program must extend beyond the walls of the school to the resources of the community. Other resources for science teaching in the community, such as science centres and museums, national laboratories, and aquaria, as well as hospitals or in industry, can contribute greatly to the understanding of science and encourage students to further their interests outside of school. In addition, the physical environment in and around the school can be used as a living laboratory for the study of natural phenomena. Whether the school is located in a densely populated urban area, a sprawling suburb, a small town, or a rural area, the environment can and should be used as a resource for science study. Working with others in their school and with the community, teachers build these resources into their work with students (NSES, 1996).

In addition, the NSES summarizes the dimensions of the science education learning environment as (a) time for extended investigations; (b) a flexible and supportive setting for inquiry; (c) a safe working environment; (d) sufficient resources, including

tools, materials, media and technological resources; (e) resources outside school; and (f) engagement of students in active learning processes.

Furthermore, the NSES suggests that science teachers should provide a learning environment that (a) provides for the physical needs and variations of learners, including disabled learners; (b) provides for the safety of all students; (c) is orderly and well managed; (d) is physically and socially appropriate for the age and maturity of the learner; (e) stimulates interest and engagement in learning and (f) recognizes and respects the need for appropriate and humane treatment of living things. Riechard (1993) suggest that science teachers should be aware of issues related to the humans, animals and plants in the classroom and show concern for safety and the legal issues related to liability for their actions. Weld (1990) discusses the need to provide an accessible learning environment for all science students and teachers must demonstrate an awareness of the more difficult activities, for instance field trips. They should also be aware of steps they can potentially take to meet the needs of all learners, from customizing equipment, to adapting lessons, to using cooperative learning approaches.

In conclusion, science education has specific characteristics which are different from other fields of education. Therefore, the learning environment in science education can be very complex and the challenge for science teachers is to develop a good learning environment in their classes. However, science teachers have to understand their students and other factors related to their science classes. For example, they have to know about the students' prior science concepts, what they think about science lessons, and what are their students' perceptions of their science classroom learning environment. These answers can help science teachers to improve the learning environment in science education. As a result, an effective learning outcomes in science classrooms will occur.

2.2.6 Previous research studies of classroom environment

There have been a great many research studies about classroom environment conducted in various settings, at all levels, and in many countries around the world.

The following section describes some examples of this research and is divided into two main parts, the first section describes research carried out in other countries and the second part describes research carried out in Thailand.

According to literature in learning environment research in the past three decades, there has been a strongly emphasis on the use of numerous validated questionnaires to assess students' perceptions of their classroom learning environment (Fraser, 1998a). Questionnaires have been used in a variety of research investigations with different target groups in many countries around the world. For example, in the USA, Canada, Netherland, Australia, South Africa, Nigeria, China, Taiwan, Korea, Hong Kong, Singapore, Brunei, Indonesia, and Thailand (Aldridge, Fraser, Dryden, Taylor & Fraser, 1998; Fisher & Churach, 1999; Goh & Khine 2002; Idiris & Fraser, 1997; Khine & Fisher 2002; Nair & Fisher, 1999; Puacharearn & Fisher, 2004; Sebela, 2003; Taylor, Dawson, & Fraser, 1995). In Asian countries, during the past decade, there is evidence of a similar pattern (Kim, Fisher & Fraser, 1999; Lee & Fraser, 2000; Paucharearn & Fisher, 2004; Taylor & Chen, 2000; Paucharearn & Fisher, 2004; Soerjaningsih, Fraser, & Aldridge 2001; Song & Hunt 2002; Thomas, 2002; Wanpen & Fisher, 2004). This section provides some examples of this classroom environment research in other countries and in Thailand.

Nair and Fisher (1999) modified and validated a modified form of the College and University Classroom Environment Inventory (CUCEI), and compared students' and instructors' actual and preferred perceptions of their science classroom learning environments at the tertiary level of education. The reliabilities of the modified CUCEI scales ranged from 0.73 to 0.94. Students' perceptions of their classrooms indicated a preference for a more favourable learning environment on all scales of the CUCEI. Instructors, on all the science classes, generally perceived their environment more favourably than did their students.

Newby (1998) conducted a study focusing on the computer laboratory class as a learning environment in university courses. The main aim was to develop and validate two instruments, the Computer Laboratory Environment Inventory (CLEI) and the Attitude towards Computing and Computing Courses Questionnaire (ACCC). These

instruments were administered at three universities, in Australia, England and the USA. The results showed that there were significant associations between the attitudinal variables, Anxiety, Enjoyment and Usefulness of the Course and achievement. Regression analysis supported the findings that the environment variables made a significant contribution to the attitudinal variables, and these in turn made a significant contribution to achievement. Further analysis using structural equation modelling suggested that perception of the computer laboratory environment affect achievement indirectly by directly affecting students' attitudes towards computers but even more so their attitude towards the course.

Rickards, Bull, and Fisher (2001) used the WHIC in a study of school racial diversity and socio-economic status. The purpose of this study was to validate the What Is Happening In this Class (WIHIC) questionnaire with a large sample in the USA and investigate associations between school socio-economic and racial diversity factors and students' perceptions of their classroom learning environments. The sample involved 1,720 eighth-grade science students from 65 classes in 11 middle schools in the USA. Socio-economic status was determined for each school by examining free and reduced lunch percentages. Racial diversity for each school was determined through county demographics, which listed ethnicity percentages for all schools within the county's jurisdiction. The results indicated that the WIHIC was a valid and reliable instrument for use with eighth-grade science classes in the USA. All students in the sample regardless of school SES or racial diversity perceived the Task Orientation scale most positively and the Investigation scale least positively. The results also showed that students from schools with high socio-economic status were more satisfied with collaborative efforts with other students and the amount of attention they receive from the teacher than are the lower SES levels.

Henderson, Fisher, and Fraser (1998) reported the first use of a classroom learning environment questionnaire named the *Environmental Science Learning Environment Inventory* (ESLEI). The study had three objectives; to measure students' perceptions of aspects of their learning environment in senior Environmental Science classrooms. by means of the Environmental Science Learning Environment Inventory (ESLEI); to investigate associations between students' perceptions of their classroom learning environment and students' attitudinal outcomes; and to investigate differences in

student perceptions based on the students' sex. The results indicated that the ESLEI was a valid and reliable instrument (reliability coefficients ranged from 0.69 to 0.77). There were some overlaps between scales, but the discriminant validity of the ESLEI, indicated that each scale measured a distinct aspect of the classroom environment.

Thomas (2002) conceptualised, developed and validated the *Metacognitive Orientation Learning Environment Scale-Science* (MOLES-S) in Hong Kong, drawing on extensive literature and research on metacognition across subject areas including science education. A seven scale instrument was developed to assess metacognitive demands, student-student discourse, student-teacher discourse, student voice, distributed control, encouragement and support, and emotional support. The successful development of the MOLES-S provides researchers and teachers with an effective means for assessing the metacognitive orientation of science classrooms. Thomas suggested that the MOLES-S could be used as a template for the development of similar instruments in other subject areas of the school curriculum

Quek, Wong, and Fraser (2002) investigated differences between boys' and girls' perceptions of their chemistry laboratory classroom environment using the Chemistry Laboratory Environment Inventory (CLEI). The sample comprised 312 boys and 185 girls in four chemistry classes of year 10 from 18 secondary independent schools in Singapore. The results indicated that the CLEI was found to be a reliable and valid instrument for use in the Singapore context. Statistically significant differences were found between boys' and girls' perceptions of their chemistry laboratory classroom environment. This study showed that girls perceived their learning environment more favourably than did boys.

There are many classroom environment research studies involved investigating the association between learning environments in particular classrooms and the students' learning outcomes in those classrooms. Results of studies conducted over the past 30 years have provided convincing evidence that the quality of the classroom environment in schools is a significant determinant of student learning (Fraser, 1998, pp. 1-5). That is, students learn better when they perceive the classroom environment more positively. Examples of these studies follow.

Goh and Fraser (1998) used the Questionnaire on Teacher Interaction (QTI) and a modified version of the My Class Inventory (MCI) to investigate associations between student cognitive and affective outcomes and perceived patterns of teacher-student interaction in mathematics classes in primary schools in Singapore. The results found that higher cognitive outcomes were associated with better classroom teacher leadership, more helping/friendly classroom environments and teacher behaviours that demonstrate understanding and empathy towards students. Additionally, the affective outcome measure, student liking and interest in mathematics, was related positively with improved levels of student cohesion and reduced levels of classroom friction.

Flinn (2004) assessed student perceptions of health science teacher interpersonal behaviour by using the QTI in health science classrooms in Tasmania, Australia. The study involved 1,471 grades 9 and 10 health science students and their teachers in 75 classes. The results indicated that the QTI is a valid and reliable instrument for use in health science classrooms. The results found that there are associations between all QTI scales and students' attitudinal and cognitive outcomes. The scales of Leadership and Helping/Friendly had the greatest positive influence on student attitudinal and cognitive outcomes. Health science students perceived their teachers as displaying high levels of leadership, helping/friendly and understanding behaviour, and low levels of uncertain, dissatisfied and admonishing behaviour. Teachers generally perceived themselves in a more favourable manner than did their students. The students also perceived that less experienced teachers were less dominant and more oppositional compared with teachers with more experience. This study also used qualitative data of students' comments to supported the findings.

Adolphe (2002) conducted a cross-national study of classroom environment and attitudes among junior secondary science students in Australia and Indonesia. The main purposes of this study was; 1) to validate a modified versions of the WIHIC questionnaire and the TOSRA in Australia and Indonesia; 2) to find out whether the scores on the WIHIC questionnaire and TOSRA vary with country and with gender; and 3) to evaluate the strength of the associations between students' perceptions of

their classroom environment and their attitude to science in both Australia and Indonesia. The results indicated that there were a few differences between Australian and Indonesian students' perceptions of their classroom environments and in their attitudes to science. Australian students had a more positive attitude towards scientific inquiry while Indonesian students had a more positive attitude towards career interest in science. This study also reported that both genders in the two countries had almost similar perceptions of their learning environments and attitudes to science. There were also a strong and positive associations between each scale of the WIHIC and the attitude scale in both Indonesia and Australia.

Zandvliet (1999) conducted a cross-national study aimed at investigating associations between the physical and psychosocial environment of classrooms that were using new information technologies in Australian and Canada. The results indicated that there were statistically significant and independent associations between physical and psychosocial factors and between psychosocial factors and students' satisfaction with their learning. Qualitative findings from case studies complemented these results. These quantitative and qualitative results were used to develop a model for educational productivity for computerised classrooms. The model included a number of important physical and psychosocial factors which when considered together, could influence student attitudes in networked and computerised learning environments.

Aldridge and Fraser (1997) combined qualitative and quantitative research methods in examining science classroom environments in a cross-national study in Taiwan and Australia. The WIHIC was administered to 50 lower secondary school science classes in Taiwan (1,879 students) and Australia (1,081 students). The data from the questionnaires were used to guide the collection of qualitative data. Dimensions on which larger differences between Taiwan and Australia occurred were examined more closely using observations, interviews and stories. The findings contributed towards explaining differences in student perceptions and tentatively suggest: that students' perceptions of their learning environment are influenced by socio-cultural factors; the need for caution when using a questionnaire framed in a Western context in a different culture; and implications for future research involving cross-national studies.

Nix (2003) evaluated a new instrument named *Integrated Science Learning Environment* (ISLE) and used a combination of qualitative methods and quantitative measures to provided insight information about the study. Data were collected from learning environment scales, attitude scales, and concept map. The results indicated that the ISLE program was effective in terms of teachers' perceptions of the university field trip learning environment; changes in teachers' attitudes to information technology; and teachers' conceptual development. The results also suggest that ISLE model can create a rich learning environment. Virtual field trips based on the ISLE model, can enable the principles of student-centred inquiry and constructivism to be practised for the benefit of all learners.

Stolarchuk and Fisher (2001) assessed the effectiveness of laptop computers in independent schools of Australia. Quantitative data were collected from three instruments; 1) the *Science Classroom Environment Survey* (SCES) was used to assess students' perceptions of their classroom; 2) the TOSRA was used to assess students' attitudes toward science; and 3) students' achievement was measured by using the *Test of Enquiry Skills* (TOES). The three quantitative instruments were administered to over 800 students in years 8 and 9 science classes, in 14 independent schools, across four Australian states in 1995. Qualitative data were collected from two of the fourteen schools in 1996. The reliability and validity of the SCES for science laptop classroom research were confirmed. The results indicated that students' perceptions were found to be positively associated with attitudinal outcomes and greater than associated between students' perceptions with their cognitive achievement outcomes.

2.2.7 Research using learning environment instruments in Thailand

Chantavong and Malone (2004) used modified and validated versions of the QTI and the CUCEI in order to assess students' perceptions of their learning environment in statistics classrooms in the Rajabhat Institute system in Thailand. This study assessed students' attitude towards statistics using an abbreviated version of the TOSRA. Associations between students' learning environments and their attitudes towards statistics as a subject, and their cognitive achievement scores were investigated. The study also investigated differences between male and female students on their perceptions of their learning environment in statistics classes. The results indicated

that the modified version of the QTI and the CUCEI had satisfactory reliability. The results from simple and multiple correlation analysis revealed reasonably strong and positive associations between each of the classroom learning environment scales and students' attitude towards statistics and cognitive achievement scores

Kijkosol and Fisher (2004) assessed teacher-student interactions and the laboratory learning environments in biology classes in Thailand. The main purpose of this study was to described the validation and application of the modified Thai versions of the QTI and the SLEI in biology secondary classes in Thailand. This involved over 1,000 secondary school biology students from different areas of Thailand who completed the questionnaires. The data provided evidence for the validity and reliability of the questionnaires for use in biology secondary classes in Thailand. Positive associations were found between learning environments scales and student attitudes to biology classes. For example, the Leadership, Helping/Friendly, and Understanding scales.

Wanpen and Fisher (2004) used the CLES at an undergraduate level in a university in North-eastern Thailand. The action research aimed to create a collaborative learning environment in a computer classroom using the constructivist learning environment survey. This CLES was administered to 710 undergraduate students in 33 computer classes. The results found that the instructor was able to used the CLES to improve the learning environment of a computer class in Thailand.

Santiboon and Fisher (2004) studied students' perceptions of their physics classroom learning environments and interactions with their teachers in upper secondary school classes in Thailand by using the Physics Laboratory Environment Inventory (PLEI) and the QTI. This study also investigate associations between these perceptions and students' attitudes toward physics. The results indicated that there are statistically significant differences between the students' perceptions of actual and preferred environments and teacher interpersonal behaviour. The results also found associations between students' perceptions of their learning environments and teachers' interpersonal behaviour with students' attitudes towards physics classes.

2.3 SUMMARY

This chapter has described a review of the literature related to the classroom learning environments. The chapter consisted of a history of classroom learning environment research, the instruments used for assessing classroom environment, science education learning environments and examples of some of the past studies related to classroom learning environment. It is noteworthy that there have been very few learning environment studies in Thailand and very few in the area of Health Education. The next chapter provides a description of constructivism theory, constructivist teaching approaches, and past studies in which a constructivist approach was used. It concludes by linking Chapters 2 and 3 with a discussion of the Constructivist Learning Environment Survey (CLES) and examples of past studies in which this questionnaire was used.

CHAPTER 3

CONSTRUCTIVISM AND CONSTRUCTIVIST TEACHING

As long as there are people asking each other questions, we have had constructivist classrooms. Constructivism, the study of learning, is about how we all make sense of our world

Jacqueline Grennan Brooks (1999, p. 1)

3.1 INTRODUCTION

The quote above implies that the constructivist approach has been used in the classrooms for a long time. Brooks (1999) stated that the characteristics of a constructivist classroom are that people learn how to learn and the things that they have learned are related to the real world outside the school. Obviously, health issues are very important for everybody as they are a part of their lives. This chapter describes a review of the literature related to the implementation of a constructivist approach to improve students' perceptions of a health science classroom learning environment and learning achievement. The chapter consists of six main sections. The first section begins with a definition, basic concepts, and various types of constructivism theory. The second section describes a constructivist teaching approach, characteristics of the constructivist teaching and learning approach, and teacher and student roles in constructivist teaching and learning. This section also describes constructivist teaching strategies. The next section discusses implications of constructivism for instructional design. Assessment methods used in constructivist teaching are presented in the following section. The fourth section describes previous studies that utilized constructivist teaching approaches. The following section describes characteristics of the constructivist classroom learning environment. Finally, the development of the constructivist learning environment survey (CLES) and some past studies using the CLES are described.

3.2 CONSTRUCTIVISM THEORY

Constructivism is one of the most influential theories in contemporary education and learning theory. It has had a great influence on science education in the past three decades (Matthews, 1998). Fosnot (1992) stated that constructivism can be used to analyse the learning potential of any classroom situation. It also has been used as a referent to build a classroom that maximizes student learning. The teacher takes account of what students know, maximizes social interaction between learners, such that they can negotiate meaning and provides a variety of sensory experiences from the use of the constructivist approach. Tobin (1993) noted that there is a widespread acceptance of constructivism, and the constructivist approach has become increasingly popular, indeed it represents a paradigm change in science education. In this research study, Constructivism Theory was used as a basis for determining intervention strategies in order to improve classroom learning environment in an attempt to improve students' learning outcomes. The following section describes some theories related to constructivism.

3.2.1 Definition of constructivism

Constructivism is a philosophical perspective contending that individuals form or construct much of what they learn and understand (Burning, Schraw, and Ronning, 1995). Bruner (1996) described constructivist learning as an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Von Glasersfeld (1989) described constructivism as a theory of knowledge with roots in philosophy, psychology and cybernetics. From a constructivist perspective, knowledge is constructed as a result of cognitive processes within the human mind and through interaction with his environment. Fosnot (1996) also stated that constructivism is a psychological theory that construes learning as an interpretive, recursive, building process by active learners interacting with the physical and social world. From these perspectives, constructivism is a theory about learning in which students play a key role in the learning process. The prior knowledge or experiences of learners is very important in

their construction of new knowledge within their mind, and in relating this knowledge to their environment in the world outside the classroom.

3.2.2 Basic concepts of constructivism

Bell (1993) said that the constructivist view of learning is not about filling students' empty heads or about students acquiring new ideas, but about students developing or changing their existing ideas. Learning is seen as conceptual change, the construction and acceptance of new ideas or the restructuring of existing ideas, or in other word, the students construct rather than absorb new ideas and actively generate meaning from experience. Likewise, Matthews (1998) stated that constructivist teaching methods emphasize the engagement of the students in the learning process and stress the importance of prior knowledge or conceptualizations for new learning.

There are two basic principles of constructivism: the first is that knowledge is not passively received from the environment, but students actively construct their own knowledge; and the second describes knowledge construction as an adaptive process in which the learners link their prior experiences to construct new knowledge that relates to the world outside. (Treagust, Fraser, & Duit, 1996; von Glasersfeld, 1990; Wheatley, 1991)

Driver and Bell (1986) summarized the constructivist view of learning as follows:

1. Learning outcomes depend on the learning environment and the knowledge of the learner
2. Learning involves the construction of meanings by students and meaning is influenced to a large extent by the students' existing knowledge.
3. The construction of meaning is a continuous and active process.
4. Meanings, once constructed, are evaluated and can be accepted or rejected.
5. Learners have a final responsibility for their learning.
6. There are patterns in the types of meaning students construct due to shared experiences with the physical world and through natural language.

3.2.3 Types of constructivism

Ernest (1995) points out that “there are as many types of constructivism as there are researchers” (p. 459). Various terms of constructivism have emerged, including, radical constructivism, cognitive constructivism, social constructivism, postmodern constructivism, social constructivism, and information-processing constructivism. The following sections describes the terms of radical constructivism (von Glasersfeld, 1989) cognitive constructivism (Piaget cited in Kneller, 1984) and social constructivism (Vygotsky 1978, cited in Palincsar 1998) that are relevant to this study.

Radical constructivism

Von Glasersfeld defines radical constructivism as an epistemology, a theory of knowledge. This knowledge is seen as a tentative human construction based on already existing knowledge. There are two key principles of radical constructivism. The first states that knowledge is not passively received but is built up by the cognizing subject. According to this principle, students construct their own meanings from the words or visual images they hear or see. What the learners already know is of key importance in this construction process. The second principle states that the function of cognition is adaptive and enables the learners to construct viable explanations of experiences. Knowledge of the world outside, therefore, is viewed as human tentative construction (von Glasersfeld, 1989).

Cognitive constructivism

Cognitive constructivism is based on the work of developmental psychologist Jean Piaget. Piaget’s theory of cognitive development is the major foundation of cognitive constructivist approaches to teaching and learning which place emphasis on the individual cognitive structuring process. This theory suggests that humans cannot be “given” information which they automatically understand and use, they must “construct” their own knowledge through their past experiences. Experience allows them to create mental images in their head. Cognitive prospective theories focus on both what students learn and the process by which they do so (Piaget cited in Kneller, 1984). The role of the teacher and the classroom environment are important parts of Piaget’s theory. The role of the teacher is to provide a classroom full of interesting

things to encourage the child to construct his or her own knowledge and to have the ability to explore. The classroom environment must give students the opportunity to construct knowledge through their own experiences. They cannot be “told” by the teacher. There is less emphasis on directly teaching specific skills and more emphasis on learning in a meaningful context.

Social constructivism

Social constructivism is a theory developed by the psychologist, Lev Vygotsky. Vygotsky’s theory is about how children learn, and places more emphasis on the social context of learning. Social constructivism argues that students cannot understand concepts or construct knowledge only on their own, Vygotsky believed that people construct their knowledge through social interaction with their environments. This view is different from cognitive constructivism, because teachers involved in social constructivism do not just stand by and watch children explore and discover. The teacher may guide students as they approach problems, may encourage them to work in groups to think about issues, ask questions, and support them with encouragement and advice (Vygotsky 1978, cited in Palincsar 1998).

3.3 CONSTRUCTIVIST TEACHING APPROACH

3.3.1 The stages of the constructivist teaching approach

Driver and Oldham (1986) described constructivist teaching as being characterized by a number of stages as shown in Figure 3.1 and described as follows:

1. Orientation, where students are given the opportunity to develop a sense of purpose and motivation for learning the topic.
2. Elicitation, during which students make their current ideas on the topic of the lesson clear. This can be achieved by a variety of activities, such as group discussion, designing a poster or writing.
3. Restructuring of ideas; this is the heart of the constructivist lesson sequence. This stage consists of four steps, including

- 3.1 Clarification and exchange of ideas during which students' meaning and language may be sharpened up to contrast with other, and possibly conflicting, points of view held by other students or contributed by the teacher.
- 3.2 Exposure to a conflict situation in which students' old ideas conflict with the new ones to which they are being exposed.
- 3.3 Construction of new ideas in the light of the above discussion and demonstrations. Students can learn that there are a variety of ways of interpreting the phenomena of evidence.
- 3.4 Evaluation of the new ideas either experimentally or by thinking through their implications. Students try to work out the best ways of testing the alternative ideas.
- 4. Application of ideas, where the students are given the opportunity to use their developed ideas in a variety of situations.
- 5. Review, the final stage in which students are invited to reflect on how their ideas have changed by drawing comparisons between their pre-instruction concepts and after finish each learning activity.

As can be seen in Figure 3.1, the teaching sequence involves, an initial orientation phase to develop a sense of purpose, bringing to the surface the students' own ideas, discussions between teacher and students to clarify ideas, some conflict between students' old and new ideas may occur and eventually students construct new ideas. This may require a time for evaluation as students reconstruct ideas.

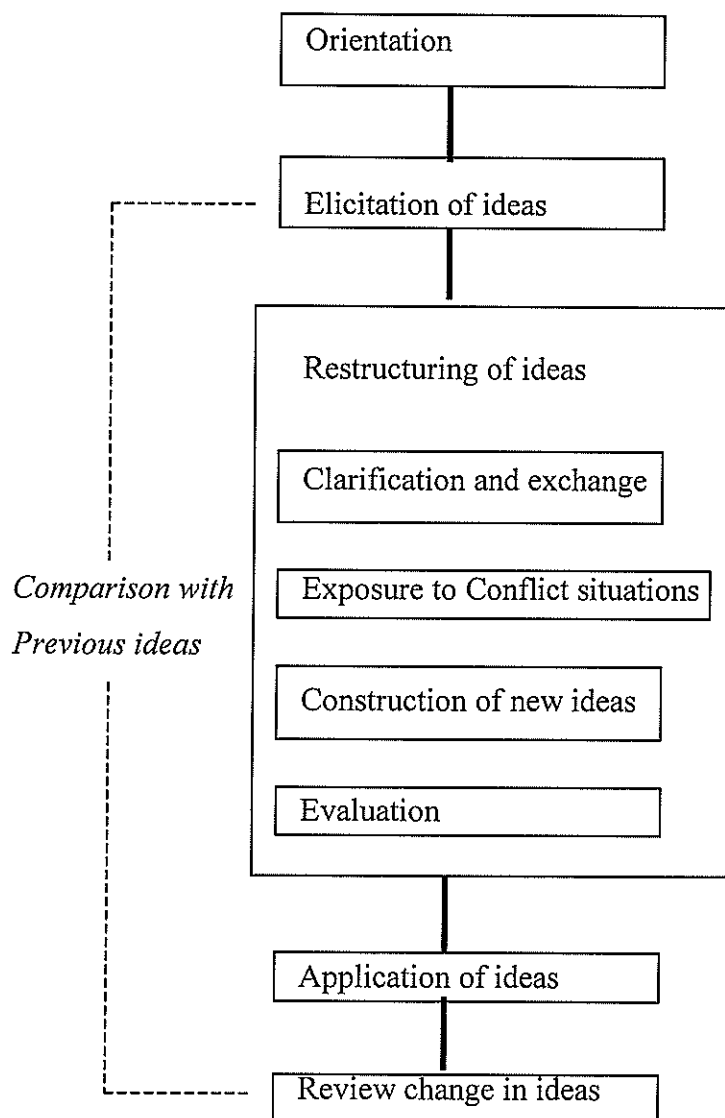


Figure 3.1. A constructivist teaching sequence (From Driver, 1989, p. 88).

3.3.2 Characteristics of the constructivist teaching approach

The constructivist classroom presents the learners with opportunities to build on their prior knowledge and understanding, to construct new knowledge and understanding from authentic experience that is related to the topic. From a constructivist perspective, teachers do not teach in the traditional sense of delivering instruction to a group of students. Rather, they use material with which the learner become actively involved through manipulation or social interaction. Learning activities include observing, collecting data, generating and testing hypotheses, drawing conclusions

and working collaboratively with others. The teacher and students are always reflecting on their learning experiences. In other words, the constructivist learning process runs as a spiral. In this perspective, students are taught to be self-regulated and take an active role in their learning process by setting their learning goal, monitoring and evaluating learning progress, and going beyond basic requirements by exploring interests (Burning, Schraw, & Ronning, 1995; Geary, 1995). Thus, in the constructivist classroom, the learners actively construct knowledge in their mind in an attempt to make sense of their world, and learning will likely emphasize the development of meaning and understanding. One of the most important points for this approach is that well-planned learning activities must be adopted in order to help students to know how to learn and encourage them to achieve their learning goal. Murphy (1997) described some of the themes that are frequently associated with constructivist learning and teaching, such as multiple perspectives, authentic activities, and real-world environments. Thus, the implication of constructivist teaching for instructional design must relate to these themes. The following section presents a summary of important characteristics in each stage of constructivist learning and teaching approach as suggested by the previous section on constructivist theory.

1. *Orientation*, the students are given the opportunity and encouraged to be involved in the process of negotiation in order to develop a purpose for learning and to be motivated towards the topic.
2. *Elicitation*, the teacher can use a variety of activities, such as group discussion, designing a poster or writing in order to elicit students' pre-instruction ideas.
3. *Restructuring of ideas*. This stage consists of three main steps, which are: clarification and exchange of ideas during which students' meaning and language may be sharpened up and contrasted with other, and possibly conflicting, points of view held by other students or provided by the teacher; construction of new ideas in the light of the above discussion and demonstrations; and evaluation of the new ideas either experimentally or by thinking through their implications. Students try to work out the best ways of testing their alternative ideas.

In this step, teachers in serve the role of guides, monitors, coaches, tutors and facilitators and students plays a central role in mediating and controlling their own learning. The learning activities, tools, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the 'real world'. Therefore, the learning process encourages students to develop their higher-order thinking skills.

4. *Application of ideas*, the students are given the opportunity to use their prior knowledge or past experience to develop new ideas in a variety of situations. The learner's previous knowledge constructions, beliefs and attitudes are considered in this process. This construction takes place in individual contexts and through social negotiation, collaborative and cooperative learning experiences. These learning situations expose the learner to alternative viewpoints in order for them to learn.

5. Review, the final stage is that the students are invited to reflect on how their ideas have changed after completing each learning activity. They can reflect by making comparisons between their pre-instruction ideas and then new ideas.

3.3.3 Teacher and student roles in the constructivist approach

Gergen (1995) stated that understanding the role of the teacher and student in the constructivist classroom provides a useful vantage point from which to grasp how constructivist theory impacts on practice. Therefore, the next section summarises the teacher and learner roles in the constructivist classroom.

Teacher role

Matthews (1998) stated that constructivism has encouraged teachers to address students' prior learning and help them to learn a new concepts in the process of learning, by stressing the importance of understanding as a goal of science instruction. Students are encouraged to engage in lessons, to use active techniques to create more knowledge and then, to reflect by talking about what they are doing and how their understanding is changing. Tobin and Tippins (1993) emphasized the important role of the teacher in the constructivist classroom in promoting the learning of students, by planning and implementing tasks, providing opportunities for students to represent

their knowledge in variety of ways though out the lesson, allocating time for students to think or engage in the learning process, to make connections, clarify, elaborate, build alternatives, speculate and evaluate their learning. The constructivist teacher provides several teaching and learning tools, including problem-solving and inquiry-based learning activities where students can get involved in the process of formulating and testing their ideas, then drawing conclusions, inferences and conveying their knowledge in a collaborative learning environment (Airasian, 1997; Brooks, Grennon, & Brooks, 1993; Gergens, 1995). In other words, the constructivist teacher works as a facilitator, a coach, mediator, coordinator, resource advisor, tutor, and someone who encourages and helps students to learn how to learn the new concepts which relate to their prior experience in order to achieve their learning goal. The following, is a list of the important principles that can guide the work of a constructivist teacher, suggested by Brooks and Brooks (1993).

1. Constructivist teachers encourage and accept student autonomy and initiative.
2. Constructivist teachers use raw data and primary sources along with manipulative, interactive, and physical materials.
3. Constructivist teachers use cognitive terminology such as "classify," "analyse," "predict," and "create" when framing tasks.
4. Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content.
5. Constructivist teachers inquire about students' understandings of concepts before sharing their own understandings of those concepts.
6. Constructivist teachers encourage students to engage in dialogue both with the teacher and with one another.
7. Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.
8. Constructivist teachers seek elaboration of students' initial responses.
9. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.
10. Constructivist teachers allow a waiting time after posing questions.
11. Constructivist teachers provide time for students to construct relationships and create metaphors.

12. Constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model
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21. Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.
22. Constructivist teachers allow a waiting time after posing questions.
23. Constructivist teachers provide time for students to construct relationships and create metaphors.
24. Constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model

Student role

Constructivist learning activities require the students' full participation. The role of students in the constructivist classroom is to be actively involved in their own learning. For example, the students work with the teacher in order to set their own learning goals. They have to learn to think for themselves to create new knowledge related to their past experiences, express their own ideas clearly in their own words, negotiate the ideas with their peers, and involve in the process of assessment. They also have to reflect on their prior knowledge and experience appropriate learning activities that are created by the teacher in order to create new understanding for

themselves (Airasian, 1997; Brooks, Grennon, & Brooks, 1993; Matthews, 1998; Tobin & Tippins, 1993). In conclusion, constructivist classrooms have the potential to transform the student's learning role from a passive recipient of information to an active participant in the learning process.

3.3.4 Constructivist teaching strategies

The purpose of this section is to describe constructivist teaching strategies that can be used to help students construct their own knowledge. The content is divided into a first part about the methods used for pre-assessment (to probe students' understanding, or to elicit students' pre-instruction conceptions), and the second part about the methods used in the constructivist learning process, such as how to challenge misconceptions, how to introduce new concepts, how to make connections, and reflection.

Polin (1992) discussed constructivist teaching methods and said that these methods "do not tell you what to know; but, show you how to know it and allow you to be a scientist, a mathematician, a sociologist, an economist and so on by providing authentic tools and authentic tasks for activity" (p. 6). There are a variety of constructivist teaching strategies. Hanna (1999) and Bell (1993) explain the various methods use for constructivist teaching as follows:

Pre-assessment

In the constructivist classroom, a teacher builds on what students already know. Assessing students' prior knowledge or past experience is important for this kind of teaching approach. Since every student develops their own knowledge based on their previous experience, it is important for a teacher to understand the students' past experiences. The main purpose of the teacher probing students' understanding is not to seek the right or wrong answer, but to find out what students already know, or the way students think about the issues. Also, these activities help students put their ideas into words and so begin the process of constructing their knowledge. Pre-assessment activities can be used at the beginning of a new topic and used throughout a lesson every time that teacher introduces a new idea, word, or situation. There are a variety of methods for finding out the alternative concepts held by students.

Oral discussion

Using a focus question, a teacher can elicit the ideas and theories of students in an open discussion. This discussion can begin with a "think, pair, share" by asking students to take five or ten minutes to think about their answer and jot down some notes, then to explain their answer to a partner and listen to the partner's ideas before opening the discussion to the whole class.

KWLH chart

(What We **K**now. What we **W**ant to Know. What We Have **L**earned. **H**ow We Know It.) This method is used to start a new topic by asking students to list what they already know. This can be done as a whole class, but asking the students to respond first in small groups allows more children to participate and provides more time to think of ideas. The phrase "What We Know, How we know it" allows the teacher to learn about the previous experiences of the students and how they think. Then, "What We Want to Know" engages the students in setting and planning their own learning. The "What We Have Learned" section helps bring closure at the end of the topic and can be used for assessment. The "How We Know It" can help students to reflect on a topic as it concludes.

Mind mapping (concept mapping, or concept webbing)

Mind-mapping is the listing and organizing of concepts, ideas or things related to a particular topic. The student may work individually, thinking about the concept related to the topic. Then, making a list of words and phrases related to the topic, the students organize the words into groups and draw lines to show relationships between the groups (sometimes using the arrows to show direction of relationships). Again, having students work in small groups allows greater participation of individuals. To encourage such individual participation, a teacher might give the students post-it notes (or cards) and ask each student to write one word or phrase related to the topic on each post-it note. Then, in small groups, or as a whole class, students are asked to organize the words and phrases and show the relationships between each concept.

Hands-on activities

In this activity, the teacher asks students to investigate a concept or problem by using tools or manipulating objects. To assess these activities, a teacher may create a checklist of the behaviours for which he or she is looking. Then, using class discussions in order to reflect on the activity providing insight into the way students are thinking.

Paper and pencil

In this activity, the teacher has to formulate questions in order to pre-test students' prior experience; then, the teacher can administer the test in the traditional fashion or might give each student a slate or white board, asking them to write the answers on the slate and hold it up. This is a quick way to find out what students know. The teacher can follow each question with discussion to allow students to describe how they determined the answer.

Interview about instances

In this type of interview, the student is shown a series of up to twenty cards with line drawing or pictures, depicting various objects or events. The purpose of the interviews is to explore the concepts (both exemplars and criteria) held by students about each object or event. Alternative questions are asked to the student in order to elicit student understanding which relates to the issues. These questions depend on the concept being explored, for example, 'In your meaning of the health, what is a good health?' and 'why do you think like this?'

Interview about events

The method of interview about event is a more flexible procedure, and is used to explore students' views of everyday phenomena, which are presented to the students through actual experience in the interview or by depicting them on cards. The questions may start with general questions, and supplementary probe questions may be asked to further explore students' understanding.

Survey

Surveys are used to investigate a large number of students' alternative conceptions to obtain a fairly reliable indication of the prevalence of various viewpoints. The advantage of this method is that it takes a short time to complete, but the data obtained from this method do not provide in-depth details.

Predict Observe Explain (POE)

In this method, the students are asked to predict what would happen when a change is made, and then provide explanations about the change and any discrepancies from that which was predicted. This method is usually used to elicit students' understanding before an experiment is performed. (Gunstone & White, 1980)

Post-box method

In this method, the students are asked to write their ideas about a particular topic on a card and put the card into the post box; then the teacher sticks the card on the blackboard. The students share their ideas with others, think about the issues and discuss it with their peers, sharing their understanding. This activity is a useful way to discover anonymously the ideas of a large group of students. Also, it is a good way for students to clarify their own ideas.

Open-ended questions

Open-ended questions are asked of students about a topic and the questions are related to their existing ideas. The questions used in this method are constructed by the teacher, and the students are encouraged to think about the question in order to explore their pre-instruction conception of the topic. This method can be used to find out students' understanding about the contents of a particular topic or used to find out students' viewpoints on a particular topic.

Experimentation

In this method, the students are asked to generate problems and then design experiments that allow them to test their hypotheses or theories. This method can be conducted a variety of experiment including small learning labs, learning centre, or can be set at which student work individually. Small groups or the whole class can

meet later to discuss findings. This method can be combined with the Predict Observe Explain technique.

Research

In this method, the students raise the research question and conduct research in order to answer their question. The research provides students with information from outside learning sources, such as from experts in the field.

Field trips

Students' ideas and knowledge put to use in real situations provide a context and value for learning. Speaking to people who use the skills and concepts in their daily work gives validity to the concept. Students are to prepare questions to be asked during the field trip, and after the field trip, students conduct a class discussion of the findings and draw conclusions.

Films

When it is impossible to visit a site, films can provide a virtual visit. Teacher preview the film and prepare questions for the students to answer as they view the film. The film topic is present to the students and they are asked to prepare some questions that might be answered by the film. If there are a lot of questions, individual students can be assigned to answer just one or two. The results can be shared in a class discussion.

Observations

The student can observe and collect data about an occurrence which is related to the topic. The students have to plan their observations and discuss them after they are completed. For example, the students study the topic "human health behaviour" and they observe the exercise behaviour of their friend. When the observations are completed they have a discussion and draw conclusion. Students may make further observations and collect additional information in order to complete their observations.

Discussion

Discussion can be used with every strategy. It is very important that students be able to voice their ideas. Students might be asked to think for two or three minutes about the idea or write their ideas in a card before expressing their ideas. The teacher can lead the discussion by asking the question about the concept before beginning. The discussion can use a think, pair, share activity, or small group, or involve a whole class. The students must be questioned and re-questioned about their ideas, before they generate conclusions.

Discovery

The teacher presents the students with a variety of experiences on a topic and then, through discussion, links the experiences and provides the students with terms that help them to discuss their experiences.

Discrepant event

A discrepant event is one that seems to disobey the rules we have for the way things work. A discrepant event can be used to generate ideas about why the event happened the way it did.

Brainstorming

Brainstorming in small groups can encourage student to generate ideas about a concept that is related to issues under consideration.

Graphic organizers

The teacher presents the students with a variety of pictures or words that will help the students understand a concept. For example, Venn diagrams may be presented and the student asked to organize the pictures.

Investigation

The teacher presents the students with an investigation in which the students change one of the variables in the situation, record the results, and draw conclusions.

Guest speakers

A guest speaker may be invited to talk about issues related to the topic of study, and the students are encouraged to prepare questions before the speaker arrives. The students may ask some questions or discuss the topic with the guest, and a discussion with the whole class may follow.

Journals

Journals are a good way to begin the process of reflection with students. Writing in a journal gives students time to think about their thinking and is often used to start a discussion or a "think, pair, share." Students can respond in journals to guiding questions or to scenarios. They can be asked to define a term or describe a concept with words and pictures.

Application

Students can be asked to reflect upon what they have learned as they apply their knowledge to real world situations. As they apply their knowledge and skills, they can explain why they are doing what they are doing.

KWLH Chart

In this method, often used for reflection, teacher ask students to complete the last two columns on the chart, "What we have learned" and "How we know it." As before, this can be done first as individuals or in small groups, and then as a whole class.

Role playing

Students have to work in groups to respond to the issues in each topic which relate to a real-world problem or task. Each person in the group is asked to take on a specific role, for example, doctor, tour guide, parent, sales person, or business manager and they play this role. After role playing is completed, each student explains how the concept/product works. Small group or whole class discussion can follow.

Point of View (POV)

Point of View (POV) by Scholastic is a history processor. Source documents, numerical data, digitized sounds and images and a timeline are all part of this program. Thematic sets (i.e, daily life, science, reform and protest, and many others)

allow students to explore history from many different perspectives. POV is designed to allow students to carry out a whole meaningful task and see the big picture of history from its many perspectives.

Problem-centred learning

Wheatley (1991) described a problem-centred learning model. In this method, students work together in small groups making meaning of the task and setting out to solve problems that are perplexing. The teacher has an important mediating role to monitor the learning activities, ascertaining what students know and structuring tasks in such a way that help the student to understandings and build knowledge structures that are commensurate with their prior knowledge of the discipline. Wheatley also described how students negotiate meaning in small group situations, and then negotiate consensus in whole class settings. Therefore, the students have opportunities to put language in their understandings and to engage in learning activities such as clarifying, elaborating, justifying, and evaluating alternative point of view. Such visions of classroom learning environments are exciting and appeal as viable alternatives to those so often reported in studies of learning in traditional classrooms (Tobin & Gallagher, 1987).

In the present research study, an open-ended question and interviews were used to elicit students' pre- instruction concepts about AIDS in the pre assessment stage. Firstly, the open-ended question was administered to students by using the card technique, then the instructor chose some interesting points about which students had misconceptions and interviewed students again in order to exploring the students' misconceptions and for triangulation of the data. In the intervention stage, the researcher used a various strategies for helped the students to constructed their own knowledge about AIDS and changed their misconceptions. For example, the students have a small group discussion about the impact of AIDS. They also have a field trips at the hospital and community. The POE was apply to used in the game about AIDS transmission. A guest speaker is invited and work as a role model for them to learn from real life experiences about AIDS. These constructivist strategies can be used for assessment.

3.4 IMPLICATIONS OF CONSTRUCTIVISM FOR INSTRUCTIONAL DESIGN

Ernest (1995) in his description of the many schools of thought of constructivism suggests the following implications of constructivism which derive from both radical and social perspectives:

1. sensitivity toward and attentiveness to the learner's previous constructions;
2. diagnostic teaching attempting to remedy learner errors and misconceptions;
3. attention to meta-cognition and strategic self-regulation by learners;
4. the use of multiple representations of mathematical concepts;
5. awareness of the importance of goals for the learner, and the dichotomy between learner and teacher goals; and
6. awareness of the importance of social contexts, such as the difference between folk or street mathematics and school mathematics (and an attempt to exploit the former for the latter). (p. 485)

Jonassen (1994) also summarizes the implications of constructivism for instructional design. The following principles illustrate how knowledge construction can be facilitated:

1. provide multiple representations of reality;
 2. represent the natural complexity of the real world;
 3. focus on knowledge construction, not reproduction;
 4. present authentic tasks (contextualizing rather than abstracting instruction);
 5. provide real-world, case-based learning environments, rather than pre-determined instructional sequences;
 6. foster reflective practice;
 7. enable context-and content dependent knowledge construction; and
 8. support collaborative construction of knowledge through social negotiation.
- (p. 35)

3.5 ASSESSMENT OF THE CONSTRUCTIVIST TEACHING APPROACH

Brooks and Brooks (1993) described what assessment in a constructivist classroom looks like: Rather than saying "No" when a student does not give the exact answer being sought, the constructivist teacher attempts to understand the student's current thinking about the topic. Through non-judgmental questioning, the teacher leads the student to construct new understanding and acquire new skills. Constructivists believe that assessment should be used as a tool to enhance both the student's learning and the teacher's understanding of the student's current understanding. Bednar, Cunningham, Duffy, and Perry (1991) defined two ways by which constructivist learning can be evaluated. They suggested that one method would evaluate how well students were able to function within a content domain, and whether they could use the tools and understandings of the domain to solve problems within that domain. If they are involved in an authentic task, then evaluation would assess whether the student successfully completed that task. The second method suggested would have students reflect on the processes whereby they came to their conclusions and to document this process. Jonassen (1991) stated that it is the process of knowledge acquisition which should be evaluated, not any product or observable behaviour. According to Jonassen, evaluating how learners go about constructing their knowledge is more important than the resulting product, suggesting that evaluative procedures must become a part of the instructional process. Jonassen also felt that goal free evaluation could be an important part of constructivist assessment, since that would allow the evaluator to be unbiased by the goals of instruction.

As in all teaching strategies, there is a continuous circle of assessment and learning. In constructivist teaching, the assessment can be both formative and summative. Formative assessment can be aligned into every part of the learning process, whereas summative assessment (in other words, post-assessment) is always used after completion of the topic. The constructivist teachers should encourage students to get involved in the assessment process and should use several methods of assessment. The teachers and students can work together to create scoring guides such as checklists or rubrics to use for assess students' learning performance.

Wilson, Teslow, and Osman-Jouchoux (1995) provided some excerpts about constructivist evaluation as follows:

- Incorporate assessment into the teaching product where possible. Technologies are available for incorporating continuous, "dynamic assessment" into learning materials. Assessment can then be seamlessly integrated into meaningful learning experiences and not tacked on at the end.
- Critique and discuss products grounded in authentic contexts, including portfolios, projects, compositions, and performances. Use of work products can complement more direct, traditional measures of knowledge acquisition and understanding. Include different perspectives in the critiquing process.
- Evaluate processes as well as products. The cognitive apprenticeship model offers a number of strategies for reflecting on process: debriefings, abstracted replays, dramatizations, interviews, group discussions, knowledge telling, co-investigation, and post-mortems of problem-solving activities.
- Use informal assessments within classrooms and learning environments. Informal assessments refer primarily to teacher observations of eye contact, body language, facial expressions, and work performance. These observations can complement formal assessments as a basis for instructional adjustments.

Hanna (1999) also described some examples of assessment methods as described below:

Reports

Reports help students organize information and make connections. The teacher must work with the students to establish guidelines and focus for the report. It is important that students understand exactly what is expected and what the product is to look like. As these guidelines are created, the class can also begin creating a scoring guide that describes what is satisfactory work for each element of the report.

Presentations

A presentation can be a secondary product of a report or an investigation. Doing reports in groups allows each report to be presented in more depth since the available time is divided into fewer parts. Guidelines and scoring guides must be explained to each of the group members.

Skits

Students can develop a skit in which group members take on the roles of specific community members as they address a problem related to the concept.

Applications

Students can be asked to apply their new knowledge to a new problem. As they respond, they should not only provide a solution to the problem, but also describe how they arrived at the solution. This description will provide insight into the thinking of students.

In this research, authentic assessment which combine quantitative and qualitative data were used for formative and summative assessment of the intervention based on constructivist teaching approach. The details of this specific assessment methods are described in the following chapter of this thesis.

3.6 THE CONSTRUCTIVIST CLASSROOM LEARNING ENVIRONMENT

Constructivist learning environments refer to contrived surroundings conducive to allowing students to construct their own knowledge. Through monitoring and guidance from the teacher and engagement with the environment and subject matter by the student, existing knowledge is used to build new knowledge (Bransford, 2000).

Wilson (1996) explains a constructivist learning environment this way :

A learning environment is a place where people can draw upon resources to make sense out of things and construct meaningful solutions to problems. Adding 'constructivist' to the front end of the term is a way of emphasizing the importance of meaningful, authentic activities that help the learner to construct understandings and develop skills relevant to solving problems.

(Wilson, 1996, p. 3).

Cunningham, and Knuth (1993) devised seven pedagogical goals for designers of constructivist learning environments as follows:

1. Provide experience with the knowledge construction process
2. Provide experience in and appreciation for multiple perspectives
3. Embed learning in realistic and relevant contexts
4. Encourage ownership and voice in the learning process
5. Embed learning in social experience
6. Encourage the use of multiple modes of representation
7. Encourage self-awareness of the knowledge construction process

Jonassen (1999) also described the characteristics of meaningful learning and provide guidelines for designing constructivist learning environments. That is, constructivist teaching strategies should be used to keep students active, constructive, collaborative, intentional, complex, contextual, conversational, and reflective.

Active: Learners are engaged by the learning process in mindful processing of information where they are responsible for the result. In natural learning situations, learners can acquire sophisticated skills and advanced knowledge about what they are learning. Also, learners are actively manipulating the objects and tools of the trade and learning by reflecting on what they have done.

Constructive: Learners integrate new ideas with prior knowledge in order to make sense or make meaning or reconcile a discrepancy, curiosity, or puzzlement. They construct their own meaning for different phenomena. The models that they build to explain things are simple and unsophisticated at first, but with experience, support, and reflection, they become increasingly complex.

Collaborative: Learners naturally work in learning and knowledge building communities, exploiting each others skills while providing social support and modelling and observing the contributions of each member.

Intentional: All human behaviour is goal directed (Schank, 1994). That is, everything that we do is intended to fulfill some goal. That goal may be simple or more complex. When learners are actively and willfully trying to achieve a cognitive goal (Scardamalia and Bereiter, 1994), they think and learn more. Learning environments need to support learners in articulating what their goals are in any learning situation.

Complex: The greatest intellectual sin that teachers commit is to oversimplify most ideas in order to make them more easily transmittable to learners. Problems are multiple components and multiple perspectives and cannot be solved in predictable ways. Therefore, teachers need to engage students in solving complex and ill-structured problems as well as simple problems. Unless learners are required to engage in higher order thinking, they will develop oversimplified views of the world.

Contextual: A great deal of recent research has shown that learning tasks that are situated in some meaningful real world task or simulated in some case-based or problem based learning environment are not only better understood, but also are more consistently transferred to new situations. Rather than abstracting ideas in rules that are memorized and then applied to other canned problems, teacher need to teach knowledge and skills in real life, useful contexts and providing new and different contexts for learners to practice using those ideas.

Conversational: Learning is inherently a social, dialogical process (Duffy and Cunningham, 1996). That is, given a problem or task, people naturally seek out

opinions and ideas from others. Technologies can support this conversational process by connecting learners across town or across the world. When learners become part of knowledge building communities both in class and outside of school, they learn that there are multiple ways of viewing the world and multiple solutions to most of life's problems.

Reflective: Learners should be required by technology-based learning to articulate what they are doing, the decisions they make, the strategies they use, and the answers that they found. When they articulate what they have learned and reflect on the processes and decisions that were entailed by the process, they understand more and are better able to use the knowledge that they have constructed in new situations (pp 1-3).

Jonassen also summarize that constructivist learning environments should emphasize the qualities illustrated in Figure 3.2.

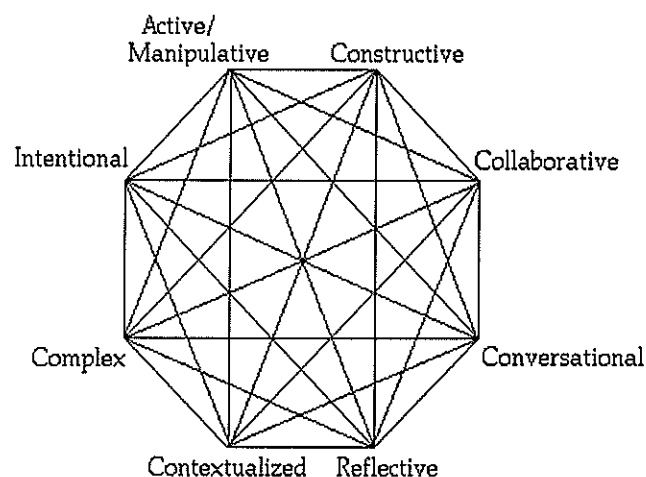


Figure 3.2. Illustration of the qualities of a constructivist learning environment. (Jonassen, p. 3).

3.7 THE CONSTRUCTIVIST LEARNING ENVIRONMENT SURVEY (CLES)

3.7.1 Introduction

The Constructivist Learning Environment Survey (CLES) (Taylor and Fraser, 1991) was developed to assist researchers and teacher-researchers to assess the degree to

which a particular classroom's environment is consistent with a constructivist epistemology, and to enable teachers to reflect on, and reshape their teaching practice. This part describes the development of the CLES and previous study involving use of the CLES.

3.7.2 Development of the CLES

The original version of the CLES was based on a theory of constructivism which refers to an epistemology that views knowledge as being 'constructed' (or generated) within learners' minds as they draw on their existing knowledge to make sense of perplexing new experiences. This version of the CLES consisted of four scales and was developed to measure important aspects of a constructivist learning environment. The *Autonomy* scale measures perceptions of the extent to which there are opportunities for students to exercise meaningful and deliberate control over their learning activities, and think independently of the teacher and other students. The *Prior Knowledge* scale measures perceptions of the extent to which there are opportunities for students meaningfully to integrate their prior knowledge and experiences with their newly constructed knowledge. The *Negotiation* scale measures perceptions of the extent to which there are opportunities for students to interact, negotiate meaning and build consensus. The *Student-Centredness* scale measures perceptions of the extent to which there are opportunities for students to experience learning as a process of creating and resolving personally problematic experiences. This version of the CLES contains 28 items (with seven items in each of four scales) in both Actual and Preferred Forms. Each item has a five-point Likert format with responses of Very Often, Often, Sometimes, Seldom, and Never. (Taylor, and Fraser, 1991)

Taylor, Fraser, and Fisher, 1997 redesigned the CLES to incorporate constructivist and critical theory perspectives on the cultural framing of the classroom learning environment. This version of the CLES has two forms, an Actual form and a Preferred Form. The CLES contains 30 items in five scales, with six items per scale and each scale is designed to measure a student's individual perception of her or his

constructivist science classroom learning environment. The five scales are Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation. The response alternatives for each item are Almost Always, Often, Sometimes, Seldom, and Almost Never.

Each scale of the new version of the CLES was designed to obtain measures of students' perceptions of the frequency of occurrence of five key dimensions of a critical constructivist learning environment:

- *Personal Relevance* focuses on the connectedness of school science to students' out-of-school experiences, and on making use of students' everyday experiences as a meaningful context for the development of students' scientific knowledge.
- *Uncertainty* involves the extent to which opportunities are provided for students to experience scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined.
- *Critical Voice* involves the extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher's pedagogical plans and methods, and to express concerns about any impediments to their learning.
- *Shared Control* is concerned with students being invited to share with the teacher control of the learning environment, including the articulation of learning goals, the design and management of learning activities, and the determination and application of assessment criteria.
- *Student Negotiation* assesses the extent to which opportunities exist for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students' ideas and, subsequently, to reflect self-critically on the viability of their own ideas.

Table 3.1

Description and Sample Items for Each Scale of the Actual Form of the CLES

Scale	Description	Sample item
Personal relevance	Relevance of learning to students' lives	In this science class I learn about the world outside of school
Uncertainty	Provisional status of scientific knowledge	I learn that the views of science have changed over time
Critical voice	Legitimacy of expressing a critical opinion	It's okay to ask the teacher "Why do we have to do this?"
Shared control	Participation in planning, conducting, and assessing of learning	I help the teacher plan what I'm going to learn
Student negotiation	Involvement with other students in assessing the viability of new ideas	I ask other students to explain their ideas

The items listed in Table 3.1 are from the Actual Form of the CLES. The wording of the preferred version is almost identical except for the use of words such as "would". For example, the item "In this class, I ask other students to explain their ideas" in the Actual Form is reworded in the Preferred Form to read "In this class, I would prefer to ask other students to explain their ideas".

3.7.3 Previous studies involving the CLES

Previous research studies have led to the CLES being validated and used in a variety of research settings in many countries around the world, including the USA, Australia, Taiwan, Korea, South Africa, and Thailand (Aldridge, Fraser, Taylor, & Chen, 2000; Dryden, Taylor, & Fraser, 1998; Kim, Fisher, & Fraser, 1999; Lee & Fraser, 2000; Puacharearn & Fisher, 2004; Sebela, 2003; Taylor, Dawson, & Fraser, 1995; Wanpen & Fisher, 2004).

Aldridge, Fraser, Taylor, and Chen (2000) used the CLES in a cross-cultural study in Australia and Taiwan. The CLES was administered with 1,081 students from 50 classes in Australia and 1,879 students from 50 classes in Taiwan. Their research revealed that both English and Mandarin versions of the CLES were valid and reliable and proved useful for providing insights into key characteristics of the teaching epistemologies in science.

Dryden and Fraser (1998) conducted research which attempted to evaluate the success of an Urban Systemic Initiative (USI) in terms of students' perceptions on the Constructivist Learning Environment Survey (CLES) in 1994 and 1997 and obtained qualitative data from external classroom observations. The findings from the student questionnaire survey indicated that moderate levels of the CLES dimensions of Personal Relevance, Critical Voice, Uncertainty of Science, and Student Negotiation were perceived by students in 1994, and that these levels did not increase during the three years of the USI. Low levels of Shared Control, were indicated and a negligible shift in this dimension occurred between 1994 and 1997. Shared Control can be considered to be rooted in the USI system.

Kim, Fisher, and Fraser (1999) also used the CLES in a study designed to assess the new curriculum in Korea. The Korean version of the CLES was found to be reliable and the results of this research indicate that Grade 10 students who studied in the new curriculum, perceived a more constructivist learning environment than Grade 11 students who were studying the old curriculum.

Lee and Fraser (2000) used the CLES to investigate Korean high school students' perceptions of their science classrooms. The sample involved 439 high school students from three different streams, the humanity stream, the science-oriented stream and the science-independent stream. The results confirmed that all scales of the Korean version of the CLES had satisfactory internal consistency, and it was also found that students from the science-independent stream perceived their classroom environments more favourably than did the students in the other two streams. There are associations between students' perceptions of their classroom environments and attitudes toward science.

The CLES has been used in South Africa by Sebela (2003). This research validated the CLES and the results of the study were used to improve mathematics teaching and learning practice through action research. The results suggest that the CLES had potential for monitoring the development of social constructivist classroom learning environments in South Africa.

Taylor, Dawson, and Fraser's (1995) study of 494 Australian students' perceptions of the constructivist learning environments, found that the CLES was useful as an heuristic device to enrich the teacher-researcher's understanding of the impact on students of their teaching innovations.

Wanpen and Fisher (2004) also used the CLES at an undergraduate level in a university in North-eastern Thailand. This action research aimed to create a collaborative learning environment in a computer classroom where the CLES was administered to 710 undergraduate students in 33 computer classes. The results found that the instructor was able to use the CLES to improve the learning environment of a computer class in Thailand. This research also provides implications for teaching practice in computer science area by focusing on computer classroom environments.

3.8 PREVIOUS RESEARCH STUDIES INVOLVING CONSTRUCTIVIST TEACHING APPROACHES

Kiggins (1998) reported on an innovation that encouraged preservice and practising teachers in New Zealand to undertake science instruction from a constructivist perspective. The findings have shown that the learners, preservice teachers and practising teachers benefited from a program. However, few preservice teachers have been able to clearly articulate their understanding of the educational theory, their instruction and pupil learning. This study also provided various strategies employed to address constructivist teaching approach.

Taylor (1992) studied the role of teacher beliefs in the implementation of constructivist theory in a mathematics classroom at the secondary school. Data were obtained from classroom participant- observations, teacher and student interviews, the teacher's report on the study, and an application of the repertory grid technique that

was designed to investigate the teacher's implicit pedagogical beliefs. The multiple constructivist perspectives (radical constructivism, social constructivism, critical constructivism) were used for interpretive analyses in order to generate a better understanding of the study. The results suggest that pedagogical reforms which are based on a theory of constructivism are susceptible to being subsumed by a powerful technical-rationalist ideology, and the hegemonic nature of this ideology is capable of disempowering reform-minded teachers from realising the practical viability of their constructivist-related ideals.

Venville (1997) investigated students' misconception about the concept of the gene in Year 10 students from eight classrooms. The theoretical framework of this study was based on the personal and social paradigms of constructivism and a multidimensional interpretive framework for conceptual change. Data were collected from classroom observations, student and teacher interviews, student work-sheets and classroom quizzes. The results reported that: 1) from an ontological perspective, the sample learning about the concept of the gene by a proposed learning pathway that consists of four ontologically distinct models. The majority of the students in the classes did not progress the entire length of the pathway, rather they completed their introductory genetics course with an "active particle gene" conception; 2) from an epistemological perspective of conceptual change, students' post instruction conceptions of genes were classified as being intelligible, plausible or fruitful to the learner. The results also show that a social perspective and affective perspective are influenced the process of conceptual change and provides information about how the teaching approach and student interest in genetics.

In Thailand, Kanjak and Chaicharoen (2003) conducted a qualitative research aimed to study about the mental model of graduated students who learning from constructivist web based learning environments. The educational technology course was selected for this research. The results indicated that a sample have two kinds of the mental model; 1) declarative knowledge; and 2) procedural knowledge. The results also shows that the constructivist web based learning environments can helped the graduated students to learn from various learning process and they have a complex schemas which effort them to understand the subject.

In another study in Thailand, Thongsa (2002) developed a multimedia lesson for secondary school student based on constructivism theory. The work involved experts in constructivist instruction and CAI design experts. The Delphi technique was used to collect data from these experts and a questionnaire was used to assess the multimedia lesson. The results indicated that a multimedia lesson based on constructivism theory should have 11 dimensions; 1) elements of learning process including lesson, contents, and students; 2) method of presentation; 3) teaching and learning; 4) learning activities; 5) direction of the lesson; 6) conclusions; 7) assessment method; 8) interactive between learners and instructor; 9) feedback information; 10) monitoring; and 11) implication. The study suggest that a constructivist multimedia lesson should provided a chance for students to develop their constructivist learning skill.

Maunsaiyat and Becker (2003) conducted a quasi-experimental study aimed to determine differences in knowledge achievement by vocational students in Thailand using constructivist instruction and traditional instruction; and to identify whether Thai vocational students preferred instruction modeled upon constructivist philosophy rather than traditional instructional philosophy. The sample consists of 108 students who attended the Electronics Measurement and Instrument course at two selected technical colleges in central Thailand. The results indicated that there was no statistical difference between the achievement scores of the students receiving constructivist instruction and those receiving traditionally instructed students. The constructivist-instructed students had higher scores on the posttest and the delayed posttest, compared with those of the traditionally instructed students. The findings also showed that there was a significant difference in student preferences. Students preferred constructivist instruction.

Also in Thailand, Siriwan and Komchit (2003) conduct a quasi-experimental study aimed to study the effects of activities based on constructivism on the emotional quotient of pre school children. The sample in the experimental group was involved in activities based on a constructivist approach while the control group learned with traditional methods. The Emotional Intelligence Assessment was used to assess the EQ of the pre school students. After the experiment, the results indicated that the students in experimental group have EQ scores greater than before the experiment and greater than the students in control group.

3.9 SUMMARY

This chapter had provided a literature review related to the implementation of a constructivist approach to improving students' perceptions of health science classroom learning environments and learning achievement. The related literature involved the constructivism theory, the teachers' and students' roles in a constructivist classroom, constructivist teaching strategies, assessment in a constructivist classroom, and the Constructivist Learning Environment Survey (CLES). The last part of this chapter provides some examples of research studies involving the used of a constructivist approach and the CLES. The next chapter describes a review of literature related to action research including the history, a definition, and the aim of action research. Information on the characteristics, the advantages, and the process of action research is also provided.

CHAPTER FOUR

ACTION RESEARCH

4.1 INTRODUCTION

The research model used in this study is based on an action research model. This chapter describes a review of some of the literature related to action research and is divided into four parts. The first part summarizes the history of action research, and is followed by a definition of action research, and the aim of action research. The following part provides the characteristics and the process of action research, while the advantages of action research and some examples are described in the last part of this section.

4.2 HISTORY OF ACTION RESEARCH

Action research is one of the most practical and efficient methods of conducting educational research. Traces of action research theory can be found in the writings of such philosophers as Galileo, Aristotle, and Newton, and one of the earliest philosophers to contribute a foundation for action research in education was John Dewey (Tomal, 2000). Stenhouse (1975) proposed a new idea at that time: the teacher should become a researcher in his or her own classrooms. Action research flourished in the business world during the 1980s (Tomal, 2000), and has been accepted and widely used, and formally applied by many educators and researchers in the educational environment in the last decades (French and Bell, 1995; Sagor, 1992).

4.3 DEFINITION OF ACTION RESEARCH

Some of the past studies have referred to action research in the educational field as “teacher action research” or “teacher as researcher”. There are many definitions of action research. For example Hopkins and Ebbutt (1985) suggested that action research is the combination of action and research rendered so that action is a form of discipline inquiry, in which a personal attempt is made to understand, improve and

reform practice. Kemmis and McTaggart (1992) regarded action research as a form of 'self-reflective inquiry' undertaken by the participant in order to improve understanding of their practices in context with a view to maximizing social justice. Glickman (1992) stated that action research in education is involve study conducted by colleagues in a school setting of the results of their activities with the aim of improving instruction. Colhoun (1994) described action research as a fancy way of saying "Let's study what's happening in our school or our class, and decide how to make it better" (p. 2). Vockell and Asher (1995) stated that action research refers to the practical application of the scientific method or other form of disciplined inquiry to the process of dealing with everyday problems, while Tomal (2000) described action research as a systematic process aimed at solving educational problems and making improvements.

In conclusion, action research is the practical application of the research method conducted by various stakeholders of the particular issue in a particular place (e.g., a health problem issue in a school or community). The participants work together in all stages of the action research cycle in order to investigate the problem in their own context and to understand their situation, to develop a specific action plan to improve their performance, then implement the plan, and evaluate the results of this process. If the results from assessment and evaluation show that there are still some problems, the participants conduct the action research process again, in an attempt to continuously improve their practice.

4.4 THE AIM OF ACTION RESEARCH

McMillan (1992) stated that the purpose of action research in education is to solve a specific classroom problem or make a decision at a local site in order to improve practice immediately within one or more classrooms. Carr and Kemmis (1986) also explained that action research has three main aims: the first is the improvement of a practice; the second is improvement of understanding of the practice by its practitioners; and the third is improvement of the situation in which the practice takes place. Wellington (2000) stated that the key aim of action research is to bring about critical awareness, improvement and change in a practice, setting or system. Skerrett (1996) suggested that the aims of action research project are to bring about practical

improvement, innovation, change or development of practice, and the practitioners' better understanding of their practices. A particular focus of teachers' action research, is to make their particular educational activities more productive and is usually more concerned with specific classes and programs (Vockell and Asher, 1995).

4.5 CHARACTERISTICS OF ACTION RESEARCH

Gray and Airasian (2003) state that action research is typically focused on a particular issues or concern that is examined in a single classroom or single school. Therefore, the results of action research tend to be localized to a given classroom, school, or department. They also describes good action research as that which integrates theory, practice, and meaningful application of research results. Stenhouse (1979) suggest that action research should contribute not only to practice, but also to a theory of education and teaching which is accessible to other teachers, making educational practice more reflective. Similarly, Elliott (1991) says action research combines diagnosis with reflection, focusing on practical issues that have been identified by participants and which are somehow both problematic yet capable of being changed. Action research is concerned with the systematic collecting of data, which is analysed and feedback given to the subjects so that action plans can be systematically developed. The collaborative efforts of the researcher and the participants enable the development of action plans to make improvements (Tomal, 1996). Borgia and Schuler (1996) summarize the components of action research as the "Five C's": commitment, collaboration, concern, consideration, and change:

Commitment. Action research take time. The researcher needs time to conduct the research process, such as observe practice, consider changes, try a new approach, then discuss, reflect, and interpret the results. It's necessary to inform the participants about the details of the action research, the roles of the participants in the project, and the time they will spend on the project. The participants should consider carefully whether they will be committed enough to join in the project.

Collaboration. In action research, the power relations among participants are equal; each person contributes. Collaboration involves a cyclical process of sharing, giving,

and taking. The ideas and suggestions of each person should be listened to, reflected on, and respected.

Concern. The interpretive nature of action research (for example, relying on personal dialogue and close working relationships) means that the participant will develop a support group of “critical friends”. Trust in each other and in the value of the project is important.

Consideration. Reflective practice is the mindful review of one’s professional actions. Reflection requires concentration and careful consideration as one seek patterns and relationships that will generate meaning within the investigation.

Change. For humans growing and changing are part of the developmental cycle of life. Change is ongoing and difficult, but it is an important element in remaining effective as a teacher.

4.6 THE PROCESS OF ACTION RESEARCH

Wellington (2000) describes the process of the action research as a spiral cycle involving five main steps; 1) planning, 2) acting, 3) observing/evaluating, 4) reflecting, and 5) re-planning as shown in Figure 4.1.

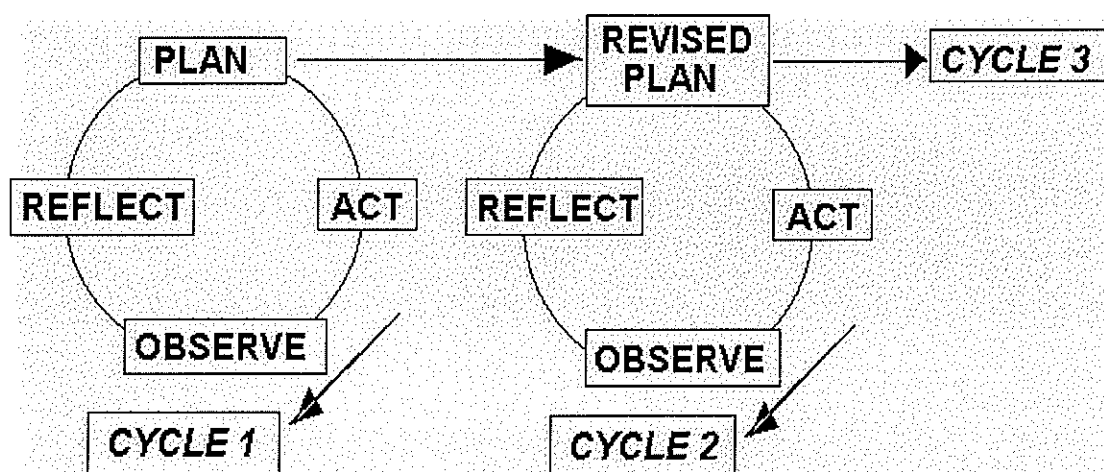


Figure 4.1. The Spiral of Action Research Cycle (Kolb, 1984, p. 3).

Stringer (1996) describes the process of action research as having three main steps. The first step (Looking) is that the researcher conducts pre-assessment by collecting data, for example, he or she observes the setting, interviews the participants, hands out the questionnaires. Next, (Thinking), the researcher interprets the results, discusses, and reflects in order to understand the situation in context. The last step (Acting) is that the participant identifies solutions, develops an action plan, and implements the plan, as shown in Figure 4.2.

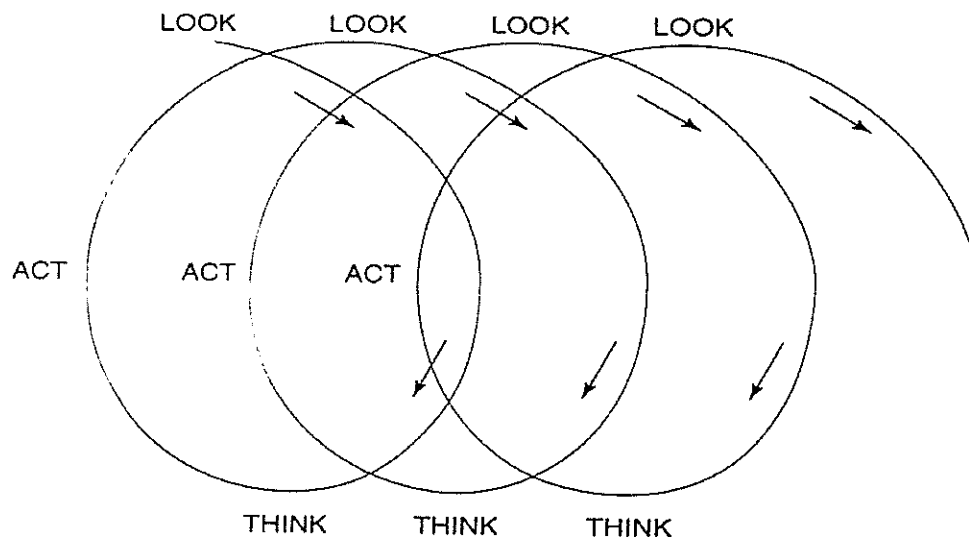


Figure 4.2. The Spiral Process of Action Research Cycle (Stringer, 1996, p. 43).

4.7 ADVANTAGES OF ACTION RESEARCH

The action research method has many advantages. The first advantage is that action research provides a teacher with an opportunity to adapt theory to practice and to involve both teachers and students as participants in their educational process in order to solve the problems in their class. The second advantage is that action research can develop the students in many dimensions, such as motivate students' learning, develop students' self esteem, increase students' learning performance and improve their learning environment. The action research process also develops students' empowerment through collaboration with one another. The next advantage of the action research approach is that it is appropriate to the context of a particular classroom, each of which has different characteristics, and this approach is also

flexible because the teacher as researcher and the other participants (i.e. students, teachers' colleague or Principal) can undertake the action research in their own setting. As a result, the action research can be meaningful, and be absorbed into the daily routine without disrupting the curriculum. This means that if some contingencies arise the process can be changed in order to make the process appropriate to the daily classroom situation. Schon (1983) stated that teacher action research is a way of empowering a classroom teacher with the ability to assess a problem within the classroom, and take action to improve or eliminate the problem. Another advantage is that the action research process is creative because a teacher can choose a topic which is intriguing and challenging as well as being appropriate for the students who are involved (Gray & Airasian, 2003; Macintyre, 2000; McNiff, 1998).

In conclusion, classroom action research has many advantages and can be used as an instructional tool for teachers in solving educational problems and to make improvements in the classroom environment and as a consequence, in their students' achievement. Knowledge and learning experience gained through action research can liberate all participants (i.e., students, teacher, and administrators), and enhance learning, teaching, and policy making. In other words, action research can be use as the means to further develop educational systems.

4.8 THE COMBINATION OF QUANTITATIVE AND QUALITATIVE METHODS IN ACTION RESEARCH

Past research studies have successfully combined quantitative and qualitative methods in studying the classroom learning environment. Orion, Dubowski, and Dodick (2000) stated that quantitative tools provide results obtained from the research population and qualitative tools validate the quantitative tools as well as contributing to a better understanding of the students' learning process. Therefore, a combination of quantitative and qualitative methods was used in this research study in order to collect different kinds of data from different sources. This technique provides very useful information that can enable the researcher to understand and explain phenomena more completely. Also, the information from quantitative and qualitative methods can be used for triangulation in order to make sure that the results of this research are

reliable. The details of each method used in this study are described in the following part.

4.8.1 Quantitative research methods

Gay and Airasian (2003) stated that quantitative research methods are based on the collection and analysis of numerical data, usually obtained from questionnaires, tests, checklists, and other formal paper-and-pencil instruments. The questionnaire is one of the most popular methods and is widely used for collecting quantitative data. The following part describes the method for collecting quantitative data in this research.

The questionnaire

The questionnaire is often use for a survey of different opinions from large numbers of people who provide anonymous replies. The items in a questionnaire are standardized and usually the respondents are randomly selected. This method is a quick and effective way of gathering a great deal of information from a number of people. Questionnaires can be used in different settings, such as within a class, within a school, in a community. In this research, three questionnaires, the CLES, the ATAQ and the SKAT were used to collect quantitative data.

4.8.2 Qualitative research methods

One important methodological option in conducting management research is the use of qualitative methods. Qualitative research places emphasis on describing, understanding, and explaining complex phenomena, for example, the relationships, patterns and configurations among factors, or the context in which activities occur. The focus is on understanding the full multi-dimensional, dynamic picture of the subject of study. Qualitative research methods are based on the collection and analysis of non-numerical data. Qualitative data are usually in the form of words rather than numbers, and gathered by observation, interviews, focus group discussion or documents. This method is the best strategy for discovery, developing hypotheses, testing hypotheses, and is useful when one needs to supplement, validate, explain, illuminate, or reinterpret quantitative data gathered from the same setting. Qualitative

analysis consists of three concurrent flows of activity: data reduction, data display, and conclusion drawing/verification (Gay & Airasian, 2003).

Several theorists have identified the characteristics of qualitative, or naturalistic, research as follows: (e.g., Bogdan & Biklen, 1982; Eisner, 1991; Lincoln & Guba, 1985; Patton, 1990).

1. Qualitative research uses the natural setting as the direct source of data. The researcher attempts to observe, describe and interpret settings as they are, maintaining what Patton calls an empathic neutrality.
2. The researcher acts as the "human instrument" of data collection.
3. Qualitative researchers predominantly use inductive data analysis.
4. Qualitative data are collected in the form of words or pictures rather than numbers and qualitative research reports are descriptive, incorporating expressive language and the presence of voice in the text.
5. Qualitative research has an interpretive character, aimed at discovering the meaning events have for the individuals who experience them, and the interpretations of those meanings by the researcher.
6. Qualitative researchers pay attention to the idiosyncratic as well as the pervasive, seeking the uniqueness of each case.
7. Qualitative research has an emergent (as opposed to predetermined) design, and researchers focus on this emerging process as well as on the outcomes or product of the research.
8. Qualitative research is judged using special criteria for trust worthiness.

Patton (1990) pointed out that "these are not absolute characteristics of qualitative inquiry, but rather strategic ideals that provide a direction and a framework for developing specific designs and concrete data collection tactics. These characteristics are considered to be interconnected" (p. 59).

The following part describes the method for collecting qualitative data in this research, namely, classroom observations, focus group discussion, and student journal.

Classroom observations

Classroom observation was used throughout the action research cycle of this study. The teacher and the students spend an extended period of time in a natural setting of the Health Science classroom and the teacher as a researcher played a role of a participant observer (or observer as a participant). This technique can help to obtained a rich understanding of the phenomena being studied.

Cohen (2001) classified observations into three types: a structured observations, semi-structured observations, and unstructured observations.

1. Structured observations. The observer will know in advance what he or she is looking for and will have observation categories worked out in advance.
 2. Semi-structured observations. The observer will have an agenda of issues in a far less pre-determined or systematic manner.
 3. Unstructured observations. The observer will be far less clear on what he or she is looking for and will therefore have to go into a situation and observe what is taking place before deciding on its significance for the research.
- (p. 304)

In structured observations, the researcher will already have the the hypothesis decided and will used the observational data to confirm or refute the hypothesis. In contrast, semi-structured observations, and unstructured observations, will be hypothesis-generating rather than hypothesis-testing. These two latter types of observations will review observational data before suggesting an explanation for the phenomena being observed.

Gold (1958) offered a classification of observation by researcher roles, from complete participation, moving to the participant as observer, thence to the observer as participant and finally to the complete observer. The move is from complete participation to complete detachment. Additionally, LeCompte and Preissle (1993) described the degree of participation in observation. The ‘complete participant’ is a

researcher who takes on an insider role in the group being studied, and maybe who does not even declare that he or she is a researcher. The 'participant as observer' is part of the social life of participants and documents and records what is happening for research purposes. The 'observer as participant' is known as a researcher to the group, and has less extensive contact with the group. The 'complete observer' participant does not realize that they are being observed, hence this is a form of covert research.

Tomal (2000) explained the four steps of observation that are always used in research. The first step is selecting the subjects which are appropriate for research purposes. The next step is designing the schedule. The third step is observing, and then summarizing the data obtained from observation. The details of data collecting in each step maybe different, depend on the type of observation and the instrument, such as audio and videotape recording, a structured observation checklist, or field notes. Tomal also described the methods which are used with observation process as follows:

Field notes refer to the recordings made by the observer while actually conducting the observations. The researcher synthesizes, summarizes, and interprets the field note immediately following the observation. *Audio and videotape recording* is useful to record some things which field notes cannot do, such as conversation, space in interactions, silences, emphasis, speed of diction and voice intonation as well as the actual words that are spoken.

The *structured observation checklist* is a very useful means of gathering objective data in the classroom. This instrument records what is happening in the classroom, where, and how often, and also provides a rich source of information for reflection and evaluation.

The observation checklist can be used as a basis for discussion and forward planning, and even be used to justify requests for resource or extra classroom help.

Patton (1990) suggested that an advantage of observational data is that it enables the researcher to enter and understand the situation that is being described. Morrison (1993) also stated that observations enable the researcher to gather data on four main aspects:

- 1) the physical setting (e.g., the physical environment and its organization)

- 2) the human setting (e.g., the organization of people, the characteristics and make up of the groups or individual being observed)
- 3) the interactional setting (e.g., the interactions that are taking place, formal, informal, planned, unplanned, verbal, non-verbal, etc.)
- 4) the program setting (e.g., the resources and their organization, pedagogic styles, curricula and their organization) (p. 80)

In this research, participant observation was used as a tool in order to obtain qualitative data. Informal classroom observations were used throughout the research cycle and an observation checklist was used during the implementation of the intervention in order to cover any aspects which might have been missed in the surveys. Thus, the quantitative findings from the questionnaires were complemented by these qualitative data. Therefore, the next part of this thesis focuses on the advantages and limitations of participant observations.

There are many advantages in using a participant observer, the first advantage being that the teacher as a participant observer has the ability to develop relationships with participants that cannot be obtained in other ways. Therefore, this technique can reduce the problem of reactivity of the members of the class being observed. The next advantage is that the teacher can facilitate the collecting of field data on site in the classroom setting or other educational setting in which they participate because the teacher understands the educational system (Vockell & Asher, 1995). Furthermore, this technique provides both breadth and depth of information about participants and the educational setting. However, the teacher taking the roles of participants observer has some limitations, such as the researcher may lose objectivity and become emotionally involved with participants, and more pragmatically, the researcher may have difficulty participating and taking detailed field notes simultaneously (Gay & Airasian, 2003)

Focus group discussion

Focus group discussion is a special type of group interview which consists of five to ten people, who are interviewed in a comfortable, non-threatening setting. The focus group discussion may also have an internal facilitator who helps to direct questions or

record the responses. Although, there are different ways of conducting a focus group, the most common is that the interviewer (sometime called the 'facilitator') asks questions to the members, and then the participants can share their feelings or opinions with the focus group members. The responses can be recorded on a flip chart or newsprint. The focus group operates best when all members have a common interest and are genuinely interested in obtaining everyone's views within the group. It is important to select several participants and so provide a representative sample. In preparing questions, the interviewer could first develop a set of questions which are appropriate to the objectives of the study.

Focus group discussions were used in three stages of this action research. In stage two, focus group discussions were used in discussions about the students' learning environment perceptions before the intervention in order to analyse discrepancies between actual and preferred perceptions. In stage three, focus group discussions were used for discussion about how appropriate the intervention strategies actually were. In stage five, focus group discussions were used to discover students' opinions about the intervention process and the results of the intervention.

Student journal

The students who were involved in this research project were requested to write their own journal during the period of the intervention. Wiggins defined a student journal as a student's personal records and reactions to various aspects of learning and developing ideas. A reflective process is often found to consolidate and enhance learning (Wiggins, 2002). These students' journals provided deeper qualitative information about the students' learning experiences throughout this action research process. For example, they wrote about their perceptions of their learning environment, their opinions about constructivist learning activities, and their feelings about AIDS.

4.9 PREVIOUS STUDIES INVOLVING ACTION RESEARCH

4.9.1 Action research studies in other countries

Ireland, (2000) developed a collaborative peer interactive classroom learning environment. Groups of students were engaged in the process of developing their social norms and utilised a collaborative approach to their learning of mathematics that included discussion, explanation, negotiation, peer teaching, giving help, receiving help and consensus building. The My Class Inventory and the Constructivist Learning Environment Survey were used as tools to measure and improve the classroom learning environment. This study combine qualitative and quantitative data. The results indicated that teachers and their students can develop an effective collaborative peer interactive classroom learning environment.

Kearney (2002) designed an interactive multimedia program that was used to elicit of students' pre-instructional conceptions of motion. This study used constructivism as a theoretical perspective to explore the main issues relating to the use of the multimedia-supported the predict-observe-explain (POE) strategy in order to encourage the students' into learning activities. The results indicated that the interactive multimedia program was an efficient and convenient instrument to help students to learn concepts of motion. The finding also suggested that the multimedia program and the use of the predict-observe-explain strategy provided an exciting opportunities for student in science education.

Liew (2004) conducted action research in Australian metropolitan high schools. This study use the POE technique to diagnose students' understanding of science and used the *Australian Student Outcome Statements* (Education Department of Western Australia, 1998) to assess students' achievement. The findings showed that the POE tasks are effective in identifying students' achievement across levels within a substrand of the *Australian Student Outcome Statements* and enable the teacher to observe and document a spread of achievement over a range of levels rather that a single outcome. The results of this research suggested that the POE technique is effective in diagnosing students' understanding of science and level of achievement.

Youngs (2003) created a constructivist learning environment in a university mathematics classroom. The three main objective of this study were to: 1) ascertain what dimensions of a constructivist learning environment (autonomy, prior knowledge, negotiation, student-centeredness) the students preferred and how these preferences changed after being in such an environment; 2) to find out how students' preferred environments matched the environment they perceived to be in place; and 3) to determine what changes occur the instructor had to make in his/her teaching practice to implement each of the constructivist dimensions. The results suggested that most students very strongly preferred the prior-knowledge and negotiation dimensions, strongly preferred the autonomy dimension, and weakly to moderately preferred the student-centeredness dimension. The data also showed that during the study, student preferences for prior knowledge and negotiation increased slightly, preferences for student centeredness increased moderately, and preferences for autonomy increased significantly.

Blose (2003) conducted action research with teachers to improve student outcomes by assessing, describing, and changing their classroom environments. This study relied on student perceptions, to assess and describe the classroom environment. Teachers used this information to develop intervention strategies designed to change the students' perceptions of their actual classroom environment to more closely mirror their preferred classroom environment perceptions. Quantitative data, using the MCI and the SLEQ, and qualitative data, teachers' case studies, were collected and analyzed. The results of this study established that an action research plan for teachers to assess, describe, and change their classroom environments could be developed. Teachers who participated in the project realized the benefits, for their students and themselves, in changing their classroom environments. However, school level environment demands negatively influenced their willingness to implement changes to their classroom environments.

4.9.2 Action research studies in Thailand

Chaimaneevong (2004) conducted action research based on constructivism theory using the Predict–Observe–Explain technique in Chemistry classes at a Rajabhat Institute in Thailand. There were three main tasks: the optimization on the three POE models; the implementation of the optimization on the three POE models into two

Chemistry classes; and the assessment of the three POE models. The results indicated that target students are able to construct their own knowledge after responding to the POE models. The students also had a highly positive attitude toward the POE model.

Jeeravipoonvarn (2002) conducted action research aim at developing a program for a lower secondary science teacher based on a constructivist approach in science classes in Thailand. The purpose was to investigate and change teachers' beliefs concerning the nature of science and the constructivist approach. Quantitative and qualitative data were obtained from a questionnaire, classroom observation, semi-structured interviews, focus group discussions, and instructional plans. Results indicated that a program based on a constructivist approach could change teachers' beliefs concerning the nature of science and the value of constructivist instruction. The program also developed the teachers' ability to use a constructivist approach in their science classes.

Puacharearn and Fisher (2004) conducted action research by using a constructivist teaching approach for improving the learning environment of science classes at secondary schools in central Thailand. The results indicated that before the intervention, students preferred a more favourable classroom learning environment than that which they perceived. After the intervention, the students' perception of their classroom learning environment had improved. The results supported the effectiveness of constructivist teaching approach in improving classroom learning environment and students' attitude toward science in science classes in secondary schools in Thailand.

4.10 SUMMARY

This chapter has presented a theoretical perspective on action research. Since this study used action research design in order to improve learning environment and learning achievement. The literature review in this chapter started with the history, definitions, and aims of action research. The next part provided characteristics and processes of action research. Quantitative and qualitative research methods available for action research were described and the last part centred on previous studies involving action research. Because the sample available for this study was a single class, it was decided that action research was the most appropriate method. The next chapter presents an overview of the research method including research design, setting, sample, participants, instruments, method of data collection and data analysis.

CHAPTER FIVE

RESEARCH METHODS

5.1 INTRODUCTION

The previous chapter has described a review of literature related to the implementation of a constructivist approach to improve students' perceptions of health science classroom environments and as a consequence improve their achievement. This chapter provides information about how the research was conducted. The research method used in this study includes the research design, the sample for the study, the instruments and their scoring procedures, data collection, data analysis, methods of statistical analysis, and stages of the study

5.2 RESEARCH DESIGN

Overall, the methodology used in this research could be summarized as action research employing a multi-method approach utilizing both quantitative and qualitative methods.

5.2.1 Action research

Action research has been one of the most practical and efficient methods of conducting research used by educators for over 30 years. Action research in the educational field has also been referred to as teacher action research or teacher as researcher. In 1975, Stenhouse proposed a new idea, for that time, which was that teachers should become researchers in their own classrooms. Later, action research flourished in the business world during the 1980s (Tomal, 2000). Action research also has been widely used and formally applied by many educators and researchers (French & Bell, 1995; Sagor, 1992). The researcher used the action research design in this thesis because of the following benefits. The first benefit is that action research provides teachers with an opportunity to adapt theory to practice and involves both teachers and students as participants in the educational process in order to solve

problems in their own classes (McNiff, 1998). The second advantage is that action research can develop the students in many dimensions, such as motivation, self esteem, increased learning performance and improvement in their learning environment (MacIntyre, 2000). Furthermore, action research is flexible because the teacher as a researcher and other participants (i.e. students, teacher's colleagues or principal) can do the action research in their own setting and if any contingencies arise the process can be changed. Therefore, it was decided to use an action research process in a Health Science class in Thailand to solve educational problems and improve students' achievement as a result of changes to the learning environment.

5.2.2 Constructivist approach

Constructivism is an approach to learning that in recent years has garnered considerable attention among science education researchers. The potential significance of constructivism has extended beyond research and into the science classroom (Cobern, 1995). A major theme in the constructivist theoretical framework states that learning is an active process in which the learner constructs new ideas or concepts based on their current or past knowledge, within the human mind (Bruner, 1990). Treagust, Fraser, and Duit (1996) stated that there are two basic principles of constructivism: first, knowledge is not received passively, but students actively construct their own knowledge; and secondly, students link their prior experience and construct knowledge that relates to the real world outside.

Research in the past has shown that using a constructivist teaching approach has many advantages and results in a significance difference in student achievement when compared with more traditional methods (Davidson & Kroll, 1991). Another advantage of the constructivist approach is that it enables teachers to develop their students in many dimensions. For example, developing responsibility for their own learning by being made accountable to themselves and others, and developing higher order thinking skills (i.e. reflective skills, work management skills, collaborative skills, problem solving skills). Therefore, in this research study, the researcher used constructivism as a basis for determining intervention strategies in order to improve

the classroom learning environment and attempt to improve students' learning achievement.

5.2.3 Using a multi-method approach

Both quantitative and qualitative research can be used in action research (Tomal, 2000). Quantitative research methods are based on the collection and analysis of numerical data, usually obtained from questionnaires, tests, checklists, and other formal paper-and-pencil instruments. Whereas qualitative research methods are based on the collection and analysis of non-numerical data, such as observation, interview, and focus group discussions. (Gay & Airasian, 2003). Orion, Dubowski, and Dodick (2000) stated that quantitative tools provide results obtained from the research population and qualitative tools validate the quantitative tools as well as contributing to a better understanding of the students' learning process. However, each research method has different advantages, different limitations and different purposes. Some studies have successfully combined quantitative and qualitative methods in studying the classroom learning environment (Aldridge, Fraser, & Huang, 1999; Aldridge, Fraser, Fisher, & Wood, 2002; Puacharearn & Fisher, 2004; Tobin & Fraser, 1998; Wanpen & Fisher, 2004). Therefore, it was decided that in keeping with this tradition, a combination of quantitative and qualitative methods would be used to collect different kinds of data from different sources. This technique provides very useful information that can enable the researcher to understand and explain the phenomena more completely. Also, the information from both quantitative and qualitative methods can be used for triangulation in order to make sure that the results of this research are valid. The details of each method used in this study are described in the following sections.

Quantitative method

Quantitative data were collected through the use of three main questionnaires, the CLES, the Attitude Towards AIDS Questionnaire (ATAQ) and the Students' Knowledge of AIDS Test (SKAT). The CLES was used on three occasions, firstly, in the initial stage of pilot testing in order to ensure that it was reliable and valid for use

in undergraduate Health Science classes in universities in Thailand. The CLES also was used to investigate students' perceptions of constructivist classroom environments in two later data gathering stages, before and after the intervention. The ATAQ and the SKAT were used for measure students' learning outcomes after the intervention was completed. These questionnaires are presented in Appendices A to C.

Qualitative method

Three different approaches were used to collect qualitative information. Informal classroom observations were used throughout the research cycle and an observation checklist was used during the implementation of the intervention in order to cover any aspects which might have been missed in the surveys. Thus, the quantitative findings from the questionnaires were complemented by these qualitative data. The checklist is presented in Appendix D

Focus group discussions were use in each of the these stages. In stage 2, focus group discussions were use for discussion about the students' learning environment perceptions before the intervention in order to analyse discrepancies between actual and preferred perceptions. In stage 3, focus group discussions were use for discussion about how appropriate the intervention strategies actually were. In stage 5, they were used to discover students' opinions about the intervention process and the results of the intervention. The question guideline for focus group discussion is presented in Appendix E

The students who were involved in this research project were requested to write their own journal during the period of the intervention. These student journals provided deeper qualitative information about the students' experiences of this action research process. For example, students wrote about their perceptions of their learning environment, their opinions about constructivist learning activities, and their feelings about AIDS. The question guideline for students journal is presented in Appendix F

5.2.4 Stages of research design

This study was conducted during the first semester of the academic year 2004 (May to October). There were five main stages and the details of each stage are described in the following sections.

Stage 1: Validation of the Thai versions of the Actual and Preferred Forms of the CLES

The first stage was conducted during the modification of the instruments before the implementation of the action research cycle (April to May, 2004). This was in order to answer the first research question which stated:

Research Question 1: Is the CLES a valid and reliable instrument for use in Health Science classrooms in Thailand?

The sample included 100 students from the Faculty of Science and Technology at the Udonthani Rajabhat University, Thailand. It was considered that the students were typical of science (including health science) and technology students throughout Thailand. Also, during this stage, interviews were used to collect qualitative data from students about the validity of the CLES. The processes adopted in this stage enabled the establishment of the reliability and validity of the Actual and Preferred Forms of the CLES and identified any minor modifications needed to be made to the questionnaire before using it in the second stage.

Stage 2: Pre-assessment of the students' learning environment perceptions and students' pre-instruction concepts about AIDS

The second stage was conducted during the duration of the first month of the semester (June, 2004). The purpose of this stage was to answer the third and fourth research questions which stated:

Research Question 3: What are the students' perceptions of the constructivist classroom environment in Health Science classrooms in Thailand ?

Research Question 4: Are there any differences in students' actual and preferred perceptions of constructivist classroom environments in Health Science classrooms?

There were two main instruments used for this stage. The adjusted Thai versions of the Actual Form and Preferred Form of the CLES were used to assess the students' perception of their learning environment in one Health Science classroom with 20 students and a focus group discussion was used to collect qualitative data. The instrument used to assess the students' pre-instruction concepts about AIDS used open-ended questions.

Stage 3: Construction of the intervention

In this stage, a focus group discussion was again used to collect qualitative data about the construction of an appropriate intervention, built on constructivist principles, to attempt to improve students' learning environment and achievement.

Stage 4: Implementing the intervention

This stage was to answer the second research questions which stated:

Research Question 2: What are the characteristics of a constructivist approach to learning in Health Science classrooms in Thailand ?

The fourth stage was conducted during the duration of three months of the semester (July to September, 2004). Classrooms were observed throughout the intervention by the researcher. The information gained from observations, checklists and field notes was used to determine what might have been missed and used to confirm and support the findings from the questionnaire.

Stage 5: Evaluation of the intervention

The investigation of this stage was to answer the fifth research questions which stated:

Research Question 5: What changes occur in students' perceptions of the classroom environment in Health Science classrooms before and after the implementation of particular intervention strategies?

Research Question 6: What are the students' attitudes to learning about AIDS and their knowledge and understanding of AIDS?

The purpose of this stage was to obtain an understanding of whether the teacher as researcher and the students were able to respond to the constructivist teaching approach and use the Actual Form of the CLES as a tool for improving the classroom learning environment. The ATAQ and the SKAT were used in this stage as measures of student outcomes.

5.3 SAMPLE FOR THE STUDY

The sample used to provide validation data on the Thai version of the CLES consisted of 100 third-year undergraduate students studying in the Faculty of Science in Udonthani Rajabhat University, Thailand. These 100 students were randomly selected from the third-year cohort.

The sample of student which participated in the action research process consisted of 20 students in one Health Science class at the undergraduate level in the Udonthani Rajabhat University, Thailand. A purposive sampling technique which includes two criteria was used for this group. The two criteria were that the students must be enrolled in Health Science Subject; and must be prepared to participate in this research study. When the intervention was completed, the information from two students was excluded from this research study because they were not involved in every part of the intervention. Therefore, the sample of this action research consisted of 18 students.

5.4 DATA COLLECTION

Data collection for this research occurred during the first semester of the academic year 2004 (May to October). The instruments used for collecting quantitative data consisted of the CLES, the students' Attitude towards AIDS questionnaire (ATAQ) and the students' knowledge of AIDS test (SKAT). The CLES was used to investigate the students' perceptions of their learning environment in Health Science classroom.

The ATAQ and the SKAT were used as outcome measures at the end of the course. Additionally, the question guideline for focus group discussion, an observation checklist, and student journals were used to collect qualitative data. The details of each of these instruments are provided in the following sections.

5.4.1 Constructivist Learning Environment Survey (CLES)

This study used the CLES to monitor the development of a constructivist learning environment in a Health Science Classroom. The CLES was developed to investigate students' perception of the constructivist learning environment. The CLES has been found to be valid and reliable in its statistical characteristics in both small-scale and large-scale surveys of classroom learning environments (Aldridge, Fraser, Taylor, & Chen, 2000; Fraser, Dryden, & Taylor, 1998; Lee & Fraser, 2000; Puacharearn & Fisher, 2004; Taylor, Dawson, & Fraser, 1995; Taylor, Fraser, & Fisher, 1997; Wanpen & Fisher, 2004). There were four main reasons for selecting the CLES. The first reason was that the CLES has been developed, accepted and used widely for a long time. Secondly, the quality of the questionnaire (reliability and validity) is accepted by many researchers and educators in many countries. (Czerniak, & Lumpe, 2000; Fraser, Dryden, & Taylor, 1998; Kim, Fisher, & Fraser, 1999; McClure, 2002; Puacharearn & Fisher, 2004; Sebela, 2003; Shelton, & West, 2001; Taylor, Dawson, & Fraser, 1995; Taylor, Fraser, & Fisher, 1997). The third reason was that the CLES does not have too many items, so that the students can complete it in much less than one hour. The fourth, and this is a most important reason, is that the CLES was appropriate for the research questions and research objectives of this study.

The CLES was developed to enable researchers and teachers to monitor the constructivist teaching approach and to address key restraints to the development of constructivist classroom climate. The original version of the CLES (Taylor, Fisher, & Fraser, 1997) was based on a theory of constructivism which refers to an epistemology that views knowledge as being 'constructed' (or generated) within learners' minds as they draw on their existing knowledge to make sense of perplexing new experiences. The CLES was redesigned (Hardy & Taylor, 1997) to incorporate constructivist and critical theory perspectives on a cultural framing of the classroom

learning environment. The CLES is available in two forms, the Actual Form and the Preferred Form (Taylor, Dawson, & Fraser, 1995). The item wording of the Preferred Form is slightly changed from the Actual Form, for instance, the Preferred Form uses phrases like I wish. Each form of the CLES contains 30 items altogether and is composed of five scales each of six items with each scale designed to measure a student's individual perception of her or his constructivist science classroom learning environment. The response alternatives for each item are Almost Always, Often, Sometimes, Seldom, and Almost Never. The five scales of the CLES are Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation described as follows:

Personal Relevance: focuses on the connection between school science and students' out of school experience and how students make use of their everyday experience as a meaningful context for the development of their scientific knowledge

Uncertainty: assesses the extent to which opportunities are provided for students to experience the inherent uncertainty and limitations of scientific knowledge as arising from theory-dependent inquiry involving human experience and values, and as evolving, non-foundational, and culturally and socially determined.

Critical Voice: examines the extent to which a social climate has been established in which students feel that it is legitimate and beneficial to question the teacher's pedagogical plans and methods, and to express concerns about any impediments to their learning

Shared Control: concerned with students being invited to share with the teacher control of the learning environment, including the articulation of learning goals, the design and management of learning activities, and the determination and application of assessment criteria

Student Negotiation: assesses the extent to which opportunities exist for students to explain and justify to other students their newly developing ideas, to listen attentively and reflect on the viability of other students ideas and, subsequently, to reflect self-critically on the viability of their own ideas

The original version of the CLES, which was translated from English into the Thai language and back translated from Thai to English by a translator who is an expert in both languages (Wanpen, 2004) was used. Wanpen administered this version of the CLES to 710 undergraduate students in 33 computer classes in the Faculty of Science at Rajabhat University. The content validity, discriminant validity, reliability and factor analysis were used to test the quality of the CLES.

In examining the results of this trial, the mean correlation of a scale with the other scales was used as an index of discriminant validity. The mean correlation with other scales of the Actual Form range from 0.40 to 0.54 and range from 0.41 to 0.62 for the Preferred Form. It was concluded that the CLES has discriminant validity although there was some overlapping between the scales (Wanpen, 2004).

The reliability (Cronbach alpha coefficient) of the CLES shows that the reliability coefficients for the Actual Form of the CLES ranged between 0.64 to 0.91 and from 0.79 to 0.93 for the Preferred Form. Each scale of the CLES in both Forms has a Cronbach's alpha value more than 0.60. These results suggest that the CLES has satisfactory internal consistency reliability (Wanpen, 2004).

Focusing on a factor analysis, a principal component analysis with varimax rotation was used to generate orthogonal factors. The CLES has five scales, therefore, a five-factor solution was considered and rotated to maximize their variance. The results indicated that the Actual Form of the CLES was able to assess five unique aspect of constructivist classroom environment and the Preferred Form produced a similar results (Wanpen, 2004).

In conclusion, the results from discriminant validity, reliability, and factor analysis suggest that the Thai version of the CLES is reliable and valid for use in Thailand. The results from Wanpen's study also found that the instructor was able to use the CLES to improve the learning environment of a computer class in Thailand. Therefore, it was decided to use the CLES in this study. (Wanpen & Fisher, 2004).

This study followed the fundamental steps of assessment, feedback, reflection and discussion, construction of the intervention, implementation of the intervention and re-assessment (Fisher, 1986; Fraser, 1999). In the assessment stage, the Actual Form and the Preferred Form of the CLES were administered to students who were undertaking a Health Science course in the first three weeks of the semester. After the intervention was over, the Actual Form of the CLES was used to re-assess the students' perception of their classroom learning environment.

The Actual and Preferred Forms of the CLES were individually scored by the researcher before data entry for computer generated statistics. Scoring of each CLES item was as follows:

A selection of answer choice	receives a score
Almost Always	5
Often	4
Sometimes	3
Seldom	2
Almost Never	1

Average item means were obtained for each scale by adding the scores for all items in a scale and dividing by the number of items in that scale. Average item means were used in preference to total scores of every scale and could be used for the other statistical analysis.

5.4.2 The Attitude Towards AIDS Questionnaire (ATAQ)

The ATAQ was included in this study as a student outcome measure in order to determine students' attitudes to learning about AIDS. This instrument provided very useful information about the students' thinking or feelings about AIDS and their favourable and unfavourable opinions.

The ATAQ was constructed based on the important knowledge and concepts related to AIDS. The first step in the development of the ATAQ was a review of the literature related to AIDS, such as ideas and past research studies (see details in Chapter 2). The important content about AIDS was summarized and then used to provide and the

outline of the instrument. The first draft of the questionnaire was constructed in which questions were created by describing specific situations and ideas concerning AIDS and provided the basis for selecting statements that are clearly favourable or clearly unfavourable. The response to each item was answered with five alternative ratings of Strongly Agree, Agree, No Opinion, Disagree, and Strongly Disagree. In scoring, the ATAQ items were scored by using values from 5 to 1 ranking for Strongly Agree to Strongly Disagree. For negative items, the values were reversed from 1 to 5 for Strongly Agree to Strongly Disagree. An individual score on the ATAQ was the sum of the scores of all items, a higher score indicating a more favourable attitude toward AIDS.

To assess the content validity and language suitability of the ATAQ, a specialist in health education issues related to AIDS examined the items and recommended modifications to items before they were used with students. Then, the ATAQ was tried out with a sample of 100 third-year undergraduate students in the Faculty of Science and Technology at Udonthani Rajabhat University and its reliability was estimated. The Cronbach alpha coefficient found to be 0.53. The ATAQ was modified again before implementing it in the main study by removing some items that had lowered the reliability. Also, some items that had confused students were revised in their wording. The final version consisted of 25 items and had a Cronbach alpha coefficient 0.61.

5.4.3 The Student Knowledge of AIDS Test (SKAT)

The SKAT was used as a second outcome measure for assessing the students' knowledge about AIDS. The purpose of using the SKAT was to determine how much knowledge the student could recall and understand of this subject. There were 28 items in the SKAT. The content included all of the main concepts in this topic, such as the causes of AIDS, the transmission of AIDS, the symptoms and the prevention of AIDS. The SKAT was constructed in the form of two-tier testing which included the questions with a two response answer of true or false, and an open-ended response where the students had to give their reasons for their response. The purpose of using two-tier testing was to check if the students did really know about AIDS or whether

they merely guessed the answer. How much knowledge the students had gained could also be inferred by observing the learning activities.

The steps for constructing the SKAT were similar to those used for the ATAQ. The first step was that the literature related to AIDS was reviewed (see details in Chapter 2). The important content about AIDS was summarized and then, used to provide an the outline of the instrument. Next, the first draft of the questionnaire was constructed. The questions were created by describing specific situations and ideas concerning AIDS and provided the two response answer of true or false, and an open-ended question where the students had to give their reasons for their first response. An individual score on the SKAT was the sum of the scores of all items, a higher score indicating the students gained more knowledge about AIDS.

To determine the content validity and language suitability of the SKAT, a specialist in health education issues related to AIDS examined the items and recommended modifications to items before their use with students. The SKAT was then tried out with a sample of 100 third-year undergraduate students in the Faculty of Science and Technology at Udonthani Rajabhat University and its reliability was estimated. The Cronbach alpha coefficient was calculated to be 0.41. The SKAT was modified again before implementing it in the main study by removing some items that had lowered the reliability. Also, some items that had confused the students were revised in their wording. The final version consisted of 28 items and, when used, had a Cronbach alpha coefficient of 0.73.

The items of the SKAT were scored by using values 0 and 1. The students received 1 if the answer was correct and 0 if the answer was incorrect. The students' reasons for their response given in the open-ended section were used to confirm/consider whether the answer was actually correct. For example, in the case of the students who selected the correct answer, but gave a wrong reason showing that they did not really know or understand, the student would get 0 for the item. The total score was calculated from the sum of the points from all 28 items, a higher score indicating a greater knowledge about AIDS

5.4.4 The guideline questions for focus group discussion

This study used focus group discussion for collecting qualitative data. Guideline questions were constructed to be used for organizing the focus group discussion process. The teacher as researcher and the students had a discussion about three main points. First, students' perceptions of the actual-preferred discrepancies of the classroom environment; secondly, how to construct an intervention to improve their classroom environment and their learning achievement, and third, the results of the intervention. The timing of when these points were used is described below:

The guideline questions for focus group discussions in the first stage.

The main purpose of this stage was to generate feedback information, from reflection and discussion about the results of students' responses to the CLES. Examples of the questions used are:

According to the results of the CLES,...

What do you think about the gap between the actual and preferred means?

What does it mean? Are there some problems in this or not?

What do you think causes this gap?

In which of the scales are there large gaps?

The guideline questions for focus group discussions in the second stage.

The main purpose of this stage was to develop intervention strategies. Examples of the questions used are as follows:

How can we decrease the gap between the actual and preferred means?

What strategies do you think we could use to improve the learning environment and achievement?

The guideline questions for focus group discussions in the third stage.

The main purpose of this stage was to collect qualitative data to determine how effective the intervention had been. Data from re-assessment of the CLES, the ATAQ,

and the SKAT were used as a basis for the focus group discussion. Examples of the questions used are as follows:

What did you think about the strategies that were used in the intervention process?

Did the intervention process help to improve your learning environment?

Are there some things in the intervention process (learning activities) that need to be changed? Why? How?

What have you learned?

How have you learned and how can you link your learning experience to your real life ?

Have you changed the way you learn after finishing the intervention process? How? Why?

5.4.5 The Constructivist Classroom Learning Environment Observation Checklist

The Constructivist Classroom Learning Environment Observation Checklist was developed to be used throughout the intervention process in order to collect qualitative data to compare with the quantitative data obtained from the instrument.

This instrument included nine areas that were developed based on the physical environment and the main concepts used in the CLES. The observation checklist that was used is presented in Figure 5.1

The Constructivist Classroom Learning Environment Observation Checklist

Observer name.....

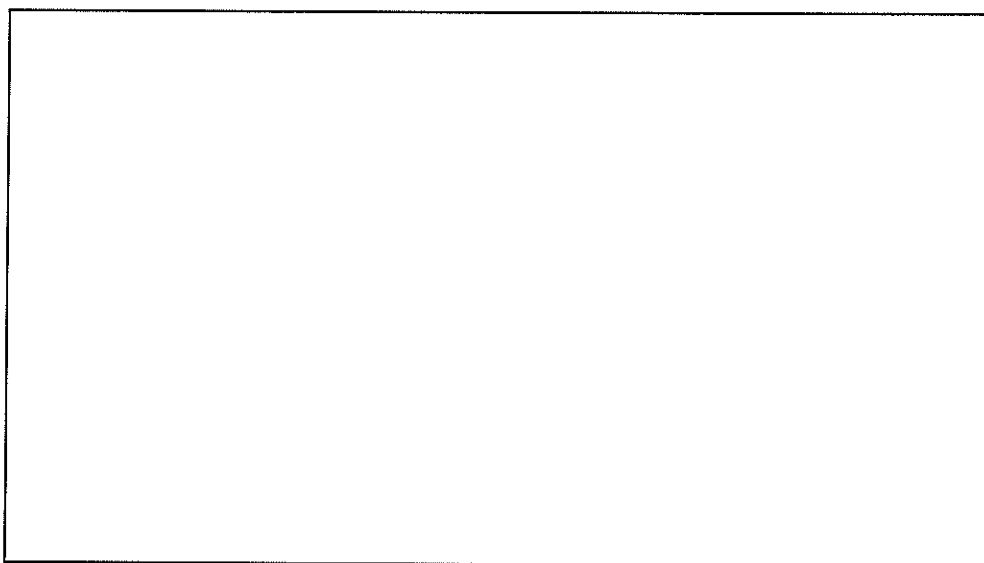
Class.....

Date/Month/Year.....Time.....

1. *Size of classroom*.....

2. *Size of class (number of students, male and female)*.....

3. *Set up (number and draw diagram of chair and table setting)*



4. *Lighting*.....

.....

5. *Displays*.....

.....

6. *Sound*.....

.....

7. *Movement*.....

.....

8. *Climate /atmosphere*.....

.....

9. *Teacher and Students' behaviour (as shown in the table)*

9. Teacher and Student's behaviour	Always	Often	Sometime	Seldom	Never
1.The teacher starts the lesson with a problem about the real world outside of school					
2.The teacher provides the correlation between Health Science lessons and daily experiences.					
3.The teacher give an example from everyday life in their teaching					
4.The teacher asks questions to students to elicit their conceptual understanding					
5.The teacher makes lesson relevant by students' interest/prior knowledge					
6.The teacher encourage the students think about an examples from their own experience					
7.The students can apply Health Science to their real life					
8. The teacher gives an example which show that Health Science has changed over time					
9. The teacher gives an example which show that Health Science is influence by people's value/opinions					
10.The teacher gives an example which show that scientists have invented a new knowledge about AIDS					
11.The teacher gives a chance for the students to ask their questions					
12.The teacher gives a chance for the students to express their opinion					
13. The teacher gives a chance for the students to speak up for their right					
14. The teacher gives a chance for the students to set their learning goal					
15. The teacher gives a chance for the students to plan the contents which they want to learn					
16. The teacher gives a chance for the students to make decision about how much time they will spend on activities					
17. The teacher gives a chance for the students to assess their learning					
18.Each student gets the chance to talk with other students about the things that he/she have learned					
19. Each student gets the chance to express his/her ideas with other students					
20. Each student gets the chance to be involved in negotiations with his/her peers.					
21.The teacher encourages active participation of all students					
22.The teacher provides time for students to consider their points of view					
23.The teacher fosters a climate of respect for student ideas					
24.The teacher modifies lesson/learning activities based on student questioning					
25.The learning environment in this class is relaxed, flexible and encourages students to involved in learning activities.					

Figure 5.1. The Constructivist Classroom Learning Environment Observation Checklist.

5.4.6 The student journal

Student journals also were used for collecting qualitative data. These journals gave a historical perspective of the journey of knowledge acquisition and helped students to monitor their learning process. The journal was designed to encourage student reflection. Monitoring of the journal also provided information that could be used as a basis for teacher-student discussion during the intervention process. The journals also were of benefit to the parents, since when students took them to their homes, their parents were informed about what the students had learned

The following guideline questions were used to assist the students in the writing of their journals.

- 1. What have you received from the learning experience about the AIDS topic?*
- 2. How did you learn about AIDS?*
- 3. How are the learning activities helping you to gain understanding about AIDS?*
- 4. How much knowledge or understanding have you gained about AIDS?
(assesses cognitive dimension)*
- 5. What do you think or feel about AIDS? (assesses affective dimension)*
- 6. How can you link your learning experiences in this topic to your real life?*
- 7. According to your learning experiences in this topic,*
 - 7.1 Does the instructor provide the chance for you to involved in
planning your learning (plan about the time, content, activities),
How?*
 - 7.2 Does the instructor encourage you to practise, think, express
your opinions? How?*
 - 7.3 Does the instructor provide the chance for you to be involved in
learning assessment? How?*
 - 7.4 Did you learned from your peers? How?*

8. *Do you think this new way of learning was similar to or different from traditional learning? Why? How?*
9. *Do you think this new learning approach helped you to improve the learning environment in your class? Why? How?*
10. *What do you think or feel about this new learning approach? Why?*

The students were assigned to write their journals throughout the intervention process and gave their journals to the instructor after the intervention had been completed.

5.5 DATA ANALYSIS

5.5.1 Quantitative data analysis

Data analysis

The students' perceptions of their classroom environment were analyzed by using the individual mean score as the unit of analysis.

To provide reliability data for the CLES, the internal consistency reliability was analyzed by using the Cronbach alpha coefficient. The mean correlation with other scales of the CLES was used as an index of discriminant validity. To check the factor structure of the CLES, a principal component analysis with varimax rotation was used to generate orthogonal factors and a five-factor solution was considered and rotated to maximize their variance.

The descriptive statistical analysis such as frequencies, percentiles, mean and standard deviation were used to analysed the data from the post-assessment of the CLES, the ATAQ, and the SKAT. Paired t-tests were used to compared students' perceptions of their actual and preferred learning environment before and after the intervention stage.

Data interpretation

The CLES

The data interpretation of students' perception of their classroom environment by using the CLES was done by comparing mean scores of each CLES scale before (pre-actual) and after completion of the intervention (post-actual). From the scale which had the highest mean difference, it was implied that the students had developed their perceptions most on that aspect of their constructivist classroom learning environment.

The ATAQ

The total mean scores of students' attitude toward AIDS and Standard Deviation was used as a criterion for dividing students into three groups. The first group had total mean scores at the high level (mean + one standard deviation); the second group had total mean scores at the middle level (mean- one SD to mean+ one SD); and the third group had total mean scores at the low level (mean- one SD).

The SKAT

The same method was used to establish the levels of student achievement on the SKAT.

5.5.2 Qualitative data analysis

The qualitative data obtained from open-ended questions, classroom observations, focus group discussions and student journal were analyzed by content analysis and organization of the information into categories. Finally, the conclusions that were made were feed back to the students again to check whether the conclusions did actually portray their ideas.

5.6 TRIANGULATION OF DATA

In the present study, a combination of methods was used in order to ensure the quality of the information. Triangulation is one of the most common analytical techniques to enhance the credibility of results of research qualitative study. This section of the

thesis describes some theory about triangulation including definition, type, and advantages of triangulation.

5.6.1 Definition of triangulation

Denzin (1997) defined triangulation as the use of different methods of gathering data with different samples, at different times, or in different places to compare different approaches to the same thing. Wiersma (2000) explained that triangulation is a qualitative cross-validation process involving comparison of information from multiple researchers or multiple data sources or multiple data collection procedures in order to determine whether or not there is corroboration. It is a search for convergence of the information on a common finding or concept. To a large extent, the triangulation process assesses the sufficiency of the data. Chen and Manion (1994) defined triangulation as the use of two or more methods of data collection in the study of some aspect of human behaviour. While, Wellington (2000) described it as the application and combination of several research methodologies in the study of the same phenomenon.

5.6.2 Types of triangulation

A typology of triangulation has been suggested by Denzin (1970) and Patton (1990). The following are the principal types of triangulation which might be used in research *Data triangulation*, which is subdivided into:

- (1) *Time triangulation*: the researcher attempts to consider the influence of time using cross-sectional and longitudinal research design.
- (2) *Space triangulation*: the researcher engages in some form of comparative study, e.g., of different regions, different countries.
- (3) *Person triangulation* at the following levels of analysis:
 - (i) the individual level
 - (ii) the interactive level among a group
 - (iii) the collective level
- (4) *Investigator triangulation*: more than one person examines the same situation

Theory triangulation: alternative or competing theories are used in any one situation

Methodological triangulation: which involves “within method” triangulation, that is the same method used on different occasions, and “between method” or different methods are used in relation to the same object of study.

Multiple triangulation, when the researcher combines more than one type of triangulation

Based on this information, it was decided to use a methodological triangulation technique for comparison of information from several sources of data in the three main stages of action research as shown in Table 5.1

Table 5.1

Triangulation Methods Used in Each Stage of Action Research

Stages of Action Research	Data collecting method 1	Data collecting method 2	Data collecting method 3
Stage 1			
1.1 Pre-assessment of students' perceptions of their classroom learning environment	Open-ended question	Interview	
1.2 Assessment of students' pre-instruction conceptions about AIDS	The CLES	Focus group discussion	
Stage 2			
Implementing the intervention based on constructivist approach	Formative assessment instrument -self assessment -peer assessment -group work checklist -short quiz -concept mapping	Classroom observation -Observation checklist -informal observation	Focus group discussion
Stage 3			
3.1 Post-assessment of students' perceptions of their classroom learning environment	The CLES	Focus group discussion	
3.2 Post-assessment of students' conceptions about AIDS	The ATAQ The SKAT	Focus group discussion	

5.7 ETHICS

An important ethical issue addressed in this research was that the Principals and the Deans of the Faculties were requested to provide their informed consent in a letter prior to any research being undertaken in the university. The purpose of the research, the research process and students' roles in the research were explained to the students in class prior to their engagement in the process. The researcher encouraged the participants to volunteer to be involved in the study and it was made explicit that they were free to withdraw from the research at any time. They also had the right to inspect and withhold any data collected from their classroom. Pseudonyms were to be used consistently throughout the research process. In this way, confidentiality was ensured and the rights of the participants protected. Furthermore, the students who were selected for interviewing in focus group discussions were given the choice of not participating. The questionnaire completion did not take too long and was given in a way that would not disrupt the normal teaching program. All participants were given the choice as to whether they wished to be acknowledged as having taken part in the research in the final thesis.

5.8 SUMMARY

This chapter has described the methodologies employed in this study. Action research was used and a multi-method approach utilizing both quantitative and qualitative employed. The study consisted of five stages as follows:

1. Validation of the Thai version of the Actual and Preferred Forms of the CLES.
2. Pre-assessment of the students' learning environments perceptions using the CLES and find out students' pre-instruction concepts about AIDS.
3. Construction of the intervention.
4. Implementing the intervention.
5. Evaluation of the intervention

The sample to validate the Thai version of the CLES consisted of 100 third-year undergraduate students who study in the Faculty of Science at Udonthani Rajabhat University, Thailand. These 100 students were randomly selected from the third-year

cohort. The sample of student who participated in the action research process consisted of 20 students in one Health Science class at the undergraduate level in the Udonthani Rajabhat University, Thailand. A purposive sampling technique which included two criteria was used for this group. The two criteria were that the sample of students must be enrolled in Health Science Subject and must be prepared to participate in this research study.

The instruments used for collecting quantitative data consisted of the CLES, the Attitude Towards AIDS Questionnaire (ATAQ) and the Students' Knowledge of AIDS Test (SKAT). Additionally, focus group discussions, an observation checklist, and student journals were used to collect qualitative data.

The data collection for this study proceeded during the first semester of the academic year 2004. The CLES was used to measured the students' perceptions of their Health Science classroom learning environment before and after the interventions; and the ATAQ and the SKAT were used to assess students' learning outcomes after the intervention was completed.

To provide reliability data for the CLES, the internal consistency reliability was analyzed by using Cronbach alpha coefficients. The mean correlation with other scales of the CLES was used as an index of discriminant validity. To check the factor structure of the CLES, a principal component analysis with varimax rotation was used to generate orthogonal factors and a five-factor solution was considered and rotated to maximize variance.

Data analysis of this study used the class mean score as the unit of analysis of the students' perceptions of their classroom environment. Descriptive statistical analysis were used to explain the frequencies, percentiles, mean and standard deviation of the questionnaire score. Paired t-tests were used for compared mean scores of students' perceptions of their actual and preferred learning environment and compared mean scores between before and after the intervention.

CHAPTER SIX

VALIDATION OF THE CLES IN THAILAND

6.1 INTRODUCTION

The last chapter described the methodology of this research study and this chapter reports the results of the first stage of the study which was related to the first research question: Is the CLES a valid and reliable instrument for use in Health Science classrooms in Thailand? This chapter describes the validation and reliability of the student Actual and Preferred Forms of the CLES for use in Health Science classrooms in Thailand. The sample used in this stage consisted of 100 undergraduate students in the Faculty of Science at the Udonthani Rajabhat University, Thailand. Before beginning the action research study, the Actual and Preferred Forms of the original version of the CLES were translated into Thai language and back-translated by a translator who had expertise in both languages. The Thai versions of the Actual and Preferred Forms of the CLES were administered to 100 undergraduate students undertaking Health Science classes in the Faculty of Science at the University. Then, the analysis was run using SPSS for Windows Version 12 (Norusis, 1993). Analyses of the CLES data included factor analysis (described in section 6.2) reliability (described in section 6.3), and discriminant validity (described in section 6.4). Qualitative data obtained from student interviews to identify items that made the students confused and needed some change in wording are described in section 6.5. The CLES has been slightly modified in wording in order to make it more appropriate for use in the socio-cultural context of Thailand. A description is given on how some individual items of the CLES were modified, in order to make them more suitable, in section 6.5.

6.2 FACTOR ANALYSIS

The first stage of the analysis consisted of a principal component analysis with varimax rotation used to generate orthogonal factors. The CLES has five scales, therefore, a five-factor solution was considered and rotated to maximize their variance. The results of the factor analysis of the Thai Actual Form of the CLES are reported in Table 6.1. The results indicate that all of the items have a factor loading of at least 0.40 in their *a priori* scale and range between 0.40 and 0.87. In the Critical Voice scale, there are two items (items 17 and 18) that also loaded on the Student Negotiation scale. This may be caused by the content of these items as they are about students' expressing their opinions, which is closed to the content of the Student Negotiation scale. The percentage of the total variance extracted and eigen values associated with each factor are also recorded at the bottom of the table. In this analysis of the factor structure, 67.05 % of the variance could be accounted for by the five factors.

Table 6.1

Item Factor Loadings for the Actual Form of the CLES

Item	Component				
	Personal Relevance	Uncertainty	Critical Voice	Shared Control	Student Negotiation
Q1			.73		
Q2			.80		
Q3			.65		
Q4			.76		
Q5			.77		
Q6			.74		
Q7				.64	
Q8				.71	
Q9				.77	
Q10				.58	
Q11				.69	
Q12				.48	
Q13					.61
Q14					.74
Q15					.69
Q16	.43				.55
Q17	.58				.40
Q18	.53				
Q19		.67			
Q20		.78			
Q21		.87			
Q22		.84			
Q23		.81			
Q24		.76			
Q25	.70				
Q26	.74				
Q27	.73				
Q28	.77				
Q29	.74				
Q30	.81				
Cumulative %of Variance	17.21	32.70	46.85	57.31	67.05
Eigen value	5.16	4.64	4.24	3.13	2.92

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 7 iterations.

Only factor loadings $\geq .40$ are included.

Table 6.2 reports the results for the factor analysis of the Preferred Form of the CLES. For this version of the CLES, it would appear that again the items generally loaded on the expected scale and ranged between 0.41 and 0.83. There are two items (items 8 and 9) in the Uncertainty scale that have a loading less than 0.40 . Therefore, these items did not show in Table 4.2. The percentage of the total variance extracted and eigen value associated with each factor are also recorded at the bottom of the table. In this analysis of the factor structure, 60.54% of the variance could be accounted for by the five factors.

Table 6.2

Item Factor Loadings for the Preferred Form of the CLES

Item	Component				
	Personal Relevance	Uncertainty	Critical Voice	Shared Control	Student Negotiation
Q1			.55		
Q2			.77		
Q3			.64		
Q4			.71		
Q5			.64		
Q6		.51			
Q7					.76
Q8					
Q9					
Q10				.67	
Q11				.66	
Q12				.62	
Q13			.41	.43	
Q14	.41				.51
Q15	.45				.54
Q16					.64
Q17				.50	
Q18		.51			
Q19	.78				
Q20	.80				
Q21	.83				
Q22	.82				
Q23	.78				
Q24	.73				
Q25		.61			
Q26		.69			
Q27		.67			
Q28		.75			
Q29		.73			
Q30		.76			
Cumulative % of Variance	16.70	31.36	42.75	51.99	60.54
Eigen value	5.06	4.39	3.41	2.77	2.56

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 6 iterations.

Only factor loadings $\geq .40$ are included.

6.3 RELIABILITY OF THE CLES

Reliability refers to the consistency of the research and the extent to which studies can be replicated (Wiersma, 2000). Internal consistency reliability can be estimated using the Cronbach alpha coefficient and is based on the idea that items within a factor or scale should be measuring the same thing (Pedhazur and Schmelkin, 1991). The values of alpha reliability coefficients may range from 0 to 1. Higher values are indicative of higher internal consistency, Cronbach alpha coefficients values of 0.60 and greater are generally considered to be adequate for this type of scale (Nunnally, 1978).

Table 6.3 shows that the reliability (Cronbach alpha coefficient) for each scale of the CLES in the Actual and Preferred Forms using the individual student as the unit of analysis. For the Actual Form, the reliability of the scales ranged from 0.82 to 0.91. In the Preferred Form, the scale reliability ranged from 0.65 to 0.91. These results suggest that the Thai version of the CLES has satisfactory internal consistency reliability.

Table 6.3

Internal Consistency Reliability (Cronbach Alpha Coefficient) of Each Scale of the Thai Version of the CLES in the Actual and Preferred Form Using the Individual Student as the Unit of Analysis.

CLES Scale	Alpha Reliability	
	Actual	Preferred
Personal Relevance	0.89	0.81
Uncertainty	0.82	0.65
Critical Voice	0.87	0.81
Shared Control	0.91	0.91
Student Negotiation	0.90	0.88

The sample consisted of 100 undergraduate students in Science classes in Thailand

These results are very similar to previous research studies conducted in Australia and typically the results show that four of the CLES scales (i.e., Personal Relevance, Critical Voice, Shared Control, Student Negotiation) have alpha reliabilities above 0.8 with the student as the unit of analysis. Although the remaining scale (Uncertainty) had a somewhat lower alpha value in the Australian study (0.72), it was considered to be quite satisfactory (Taylor, Fraser, & Fisher, 1997).

Fraser, Dryden, and Taylor (1998) conducted research on the impact of systemic reform efforts in promoting constructivist approach in high school science in Dallas in the USA. The internal consistency reliability (Cronbach alpha coefficient) of each scale of the CLES for the individual student as the unit of analysis ranged from 0.61 to 0.89.

The CLES also has been used in South Africa by Mogkoko (2003). This research validated and used the CLES in mathematics classroom. The sample consisted of 1,864 students in 34 classes. The results indicated that the alpha reliability values for each scale of the CLES, with the individual student as the unit of analysis, ranged from 0.61 to 0.91 for the Actual Form, and from 0.56 to 0.97 for the Preferred Form.

There are few examples of using the CLES in Asia. In one study the CLES was used to investigate Korean high school students' perceptions of their science classrooms. The sample of this study involved 439 high school students from 13 classes. The alpha reliability values for different scales with the individual student as the unit of analysis ranged from 0.78 to 0.87, for the Actual Form and from 0.90 to 0.94 for the Preferred Form. This results confirmed that all scales of the Korean version of the CLES possess satisfactory internal consistency (Lee and Fraser, 2000). The following two examples are in Thailand, but used a slightly different version of the CLES.

Puacharearn and Fisher (2004) conducted action research by using a constructivist teaching approach for improved the learning environment of science classes at secondary schools in the central Thailand. The validation of the CLES (25 items) reported that the reliability estimate (alpha coefficient) for each CLES scale in the Actual Form and the Preferred Form with the individual student as the unit of analysis ranged from 0.81 to 0.85 and 0.62 to 0.84, respectively.

Wanpen and Fisher (2004) also used the CLES at an undergraduate level in a university in Northeastern Thailand. The action research aimed to create a collaborative learning environment in a computer classroom by using the CLES. The CLES was administered to 710 undergraduate students in 33 computer classes. The reliability coefficients for the Actual Form of the CLES ranged between 0.64 to 0.91 and from 0.79 to 0.93 for the Preferred Form. The results from both Thai studies suggested that all scales of the Thai version of the CLES have satisfactory internal consistency in both Actual and Preferred Forms. (Puacharearn & Fisher, 2004; Wanpen & Fisher, 2004).

6.4 DISCRIMINANT VALIDITY

The mean correlation of a scale with all the other scales was used as an index of discriminant validity. The results are reported in Table 6.4. In this analysis the unit of analysis was again the individual student. The mean correlation of one scale with the other four scales of the Actual Form ranged from 0.40 to 0.54 and from 0.41 to 0.62 for the Preferred Form. Therefore, when considered with the factor analysis reported in section 6.2, it was concluded that the CLES has discriminant validity and the scales measure distinct although somewhat overlapping aspects of the constructivist learning environment of Health Science classes in Thailand.

Table 6.4

The Discriminant Validity (Mean Correlation with Other Scales) of the Thai Version of the CLES in Actual and Preferred Forms Using the Individual Student as the Unit of Analysis .

CLES Scale	Mean Correlation with Other Scales	
	Actual	Preferred
Personal Relevance	0.46	0.62
Uncertainty	0.45	0.47
Critical Voice	0.54	0.59
Shared Control	0.40	0.41
Student Negotiation	0.48	0.52

The sample consisted of 100 undergraduate students in Science classes in Thailand

6.5 ADAPTATION OF THE CLES

In order to make the original CLES more appropriate for Health Science classes in Thailand's socio-cultural context and for use in this study, the results from factor analysis, reliability, discriminant validity as well as the qualitative data from student interviews were used as a guideline for adaptation of the CLES. The internal consistency reliability values of all scales of the Thai version of the CLES used in this study have satisfactory (reliability range from 0.65 to 0.91), however, from the factor analysis, there are some points which differ from research in the past, especially, with the Preferred Form. In this form, there were some items of some scales (i.e. Critical Voice, Shared Control) that did not load in their expected scale. The qualitative information from student interviews indicated that some students were confused, or misunderstood or misinterpreted some items of the CLES. Examples of students' opinions resulting from interviews are as follows:

- Opinions 1 It would be suitable for our context and easy to understand, if you replaced the word 'science' and use the specific word 'Health Science'.*
- Opinions 2 I'm not completely clear of the meaning of the words 'modern science' in item 10, and 'people in other cultures' in item 11.*
- Opinions 3 The word 'complain' has a negative meaning in the Thai language. In Thailand, the student should not complain to the teacher. So, this word may make the students respond in the wrong way.*
- Opinions 4 The phrase '..prevent me from learning..' made me confused. It is difficult to understand, so you should adjust it in appropriate way and make it easier to understand.*
- Opinions 5 This sentence is not clear about the object, I express my opinion to whom? My teacher or my friends.*
- Opinions 6 What is the real meaning of the words "It's O.K?". Actually, I can understand, but I think that this is not so good. Does it means 'I can' or 'I should'?*
- Opinions 7 I think that the sentence 'It's OK for me to question the way I'm being taught' is difficult to understand. Is it the same meaning as this sentence 'I can ask the question about the method that the teacher taught me?'*

The qualitative information from students' recommendations led to important modifications in the CLES. As a result, there were 10 items in which the words were changed slightly. In some items, such as items 10 and 11, the wording was not changed, but the researcher explained the meaning of 'people in other countries' in item 10 and 'modern science' in item 11 to the students before they did the CLES. The details of students' comments, the modification of the CLES, and examples of the modified version of the Thai CLES items are shown in Table 6.5.

Table 6.5

Item Wording of the Original English Version of the CLES, Comments from the Students and the Modified Thai Version in the Actual Form.

Item	Item Wording of the Original English Version	Comments of the Students	Modified Version of the Thai CLES
7	I learn that science <u>cannot</u> provide perfect answers to problems.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context.	I learn that <i>health science</i> <u>cannot</u> provide perfect answers to problems.
8	I learn that science has changed over time.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context.	I learn that <i>health science</i> has changed over time.
9	I learn that science is influenced by people's values and opinions.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context	I learn that <i>health science</i> is influenced by people's values and opinions.
10	I learn about the different sciences used by people in other cultures.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context	I learn about the different <i>health sciences</i> used by people in other cultures.
11	I learn that modern science is different from the science of long ago.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context	I learn that modern <i>health science</i> is different from the <i>health science</i> of long ago.
12	I learn that science is about <u>inventing</u> theories.	It would be better and easy to understand, If use the specific wording Health Science and suitable for our context	I learn that <i>health science</i> is about <u>inventing</u> theories.
15	It's OK for me to complain about activities that are confusing.	The word complain has negative meaning in Thai language and in the norm of Thailand the student should not complain to the teacher. Therefore, the students may be response the answer never	Changed the word complain to talk The new version is It's OK for me to <i>talk</i> about activities that are confusing.

Item	Item Wording of the Original English Version	Comments of the Students	Modified Version of the Thai CLES
16	It's OK for me to complain about anything that prevents me from learning.	1. The word complain has negative meaning in Thai language and in the norm of Thailand the student should not complain to the teacher. Therefore, the students may be response the answer never 2. The phraseprevent me from learning..... made me confused	<i>I can talk about the obstacles to my learning.</i>
17	It's OK for me to express my opinion.	1. The sentence is not clear about the object, I express my opinion to whom? My teacher or my friends. 2. What is the real meaning of the word It's O.K. . actually, I can understand, but I think that this is not so good. Is it means I can or I should	<i>I can express my opinion to my teacher.</i>
18	It's OK for me to speak up for my rights.	What is the real meaning of the word It's O.K. Actually, I can understand, but I think that this is not so good. Is it means I can or I should.	<i>I can speak up for my rights.</i>

6.6 SUMMARY

In this chapter, results from the use of the Thai version of the CLES in this Thai research study supported its validation. The Thai version of the CLES was validated by using quantitative data from students' responses to the Actual and Preferred Forms of the CLES. The sample in this stage consisted of 100 third year undergraduate students in the Faculty of Science and Technology, Udonthani Rajabhat University, Thailand. The unit of analysis was the individual student. A principal components factor analysis with varimax rotation indicated that the Actual Form of this instruments which has five scales is able to assess five unique aspects of a constructivist classroom environment. The factor analysis for the Preferred Form

produced a similar result. The alpha reliability values and discriminant validity were satisfactory. The last part of this chapter describes some adaptations of the CLES. The next chapter describes the results of using the CLES to improve a Health Science classroom learning environment and learning outcomes.

CHAPTER SEVEN

PRE-ASSESSMENTS AND DEVELOPMENT OF THE CONSTRUCTIVIST-BASED INTERVENTION

7.1 INTRODUCTION

The last chapter presented the validation of the Thai version of the CLES. The results indicated that alpha reliability values and discriminant validity of all CLES scales were satisfactory. After it had been validated, the Thai version of the CLES was used to investigate students' perception of their learning environment in Health Science classrooms. Following this, focus group discussions were used to generate feedback for reflection and discussion about the results of the CLES in order to construct an appropriate intervention to attempt to improve the learning environment and as a consequence achievement. This chapter contains three main sections, the first section describes the results of the pre-assessment of the students' perceptions of their classroom environment according to the CLES. The second section describes the results of the pre-assessment of the students' knowledge about AIDS. The third section provides the construction of the intervention and is presented in two parts; first, the students' setting of their learning objectives; and second, the students planning the learning activities based on constructivism theory.

7.2 PRE-ASSESSMENT OF THE STUDENTS' PERCEPTIONS OF CLASSROOM LEARNING ENVIRONMENT: ACTUAL AND PREFERRED DIFFERENCE

7.2.1 Quantitative data from the CLES

The CLES was administered to 18 undergraduate students in one Health Science class at a Rajabhat University in the Northeastern region of Thailand. The data from the CLES were analyzed and interpreted in order to answer Research Questions 3 and 4 of this study which were:

Research Question 3: What are the students' perceptions of the constructivist classroom environment in Health Science classrooms in Thailand ?

Research Question 4: Are there any differences in students' actual and preferred perceptions of constructivist classroom environments in Health Science classrooms?

In the pre-assessment stage of this study, the individual student was used as the unit of analysis. The number of items in each CLES scale was computed and divided by the number of items in that scale so that the average item means could be presented. These average mean scores of the whole class were used to create profiles and generate feedback information. Table 7.1 contains the average item mean scores and standard deviations for each scale for the Actual and Preferred Forms of the CLES before the intervention. Next, the comparisons of average item mean scores between each scale of Actual and Preferred Forms of the CLES were checked for statistical significance using paired sample t-tests.

Table 7.1

Average Item Mean Scores and Standard Deviations for Each Scale of the Actual and Preferred Forms of the CLES before the Intervention Using The Individual Student as the Unit of Analysis (N=18)

Scale	Mean		Standard Deviation		Mean Difference	t
	Pre-Actual	Preferred	Pre-Actual	Preferred		
Personal Relevance	3.62	4.30	0.51	0.48	0.68	5.51***
Uncertainty	3.56	3.82	0.62	0.50	0.26	1.32
Critical Voice	3.59	4.37	0.68	0.46	0.80	3.87*
Share Control	3.00	4.18	0.51	0.50	1.18	8.37***
Student Negotiation	3.62	4.47	0.50	0.48	0.85	4.41***

* $p < 0.05$ *** $p < 0.001$

The results in Table 7.1 show that, for the Actual Form, the average item mean ranged from 3.00 to 3.62. The mean is lowest for the Shared Control scale (3.00) and the other four scales are nearly the same, Uncertainty (3.56), Critical Voice (3.59), Personal Relevance (3.62), and Student Negotiation (3.62). The results of the Preferred Form show that the mean scores are higher than the actual scores on all CLES scale. For the Preferred Form, the means ranged from 3.82 to 4.47. There are four scales in which the values of mean scores are greater than 4.00. The Student Negotiation scale is highest (4.47), then in order are Critical Voice (4.37), Personal Relevance (4.30), Share Control (4.18) and Uncertainty (3.82).

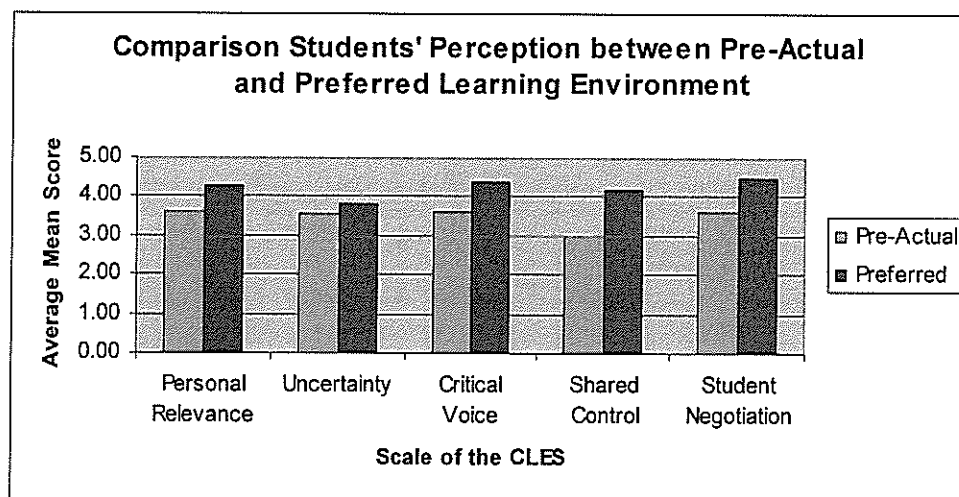


Figure 7.1. Differences between student perceptions of Pre-Actual and Preferred classroom learning environment for each scale of the CLES.

The results from Table 7.1, and Figure 7.1 clearly show that there are differences in students' perceptions of their actual and preferred Health Science classroom learning environment on every scale of the CLES. This means that the students would prefer higher levels of these aspects of the learning environment on all scales of the CLES than they actually perceive to be present. Furthermore, the students' perception of the actual classroom learning environment on the Shared Control scale is lowest (3.60) while the mean score on the Preferred form is 4.18. Therefore, the actual-preferred discrepancy of this scale is greatest (1.18). These results indicate that the students believe that the teacher gives little chance for them to share in aspects of learning in Health Science classrooms.

The pre-actual-preferred discrepancies in item means of each scale of the CLES range from 0.26 for Uncertainty to 1.18 for Shared Control. The three other scales are nearly the same level, Personal Relevance (0.68), Critical Voice (0.80), and Student Negotiation (0.85). Results of paired sample t-tests indicate that there are significant differences between the mean scores of the Actual and Preferred Forms on four scales of the CLES, Personal Relevance ($p<0.001$), Critical Voice ($p<0.05$), Shared Control ($p<0.001$) and Student Negotiation ($p<0.001$). The difference in means for the Uncertainty scale is not significant.

These results suggest that the students are not completely satisfied with their actual classroom learning environments and this result is similar to past research studies (e.g., Fraser, 1998; Lee & Fraser, 2000; Puacharearn & Fisher, 2004; Wanpen & Fisher, 2004).

7.2.2 Qualitative data from focus group discussion and observation

Physical atmosphere of the classroom

The classroom size was six square metres and it is located on the first floor. A new building is being constructed not far from this classroom. The classroom has two doors and eight windows along one side. There are six lights and two fans on the ceiling. There is a blackboard and two bulletin boards on the wall at the front of the classroom. There also is a screen for projection. The teacher's table is at the front of the classroom and there is an overhead projector on this table. For the students, there are 40 desks arranged in five rows.

The results from the pre-assessment with the CLES were used as a basic guideline for focusing reflection in the group discussion between the teacher and the students in order to construct an appropriate intervention. The results of this focus group discussion were as follows:

When the focus group discussion began, the students were informed of the objectives of the discussion, the duration of time, and the rules for this group discussion. The

students agreed with the three rules: give an equal chance for each person to express their opinion; do not interrupt while other students are speaking; and ask for permission, if wanting to go to the rest room. It was not necessary for the students to introduce themselves because they all knew their peers.

The focus group discussion began with a presentation of the results of the use of the Thai versions of the Actual and Preferred Forms of the CLES. The students were excited and interested in these results. Some of them were very surprised. Some examples of the students' comments are:

These may be signs of some problems in our class.

I have never thought about this point before.

Next, the students were encouraged to think about the gap between actual and preferred classroom learning environment perceptions by considering the following open-ended questions.

What do you think about the gap between actual and preferred?

What does it mean?

Do you think this result means our class has some problems or not?

If, the answer is yes, so what are the problems?

What are the causes of this gap? Why?

Which of the scales have the biggest gap?

The results from the focus group discussion indicated that the students were aware of the importance of the gap between actual-preferred means. They thought that these results indicated that there were problems in the learning environment and the learning style used in their class. A large group of the students thought that these problems were worth exploring. Time was then taken to discuss the causes and factors that might influence this situation.

In the first session of discussion, many of the students were excited and paid attention to the process. However, a large number of them were silent. A few of the students, three or four dominated the expression of opinions. Again, opened-end questions were used to encourage more students to think about the topic and express their opinions.

A thinks that....., Do you agree with him? Why?

A thinks that, but B thinks about this another way,
so what do you think about this point?

Do you have another opinion?

It was explained to the students that their answers were neither right nor wrong, that their comments would not have any effect on their scores or grading, and that the teacher would keep an open mind and receive useful feedback information. It was also explained that their feedback data would be used to help them to improve their classroom learning environment. These explanations improved the classroom atmosphere considerably and many students expressed their opinions. It was then apparent that the students felt happier about sharing their ideas with their peers. The following statements show the students' opinions about the result of the pre-assessment of their classroom learning environment. In response to the question,

What do the gaps mean?

Our educational system is not successful.

These may be the problems in our educational system.

Educational failure.

We need to have education reform, I mean now we have talked about education reform, but I have not seen it practised in school, college or our university.

One student said :

*I think that we have gone too far from our classroom,
I suggest that we should discuss about problems in our
class or our context, at this university*

Then, other students thought about the problems in their class. Examples of the students' feedback information about the gap related to each scale of the CLES is summarized and described as follows:

The students do not like to express their ideas because....

- *some of them are shy and lack or have low self confidence*
- *some of them do not need to share the ideas with their friends*
- *some of them do not know the answer or they have no ideas*
- *some of them are accustomed to listening to the answer
(or opinions) from the teacher*

They do not have a chance to make a decision about planning
their learning activities because :

- *they think that the teacher has a responsibility to play this role*
- *some of think that they do not have greater knowledge or
experience to help teacher do this job*
- *the Thailand educational system does not enable to help the
students to make discussions*
- *the teacher usually uses a traditional teaching style and it is
difficult to change*
- *a traditional teaching style (from primary-secondary-tertiary)
has built their learning behaviours in which it is not
necessary for the students to play a key role in learning*

Some times, the teacher apparently does not link the lesson to the students' real life because...

- *sometimes, the teacher does not give examples of real situations (about 50%)*
- *the teacher usually teaches by following the textbook*
- *the students have a chance to study out of the classroom once or twice a semester, and we do not think that this is enough.*

Another interesting comment made by a student was:

Sometimes, we are not motivated for learning because the learning environment does not encourage us to learn.

Other comments referred to the physical environment.

For example:

The temperature is too hot and the classroom set up in this way is not good to encourage us to participate in the learning activities.

The stimuli outside the classroom, such as the sounds, pretty women make me to pay attention more than the actual learning activities.

Sometimes the students have to think about their personal problems (such as illness, friends, homesickness).

Although I am studying in my fourth year, I still miss my home and my parents.

I think about the problems in my family.

I miss my girl friends.

Other comments referred directly to the effect on learning environment by the social environment.

Sometimes I feel that the teacher does not pay attention to the students' understanding. I think this because when you finish the first topic, you go on to the next topic and you do not ask me...Do you understand or have some questions? .

My opinion is different from her's. In fact, you usually do ask these questions, but you do not give enough time for me to think. I take more time to think about the answer.

I understand that the curriculum contains a lot of contents, so that you have to hurry when teaching.

I think that it will be better if we change some methods of learning, such as we will receive an assignment and we have to learn from many sources before coming to the class. When we come to the class, we just have a discussion and draw conclusions, rather than learn everything inside this classroom in the period of two or three hours. Therefore, we can use and organize the time more effectively and not be in such a hurry.

I agreed with her, but the new condition of learning which everyone has to accept is that we have to work harder than now. Do we accept this condition?

This decision making needs our commitment. If all of us or a large group of us agree, It's okay. On the other hand, if some of our friends do not agree, then we should have a discussion about the situation, such as what are the advantages if we changed our learning activities, and if we were not changed, what would be the result? If we change, is it better than now? How and why?

The students were now discussing much more than they were in the early stages of this activity. Some students agreed while others disagreed.

I think that if we are not do anything, we will received nothing.

In the same way, if we try new things, we will gain benefit.

How can you know we will receive benefit from this process?

At least, we will have a new learning experience different from the methods that we have learned in the past. If we do not receive any benefit, we also should not lose anything.

That's right, but I'm afraid that there will be a lot of work, so I don't need to change.

Why do you ignore a good chance in your life? It sounds interesting, open your mind and let's try the new thing.

Following more discussion and negotiation, a large group of the students agreed that they should try to use a new teaching and learning method in order to improve their learning environment and achievement.

A list of the students' opinions was made and written on the chalkboard. The students were told to review it again in order to summarize the main content of this focus group discussion. All of the students agreed with these conclusions. Finally, the teacher and the students made an appointment to have the next focus group discussion on how to construct the intervention in order to reduce the gap between their preferred and actual learning environment.

7.3 CONSTRUCTION OF THE INTERVENTION

In this stage, focus group discussions were used to consider, reflect further on the data, and then to construct an appropriate intervention by thinking about the methods

for improving the learning environment. The results of these focus group discussions are presented in the following sections.

When the focus group discussion began, the students were informed of the objectives and duration of time allowed for this group discussion. The group discussion began with a review of conclusions of the last discussion (the results of pre-assessment of students' perception of their actual and preferred classroom learning environment) to confirm the decision to proceed. In the case of receiving additional input or the students wanting to change something, the whole class discussed it and made a decision whether to change or not.

The second step of the focus group discussion began by encouraging the students to think about the methods to reduce or decrease the gap between actual and preferred perceptions. Most of the students agreed that the teacher should change her teaching style and that the students should change their learning behaviours. Some examples of students' comments follow:

I think that it would be better if we changed some methods of learning, such as we could be given an assignment and then, we have to learn from many sources before coming to the class. When we come to the class, we could have a discussion and draw conclusions, rather than learning everything inside the classroom in a period of two to three hours. Therefore, the classroom time can be used more effectively and there would not be such a hurry.

I think we should use participatory learning methods in every part of the learning process.

The student- centred approach is a good way, so we should try it. The teacher should encourage the students to express their opinions.

The teacher should give a chance for the students to practise themselves and increase their self confidence.

Another technique which I think could work for our class is a group process, such as, a small group discussion. I think this method could develop a better learning environment because we will have a reflection and discussion.

I agree with A because we can practise expressing our opinions and learning from our friends through the process of negotiating ideas with our peers.

It would be good to learn from the real situation, we would like to have a field trip and learn many things outside the university

I suggest a self-study method. I mean we can learn anything at any time I want to learn from many sources (such as website, journal, textbook) by myself.

The ideas of A are good, by the way, I think that we should use this information for discussion with our friends in order to make a conclusion

I agree with all of these ideas, but the commitment of the class is very important. I mention this point because the new conditions in new learning strategies, which everyone has to accept, is that we have to work harder than now.

The students were then asked:

So, what do you think? Do you agree or disagree?

The students were encouraged to think about the answer to the last question and they were given time to make a decision about their learning. The idea was that through these discussions, finally, the students would be committed to the intervention.

A list was made of the students' opinions about methods of learning, in order to improve their learning situation, and written on the blackboard. Next, the students were asked to review it again in order to summarize the main content of this focus group discussion. Finally, all of the students supported the conclusions. In this last step, a constructivist learning approach was frequently discussed with the students and they were encouraged to become involved in an intervention based on constructivism theory.

7.4 PRE-ASSESSMENT OF THE STUDENTS' PRIOR KNOWLEDGE ABOUT AIDS

This stage involved assessing the students' current knowledge and understanding about AIDS. This stage is one of the most important steps because students have different backgrounds, different ways of thinking, different prior experiences, and different concepts. Some of their concepts are correct, but others are incorrect. Such knowledge can help teachers to plan for more effective teaching. In another way, if teachers do not know what views students hold, they may teach things that are not suitable/appropriate/relevant to the students' needs or may address problems that the students do not have while ignoring crucial and important misconcepts. With knowledge of students' pre-existing concepts, teachers can more effectively group students in the most appropriate groups.

7.4.1 Assessing students' concepts about AIDS

There are many methods to find out student pre-instruction conceptual understanding or prior knowledge. For example, using interviews, questioning, concept mapping, two-tier testing or placement strategy (Venville, 2003). In this study, opened-end questions were used for probing student understanding. The following steps were used in this process.

1. The teacher described the proposed teaching methods, rationale, and the benefit students could receive from the new learning process. This was the process agreed to following the focus group discussions.

2. The teacher provided a worksheet for each student in the class and explained about the objective and learning activity to be used.
3. Students worked individually to complete the open-ended questions on the worksheet.

3.1. Students had to think about their prior knowledge and past experiences in relation to AIDS to answer these opened-ended questions. The opened-ended questions used were:

What do you know about AIDS?

Do you know the term 'AIDS'?

How does AIDS occur?

How is AIDS transmitted?

What are the symptoms of AIDS?

How can someone prevent AIDS?

Can it be treated?

What is the impact of AIDS?

3.2 Each student wrote her/his answer on the worksheet. They could use other formats, such as a concept map, graph, table, or picture

4. Students worked in a small group brainstorming their ideas and experiences of AIDS.
5. A representative of each group then presented the results of their discussion to the whole class.

7.4.2 Results of assessing students' pre-instruction concepts about AIDS

The results indicated that there were students with many misconceptions about AIDS. Examples of some interesting students' misconceptions were:

Knowledge about AIDS

How can AIDS be transmitted ?

- *Sharing something together, such as scissors for cutting hair, nail clippers, toothbrush, or clothes.*

- *Giving blood or receiving blood.*
- *Having low immunity.*
- *Having more white blood cells than red blood cells.*
- *Sharing the bathroom /bathing with an HIV infected person.*
- *Being bitten by a mosquito.*
- *Touching the skin of an HIV infected person.*
- *Eating food prepared by an HIV infected person.*
- *Swimming with an HIV infected person.*
- *Treatment at a dental clinic.*
- *Working in the same place as an HIV infected person.*
- *Drinking water from the same glass as an HIV infected person.*
- *A person who is infected with HIV, but has no signs or symptoms of AIDS cannot pass HIV to another person.*
- *A baby who is born from a pregnant woman who has HIV has a 100% chance to get HIV.*
- *Men and women are equally vulnerable physiologically to HIV infection.*
- *An infected mother cannot pass the infection to her baby by breast-feeding*

How do you know if you have HIV/AIDS?

- *Have a test of vaginal fluid.*
- *Have a test as soon as you are exposed to risk factors, such as having sex with prostitutes or homosexual person.*

What are a signs and symptoms of AIDS?

- *Asymptomatic period and window period is the same thing.*
- *The asymptomatic period is 6 months to 1 year*

How can we protect ourselves against AIDS?

- *Washing sex organs after sexual intercourse helps to prevent HIV infection.*

Can AIDS be treated?

- *The first stage of AIDS can be cured.*
- *Now we have vaccine to protect against AIDS.*

What is the impact of AIDS

- *AIDS has an impact on a person who is infected.*

Attitudes about AIDS

- *AIDS cannot be easily spread, It is not necessary to prevent it.*
- *It is normal for males to have sex with many different females.*
- *Having sex only once cannot cause infection with AIDS.*
- *A person who has good health has no chance of being infected with AIDS*
- *We should not live with a person who has HIV.*
- *Donating blood can be a cause of AIDS.*

In order to make sure, confirm and increase understanding about the students' prior knowledge, these misconcepts were explored using informal interviews and discussions about the reasons for their thinking. Therefore, some interesting points about these misconcepts were explored. The following sections describe the additional detail that resulted from this process.

Misconcept 1.

A person who is infected with HIV, but has no signs or symptoms of AIDS cannot transmit HIV to another person. It was apparent that the reason for this misconception is that the students believe that if some person gets HIV, but there are no symptoms, he or she cannot transmit HIV to another person. Therefore, a person who is infected with HIV can transmit HIV to another person when he or she has signs or symptoms of AIDS. This misconception can have a huge effect on HIV infection because prevention behaviour may not be used if they think that AIDS can not be transmitted.

Misconcept 2

HIV can be transmitted by: sharing something together, such as scissors for cutting hair, nail clippers, toothbrush, glass or clothes; living in some place with an HIV-infected person, and sharing the bathroom; swimming pool, or work place; touching the skin of an HIV-infected person; or eating food prepared by an HIV-infected person. These misconcepts are the main causes for rejecting an HIV-infected person. Therefore, one of the most important problems is the social rejection of an HIV-infected person. Therefore, infected persons are in a bad situation and find living difficult every day. The reason for this misconception is because the students lack

knowledge. Some students are not sure what is the truth/fact about this point, and some of them are not completely clear. For example, the students thought that they could get HIV if they drank water from the same glass as an HIV-infected person. Because HIV can be found in body fluids, like blood, semen, vaginal fluids, breast milk and salivary, the students thought that any practice (such as drinking water from the same glass as an HIV-infected person) would allow the penetration of the HIV from this fluid and cause HIV infection.

Misconcept 3

The third misconception was related to lack of trust in the hospital system. The students think that giving blood or receiving blood can result in being infected with HIV because they have heard news about HIV-infected blood being donated and some of them said that the laboratory in the hospital is not reliable. Similarly, treatment at a dental clinic may result in infection with HIV because the students think that the dentist may use the same instruments for many patients. Also, they do not understand about aseptic techniques, therefore, they do not trust the treatment in a dental clinic.

Misconcept 4

Other misconceptions relate to human physiology, such as: people can get HIV if they have low immunity; having more white blood cells than red blood cells; a baby who is born from a pregnant woman who has HIV has a 100% chance of getting HIV; an infected mother cannot pass the infection to her baby by breast-feeding; and males and females are equally vulnerable physiologically to HIV infection. The students thought that this knowledge was too deep for them. Although the students have learned about human anatomy and physiology in the first year of the undergraduate curriculum, they study in general and do not have a deep understanding since they have learned by receiving information from the lecturer and a very big textbook. As a result, they cannot recall their past knowledge.

Exploring students' misconceptions about diagnosis of AIDS.

Misconcept 1

Some of the students thought that HIV can be detected by many laboratory methods. For example, testing of vaginal fluid, testing blood as soon as exposed to risk factors,

like having sex with prostitutes or homosexual persons who may have HIV. The reasons for these misconcepts are related to the students' prior knowledge where they noted that HIV can be found in body fluids, like blood, semen, vaginal fluids, breast milk and saliva. Therefore, testing vaginal fluid can detect HIV infection. They also thought that if they indulge in risky behaviours, they should be tested as soon as possible after they have been exposed to the risk factor.

Exploring students' misconcepts about signs and symptoms of AIDS.

Misconcept 1

There were some students who were confused about the term asymptomatic period and window period. They thought that these two technical terms had the same meaning. The reason for this misconception is that students lack knowledge and higher - order thinking skills, such as, critical thinking. The students had received information stating that an HIV-infected person in the window period does not have any signs and symptoms of AIDS. Therefore, they interpreted this to mean that asymptomatic period and window period had the same meaning.

Misconcept 2

Some of them thought that the asymptomatic period was from six months to one year. The students explained that after one person gets HIV, then six months to one year later the signs and symptoms of AIDS will occur. If there are no signs and symptoms of AIDS in this period, then, we can imply that this person is safe. The students again shown that they are lacking of critical thinking skill.

Exploring students' misconcepts about AIDS prevention.

Misconcept 1

The students explained that there are many methods of prevention of AIDS. Washing sex organs after sexual intercourse can prevent HIV infection. This information indicated that the students have a huge misunderstanding about AIDS prevention. This incorrect knowledge may be the cause of increase HIV-infected persons.

Exploring students' misconcepts about treatments of AIDS.

Misconcept 1

There are three main misconcepts about the treatment of AIDS: the first stage of AIDS can be cured; if the doctor diagnoses it early; some herbs can cure AIDS; and now we have a vaccine to protect us against AIDS. Although only a few students thought that AIDS can be cured, this incorrect concept is important because if the students think that AIDS can be cured, they may not protect themselves against HIV infection. The reason for those misconcepts are that the students have past experiences about other diseases which can be cured in the early stage. Since AIDS has spread widely, scientist are trying to produce a vaccine for prevention. There are many experiments, but none of them have been successful. Furthermore, some Thai traditional medicine suggest the use of some herbs for curing AIDS and give information through the newspaper and other channels. Therefore, the students receive this information and have incorrect prior knowledge.

Exploring students' misconcepts about the impact of AIDS.

The students think that AIDS only has an impact on a person who gets HIV because they think in one dimension (only about the patient). This is not completely incorrect, but it is also not a completely correct understanding about the impact of AIDS. The students do not think about other dimensions which relate to a person, such as their family, social and economic well being. This point of view can have an effect on the awareness of the severity of AIDS problem.

According to this process of pre-instruction about the concepts related to AIDS, the students have many important misconcepts. This information is very useful for the teacher and the students in order to guide them in setting their learning goals and planning learning activities based on a constructivist teaching approach to attempt to change these misconcepts and improve students' perceptions of their Health Science classroom learning environment

7.5 SETTING THE LEARNING OBJECTIVE

Learning objectives can be defined as the intended products of instruction that the students should be able to do, know, and/or understand by the end of the hour, topic or course. If the learning objectives of the course are not clearly understood by both the instructor and the students, the learning and teaching process could be misleading, irrelevant, or even useless.

There are 44 Rajabhat Universities in every part of Thailand most of which are using the curriculum developed by the Office of the Rajabhat Council, Ministry of Education. This curriculum contains the learning objectives of each subject. Therefore, the lecturers in the 44 Rajabhat Universities use the same learning objective and the students do not have a chance to make any decisions about what they should learn. My teaching experience is that some learning objectives are not appropriate for the students in every area because students in different part of Thailand have different characteristics. Therefore, in this study, the students were encouraged to set their own learning objectives, in order to learn the things that they believed were suitable for their needs.

Andrews suggested that guideline questions can be used to develop learning objectives as a mean for planning an effective course. These questions are:

- 1) How does the instructor want the students to change or achieve something as a result of this class?
- 2) What should they be able to do that they cannot do now?
- 3) How are the changes to be measured?
- 4) What subject matter will be covered to help students to meet their learning objectives? (Andrews, 1982, p. 3).

*Now, all Rajabhat Universities are in the process of adjusting and develop their own curriculum and will use their own curriculum in the first semester (June to September) of the academic year 2006.

It is a fact that students in Health Science classrooms have never been involved in the process of setting their learning objectives. This is new for them, therefore, the guideline questions were used to make it is easier for them to think and create their learning objectives.

According to Thai culture and social norms, Thai children should be strictly obeying the elders and should not ask any questions. Raising a voice in the classroom is a sign of disrespect to the authority of the teachers. Therefore, Thai teachers in the past have always used traditional teaching activities which emphasized a teacher-centred focus with students learning in a passive way. The class has been dominated by teacher talk and depends on textbooks. In this research, the students were encouraged to get involved in every step of the learning process. In this stage, the guideline questions were constructed and used to encouraged the student to set their learning objectives for the AIDS topic. The guideline questions were:

- 1) What do you already know about AIDS and what will you need to know about AIDS?
- 2) What are your learning objectives for the AIDS topics?

The first question was to encourage students to rethink about their prior knowledge and think about the new things that they need to know on the AIDS topic. The answer to this question led to and related to the answer to the second question. The second question was to encourage students to set their own learning objectives and to participate actively in the learning process in an attempt to achieve their learning objectives.

7.5.1 The process used for setting students' own learning objective

There are many methods used to encourage students to get involved in the learning process and express their opinions. For example, small group discussion, placement strategy technique, and card technique. The card technique is one teaching method used to encourage the students to express their opinions to the whole class. The card technique was used in this process because some students in the class do not like to speak or express their opinions to their friends, while some students speak too much

and dominate other students. The card technique provides equal opportunities for all students to express their opinions to the class by writing on the card and reading this to the class.

1. The objective and learning activity were described carefully to the students because this was the first time students had set their own learning objectives. Therefore, the teacher informed the students about the proposed teaching methods and the rationale and the benefit students could receive from this process.
2. One card was given to each student.
3. The students worked individually and thought about their expectations of this unit while considering the previous two questions.
4. The students wrote their learning objectives of this topic on the card and glued it to the backboard.
5. The students then discussed and combined their learning objectives in order to summarize the learning objectives of their class.

7.5.2 The results of setting students' learning objectives on AIDS topic

The results from this learning activity was that the students believed they needed to learn about AIDS in seven subtopics: history of AIDS; causes of AIDS; transmission of AIDS; signs and symptoms of AIDS in each stage; severity and other complications; treatments of AIDS; other alternative medicine to cure AIDS; methods of taking care or living with an HIV-infected person; prevention of AIDS and the progression to develop a vaccine to prevent AIDS; using condoms; and the impact of AIDS. These topics were then used as a basis to develop the learning objectives. The three main dimensions of intellectual behaviour of Bloom's taxonomy (Bloom, 1956) provided a structure for writing the learning objectives as follows:

After finishing the course on AIDS the students should be able to:

1. Cognitive domain
 - define the full name of AIDS.
 - describe the history of AIDS.
 - know the causes of AIDS
 - understand how AIDS can be transmitted

- understand the stages of symptoms of AIDS
- know about the treatment of AIDS
- describe methods of taking care of an HIV-infected person
- know the methods of prevention of AIDS
- describe the impact of AIDS
- transfer knowledge of AIDS to their practical daily life.

2. Affective domain

- have a positive attitude towards prevention of AIDS.
- have a positive attitude towards curing of AIDS.
- have a positive attitude when dealing with an HIV-infected person

3) Psychomotor domain

- have the skill of using a condom.

Furthermore, the students suggested further learning objectives which they needed to achieve from the learning activities which were:

- 1) The students develop their social skill (such as, working in a group).
- 2) The students develop their presentation skill.
- 3) The students develop their thinking skill.
- 4) The students develop their communication skills.

7.6 THE STUDENT-PLANNED LEARNING ACTIVITIES BASED ON CONSTRUCTIVISM THEORY

In this step, the teacher provided an opportunity for the students to become involved in planning their own learning activities enabling the students to have their preferred learning activities. Therefore, they would enjoy their learning more, develop their thinking skills, and take more responsibility for their own learning. They were able to construct their own plan to achieved their learning objectives.

Initially, the teacher encouraged each student to think about the learning activities and make their own personal study plan. Each student could use different methods and use a variety of resources inside and outside the class. The question usually used to encourage the students on this task was:

How can you learn about AIDS?

The students then worked in small groups and discussed their ideas with their peers in order to integrate their learning activities. The learning activities were then summarized with the rest of the class. Some of the ideas suggested were:

- The students can learn by themselves by reading the textbook, search information via the Internet, multimedia, other media (TV, radio, journal, newspaper)*
- The students can learn from the real situation, such as field trip and talking with an HIV-infected person.*
- The students would like to invite guests (such as, an expert on AIDS, doctor, an HIV-infected person)*
- The students wish to attend a training program about AIDS.*
- The students preferred the active participatory learning activities which not too serious or not only address on the theory, but also related to their real life and fun such as game, or example of scenario in real situation*
- The students need the learning activities which can encourage them to have self-confidence, social skills for working with others, problem solving skills or thinking skills, such as small group discussion, problem based learning.*

Finally, the teacher and the students worked together in order to integrate the learning activities and plan the lessons about AIDS. The details of learning activities planned for each subtopic of AIDS are describes in the Table 7.2.

Table 7.2

The Students' Learning Plan Described by Each Subtopic of AIDS

Topic/contents	Learning activities
1.The history of AIDS.	-Self-direct learning (from several source, such as textbook, search information via Internet, journal, newspaper) -Small group discussion
2.The causes of AIDS.	-Game -Small group discussion
3.The transmission of AIDS.	-Game -Small group discussion
4.The signs and symptoms of AIDS.	-Field trip -Guest speaker (an HIV infected person, doctor)
5.The treatments of AIDS.	-Field trip -Guest speaker (an HIV infected person, doctor)
6.How to taking care or living with an HIV infected person	-Search data from many source, such as Internet, textbook, journal, newspaper -Small group discussion
7.The prevention of AIDS	-Demonstration and practice -Small group discussion
8. The impact of AIDS	-Search data from many source, such as Internet, textbook, journal, newspaper. -Interviews an HIV infected person -Small group discussion about example of scenario

7.7 SUMMARY

This chapter has described the results of using the CLES to investigate students' perception of their learning environment in Health Science classrooms. Following this, focus group discussions were used to generate feedback for reflection and discussion about the results of the CLES in order to construct an appropriate intervention attempt to improve learning environment and as a consequence achievement. This chapter also described the results of assessing students' prior knowledge about AIDS. Then, the teacher and the students worked together in order to encourage the students to set their learning objective and planned about the learning activities based on a constructivist approach.

CHAPTER EIGHT

IMPLEMENTATION OF THE INTERVENTION BASED ON A CONSTRUCTIVIST TEACHING APPROACH

8.1 INTRODUCTION

The previous chapter described the results of pre-assessment of students' perception of their classroom learning environment and students' knowledge about AIDS prior to the implementation. The previous chapter also provides information on how the intervention was constructed, setting the learning objective and planned the learning activities based on the constructivism theory. This chapter describes the details of each stage of implementation of the intervention including the results of formative assessment of the learning process. The purpose of this chapter is to answer the second research questions that asked, What are the characteristics of a constructivist approach to learning in Health Science classrooms in Thailand? This stage was conducted during the duration of the first semester (July to September, 2004). The topic AIDS was selected for the reasons described previously. The learning activities included self-directed learning, small group discussion, game, field trip, and presentation. Formative assessment data were collected with a questionnaire, and form informal discussions and observations. The details of the eight learning activities are described in the following sections.

8.2 IMPLEMENTING CONSTRUCTIVIST LEARNING ACTIVITIES

8.2.1 Learning Activity 1: The history of AIDS.

A self-directed learning method and a small group discussion were both used in this subtopic. The self-directed learning method was used to encourage students to learn from several sources. This method can develop students' learning skills and help them to know how to learn, allowing them to find answers or solutions to problems in real life. The small group discussion was used for reflection and discussion about

information retrieved from difference sources. This method also helped develop the students' social skills in group working.

The instruments used in this learning activity consisted of a worksheet and sources of information, such as the textbook, journals, and the Internet (see Appendix G)

1. The students were divided into four groups of equal size. The students were asked about the method and the criteria for allocating members to each of the group. The students suggested that the members of a group for each of learning activities should be different because they would like to have the experience of working with different people. The students' ID number was used as a method for deciding the membership of a group for the first learning activity.
2. A worksheet was provided to each group and the teacher explained the learning objectives and learning activities to the students.
3. Each group selected their preferred method for searching for information about the history of AIDS. It was decided to used these four methods:
 - Group 1 websites
 - Group 2 textbooks
 - Group 3 journals
 - Group 4 research studies or theses
4. The students were encouraged to working in a group in order to review the learning activities and use the information that they have got from difference sources in order to: 1) combine similar information and generate a consensus; and 2) negotiate differences of opinion and integrate the opinions of others into their views. Finally, the students draw conclusions that will help them to answer their questions on this subtopic on the worksheet.
5. A representative from each group then presented the information to the class. Finally, the students were encouraged to think about the knowledge and learning experience that they had gained from this learning activity.

Assessment of effectiveness of Learning Activity 1

The assessment method used to evaluate this activity was a group work checklist. The group work check list was constructed so that the students could assess their social skills when working together. The criteria for assessment and the scoring rubric were constructed by the students together with the teacher. The steps of the construction were as follows:

The teacher encouraged the students to think about the criteria for judging good group work and wrote their suggestions on the blackboard. The students combined their ideas and described the details of each criterion. A scoring rubric was then made resulting in five levels of performance for group work.

The ten criteria that were chosen were as follows: sharing opinions with the group; explaining ideas completely and clearly; encouraging others to work together; accepting the ideas of others and the group decision; being adaptable and flexible when working with others; having the responsibility to complete the work; offering assistance appropriately to the group; feeling happy when working in the group; receiving benefits from social interaction in the group; being satisfied with the results of the group work

The scoring rubric for assessing these students social skills that was constructed was:

Level 5 Very satisfied (total scores 81-100 %)

The members of the group always had very good roles in group work.

Level 4 Satisfied (total scores 61-80 %)

The members of the group usually had very good roles in group work.

Level 3 Acceptable (total scores 41-60 %)

The members of the group sometimes had very good roles in group work.

Level 2 Dissatisfied (total scores 21-40 %)

The members of the group seldom had very good roles in group work.

Level 1 Very dissatisfied (total scores 0-20 %)

The members of the group never had very good roles in group work.

Finally, the group work check list was composed of two sections. The first section was for students to assess themselves when working in a group. This section contained 15 items and open-ended questions allowing for comment. The content included students' actions when working in a group and students' opinions about working with others. The second section was for students to assess their group when working together. This section contained 14 items and open-ended questions. The contents included the atmosphere when working in a group, the actions when group members were working together, how the members managed the group work and the members' opinions about the result of the group work. The responses to the items were provided as levels of satisfaction: Very Satisfied, Satisfied, Acceptable, Dissatisfied, Very Dissatisfied (see Appendix I). The students assessed the group work check list after the completion of the small group discussion.

Each item of the group work check list was scored according to the rubric by using a score from one to five ranking from Very Dissatisfied to Very Satisfied. The total score in each section was the sum of the scores of all items. A higher score indicated more effective social skills in group work.

Results of group work check list assessment

The results of students assessing themselves when working in a group indicated that the item mean scores ranged from 3.89 to 4.89 and there is only one item about encouraging the students to work together where the item mean score was less than 4.00. The percentage of students described by the alternative responses of each item when students assess themselves in group working indicated that the large group of the students assessed themselves in the high level (always and usually). The details are shown in Table 8.1

The results of students assessing their group when working together indicated that the item mean scores ranged from 4.33 to 4.83. This was a similar pattern to when they assessed their individual role where the scores ranged from 3.89 to 4.89. The details are shown in Table 8.2

Table 8.1

Item Means and Percentage of Students Described by the Alternative Responses of Each Item when Students Assess Themselves in Group Working.

Item	Always	Usually	Sometime	Seldom	Never	Mean
1. I shared my opinions with others	55.6	44.4	0.0	0.0	0.0	4.44
2. I could explain my ideas clearly to others	16.7	83.3	0.0	0.0	0.0	4.17
3. I encouraged others to work together	22.2	44.4	33.3	0.0	0.0	3.89
4. I accepted the ideas of others	88.9	11.1	0.0	0.0	0.0	4.89
5. I accepted group decisions	88.9	11.1	0.0	0.0	0.0	4.89
6. I was adaptable and flexible when working with others	83.3	16.7	0.0	0.0	0.0	4.83
7. I felt responsibility to complete the work	55.6	44.4	0.0	0.0	0.0	4.56
8. I was a good participant as a member of the group by offering assistance appropriately	33.3	66.7	0.0	0.0	0.0	4.33
9. I could work with others well	72.2	27.8	0.0	0.0	0.0	4.72
10. I felt happy working in the group	50.0	44.4	5.6	0.0	0.0	4.44
11. I didn't have any conflicts working in the group	38.9	50.0	11.1	0.0	0.0	4.28
12. I could learn by social interaction with others	66.7	33.3	0.0	0.0	0.0	4.67
13. I received benefits from the group work	50.0	50.0	0.0	0.0	0.0	4.50
14. I was satisfied with the output and the result of my group work	33.3	55.6	11.1	0.0	0.0	4.22
15. Overall I was satisfied with my role	50.0	50.0	0.0	0.0	0.0	4.50

Table 8.2

Item Means and Percentage of Students Described by the Alternative Responses of Each Item when Students Assess Their Group when Working Together.

Item	Always	Usually	Sometime	Seldom	Never	Mean
1. Everyone attempt to exchanged their opinions with other	50.0	50.0	0.0	0.0	0.0	4.50
2. Everyone have assigned the work responsibilities appropriate with their ability	44.4	50.0	5.6	0.0	0.0	4.39
3. Everyone attempted to help others to learned in a group	50.0	50.0	0.0	0.0	0.0	4.50
4. Everyone have a reasonable discussion, negotiation in order to made conclusion	38.9	55.6	5.6	0.0	0.0	4.33
5. Everyone have learned from group process	44.4	50.0	5.6	0.0	0.0	4.39
6. The group has a good communication	83.3	16.7	0.0	0.0	0.0	4.83
7. Everyone understand the objective of group working	61.1	38.9	0.0	0.0	0.0	4.61
8. Everyone get involved in decision making of a group	50.0	50.0	0.0	0.0	0.0	4.50
9. Everyone attempted to encourage other	50.0	50.0	0.0	0.0	0.0	4.50
10. Everyone listened actively to others speaking	83.3	16.7	0.0	0.0	0.0	4.83
11. Everyone accepted a group decision	77.8	22.2	0.0	0.0	0.0	4.78
12. Everyone flexible to work with other	44.4	50.0	5.6	0.0	0.0	4.39
13. Everyone felt responsibility for completing his/her part of the work	27.8	66.7	5.6	0.0	0.0	4.22
14. Everyone get involved in every of a group activities	44.4	55.6	0.0	0.0	0.0	4.44
15. When problems arised in the group, everyone offered assistance appropriately and considered different ways of solving problems	38.9	61.1	0.0	0.0	0.0	4.39
16. The group spent time efficiently when working together	38.9	55.6	5.6	0.0	0.0	4.33
17. Everyone felt happy working in the group	61.1	38.9	0.0	0.0	0.0	4.61
18. Everyone could learn by social interaction with others	50.0	50.0	0.0	0.0	0.0	4.50
19. The atmosphere in group working was relax	50.0	50.0	0.0	0.0	0.0	4.50
20. Everyone received benefits from the group work	61.1	38.9	0.0	0.0	0.0	4.61
21. The group working was organized efficiently and effectively	66.7	33.3	0.0	0.0	0.0	4.67
22. Everyone was satisfied with the output and the result of the group work	66.7	33.3	0.0	0.0	0.0	4.67
23. Overall I was satisfied with my group	61.1	38.9	0.0	0.0	0.0	4.61

According to Tables 8.1 and 8.2, the results show that the students did work with one another very well. The qualitative data from observations showed that there was indeed a very good group process operating. The students had a good feeling when working in a group. However, there were some students (two to three persons) talking or doing something irrelevant while they were working in the group. After their friends encouraged them to be more involved, they stopped talking and discussed the topic with the other members. Qualitative data from informal interview were collected when the group working had been completed. Examples of students' opinions were as follows:

My group has learned from the Internet and it's very interesting. There is a lot of information on the Internet. We also learned by discussing the topic with our friends in other groups.

I have learned not only about the history of AIDS, but also learned to work with other students, such as how to be adaptable with my friends, how to listen to others and how to accept the group decision.

All of us enjoyed being involved in the group work.

All member of this group shared their opinions during the period of time of group working.

One of the most important things was how to organize our group in order to achieve the objective of this task. I found that I could do it well.

The history of AIDS is very interesting and individual differences in the same group is a new challenge for me.

I'm so bored when some of my friends are talking off the topic and they are difficult to change. By the way, we used the rules of our group to manage these people.

The history of AIDS is the main objective, but I have learned many other thing from group work. For example, when the members of the group had conflicts, we learned about conflict management.

8.2.2 Learning Activity 2: The causes of AIDS.

A game and a small group discussions were used in this subtopic. The game was used to create an active participatory learning activity, and used to encourage a good learning environment, while the students learned about the causes of AIDS at the same time. A small group discussion was used for reflection and discussion on knowledge or experiences which students gained from the game. This method also helped develop the students' social skills in group working.

The instruments used in this subtopic consisted of a worksheet and the materials used for a game, cards, colour pens, sticky tape. (see Appendix I)

1. The students were divided into four groups of equal size. Simple random sampling was used as a method for deciding on the members of a group.
2. Two sets of word cards were provided to each group. In the first set, each card had the name of one occupation (such as police, nurse, teacher). The second set contained a health risk behaviour (such as having sex without a condom, drinking water from the same glass as an HIV-infected person).
3. The teacher explained the directions of the game. The details of the two rounds of the game are as follows :

First round

1. The students were encouraged to think about the risk factors of getting HIV in different occupations.
2. They then arranged the cards from the highest risk to the lowest risk occupation.
3. The students discussed with their peers the reasons of arranging the occupations in this order.

4. When they were satisfied with their arrangement of the cards, they stuck the cards on a sheet of paper.

Second round

The process was the same as in the first round, but the word card was changed from occupation to health risk behaviour.

4. A representative from each group then presented their results and explained the reasons why they thought this occupation or health risk behaviour had the highest risk factor for infection with AIDS.

The point of the game is that a person's risk of getting an HIV infection is not dependent on their occupation, but on how they behave in relation to the risks. For example, a prostitute having sex using a condom has less risk of getting HIV than another person who has sex without a condom.

5. The students again reflected and discussed this actively in order to combine their information and generate a consensus and negotiate differences of opinions. Finally, the students wrote their conclusions on the subtopic of the causes of AIDS on their worksheets.
6. Finally, the students were encouraged to think about the knowledge and learning experiences that they had gained from this learning activity.

Assessment of effectiveness of Learning Activity 2

The assessment method used to evaluate this activity was concept mapping. A concept map was used to find out what students had learned and how well they understood the concepts and ranking of the ideas of the causes of AIDS. Concept mapping was designed to allow students to work individually. The teacher prepared a worksheet by making a list of items of health risks that may be related with the causes of AIDS. The steps of constructing the concept map were described to the students, including how to select a word and link relationships between words.

The researcher interpreted the results by checking the concept map. The criteria for checking were: how well the students identified concepts, organized the concepts, and linked the concepts on causes of AIDS

Results of concept mapping assessment

The results of the concept mapping indicated that most of the students could group the concepts and link the association between the causes and the results correctly. However, there were some students who had incorrect concepts about the causes of AIDS, for instance, people can get HIV from operations. In this case, the students do not trust in the aseptic or sterile techniques that doctors use in operation rooms. Furthermore, there were ten students who did not have a clear concept about the causes of AIDS. For example, four students wrote about kissing in their concept map and did not mention anything about wet or dry kissing or having sores in the mouth, eight students wrote about having an open wound and touching blood but did not mention whose blood, a healthy person or an HIV-infected person.

After checking the concept maps, the teacher and the students had a discussion about incorrect concepts and the concepts that were not clear in order to achieve more understanding in this session.

8.2.3 Learning Activity 3: The transmission of AIDS.

A game and a small group discussion were used in this subtopic. The game was used to create active participatory learning activities, allow the students to have fun and encourage a good learning environment, while learning about the transmission of AIDS at the same time. The game also can develop students' thinking skills about scientific processes.

The instruments used in this subtopic consisted of a worksheet, plastic glass, pure water, disposable syringe, Phenolphthaline indicator, and 0.1% Sodium Hydroxide solution. (see Appendix J)

1. The teacher prepared 20 plastic glasses, then, put 50 ml. of the pure water into 19 plastic glasses and the solution of 0.1 % Sodium Hydroxide solution 50 ml into one plastic glass.
(The students were not told which glass is different from the other)
2. The learning objectives, learning activities and direction of the game were explained to the students.
3. Each student picked one glass for him or herself. Then, each student exchanged 5 ml of their liquid with other students by using the syringe. Five volunteer students exchanged their liquid with other students one at a time. The rest students exchanged their liquid with other students for five time, but they could not repeat with the same students
4. The teacher used two to three drops of Phenolphthaline as an indicator to test the 0.1% Sodium Hydroxide solution in each glass.
5. The teacher encouraged the students to use the Predict- Observe- Explain method by predicting the results of the test, observing what happen in each glass, and explaining the results.
(The answer is that, if the glass of water had 0.1% Sodium Hydroxide solution, the solution will change the color to the red solution).
6. In thinking about the results of this game the students answered these questions.

1. In how many glasses has solution changed to a red colour?
2. Did you think how many students had different solutions at the beginning of the game?
3. How is the 0.1% Sodium Hydroxide solution spread?
4. By way of analogy, imagine the student who pick the glass with 0.1% Sodium Hydroxide solution is an HIV-infected, do you think AIDS can be transmitted like that?

7. The students worked in groups to review this learning activity and drew conclusions about the transmission of AIDS on their worksheets.
8. Finally, the students were encourage to think about the knowledge and learning experiences they had gained from this learning activity.

Assessment of effectiveness of Learning Activity 3

A short quiz was used for formative assessment in this section was to assess students' knowledge about the methods of AIDS transmission. From this instrument, the researcher could find out what the students knew about AIDS transmission and how much the students understood this. The short quiz of 25 items was created by writing the ways that AIDS can be transmitted and the ways that AIDS cannot be transmitted. The answers consisted of three choices (can be transmitted, cannot be transmitted and not sure).

Each item of the short quizzes was scored by checking the number of correct answers and incorrect answer for each question. The correct answer received 1 and the incorrect answer received 0. The total score was the sum of all items.

The results indicated that a large group of the students (55.6 %) had scores in the high level, 27.7% of the students had scores in the middle level, and 16.7 % had scores in the low level.

Table 8.3 shows the percentage results for each item of knowledge about AIDS transmission. The results indicate that there are some students also still have misunderstanding and answer incorrectly in many items. For example, 66.7% of the students answered incorrectly about sharing a toothbrush with an HIV-infected person and sharing nail clippers with an HIV-infected person and 50.0% of the students thought that they can get HIV via eating food prepared by an HIV-infected person. Another misconception is about contamination of the secretion of an HIV-infected person to eyes (38.9%). On the other hand, 33.3% of the students did not trust in the quality of condoms. Therefore, they thought that having sex with an HIV-infected person was still a risk, although a condom was used.

Table 8.3

Percentage of Students Described by Each Item on Answers about AIDS Transmission

Item	Correct answer	Incorrect answer
1.Sharing the bathroom /bathing with an HIV infected person	88.9	11.1
2.Being bitten by a mosquito	72.2	27.8
3.Having sex with an HIV infected person without a condom	94.4	5.6
4.Wet kissing with an HIV infected person and having open sores in the mouth	72.2	27.8
5.Touching the skin of an HIV infected person	77.8	22.2
6. Washing sex organs after having sex with an HIV infected person	88.9	11.1
7.Eating food prepared by an HIV infected person	50.0	50.0
8. Sharing a toothbrush with an HIV infected person	33.3	66.7
9.Swimming with an HIV infected person	77.8	22.2
10.Sharing clothes with an HIV infected person	77.8	22.2
11.Receiving blood	72.2	27.8
12. Receiving organs from an HIV infected person	77.8	22.2
13.Giving blood	83.3	16.7
14.Treatment at dental clinic	72.2	27.8
15.Passing from an infected mother to the newborn child by blood	77.8	22.2
16. Passing from an infected mother to the baby by breast feeding	77.8	22.2
17. Having sex with an HIV infected person with a condom	66.7	33.3
18. Having an open wound and touching secretion of an HIV infected person	77.8	22.2
19.Sharing needles for drug use	94.4	5.6
20.Working in the same place as an HIV infected person	88.9	11.1
21.The doctor operating an HIV infected person	72.2	27.8
22.Cutting the skin with a needles for an injection of an HIV infected person	94.4	5.6
23. Sharing nail clippers with an HIV infected person	33.3	66.7
24.Eyes becoming contaminated by the secretion of an HIV infected person	61.1	38.9
25.Having a hand with a wound contaminated by the blood of an HIV infected person	100.0	0.0

8.2.4 Learning Activity 4: Signs, symptoms and treatments of AIDS.

In this subtopic, a field trip and special lecture from a guest speaker were used to encourage students to learn about signs and symptoms and treatment of AIDS. A field trip was used to encourage the students participate actively in the learning activities. Furthermore, students could learn from several sources of real life experiences. Meeting a guest speaker, like a doctor or an HIV-infected person presented new challenges for the students. These learning activities created a different learning environment from the normal class and were more fun and exciting.

The instrument used in this subtopic was a worksheet (see Appendix K).

- 1 The learning objectives and steps in the learning activity were explained to the students.
- 2 The teacher and the students had a field trip to the Department of AIDS and Sexually Transmitted Disease, at the Udonthani Hospital in order to learn about signs and symptoms of AIDS and the treatment of AIDS.
- 3 A doctor briefed the students on the signs, symptoms and treatments of AIDS.
- 4 The teacher and the students visited an HIV- infected person in a community in a village in a suburb of Udonthani Province.
- 5 The students asked for permission to interview the HIV- infected person.
- 6 The students came back to the university and worked in a group to review this learning activity, combine similar information, generate a consensus, negotiate differences of opinions and integrate opinions of others into their views. They compared the information from the doctor and the patient. Finally, the students wrote their conclusions on the worksheet and reflected on this learning experience.

Assessment of effectiveness of Learning Activity 4

The assessment method used to evaluate this activity was open-ended questions. The open-ended questions were constructed in order to find out the students' knowledge or experience that they have gained from this learning activity. The four open-ended question were:

What are the symptoms of AIDS?

What are the stages of the symptoms of AIDS?

Can AIDS be treated?

What is the treatments for AIDS?

The students answered these opened-ended questions. The results of the students' answers are described in the following section.

Results of open-ended question assessment

The results of students' open-ended questions indicated that the students had received a lot of knowledge about the symptoms and the treatment of AIDS and it was noticed that some students' misconcepts had been changed. A summary of students' answers follows:

The signs and symptoms of AIDS

- The students have learned about the difference between the terms of an HIV infected and an AIDS patient.*
- The symptoms of AIDS have four stages, asymptomatic period, AIDS related complex and full blown AIDS.*
- The students have a clear concept about each stage of AIDS.*
- The students understand the difference between the terms asymptomatic period and window period.*

The treatment of AIDS

- The students have learned about conservative treatments for an infected person and AIDS patients.*
- The students learned about holistic care for an infected person and AIDS patients.*
- The students learned some alternative ways for cure AIDS from talking with an infected person. For example, herbs, Thai traditional medicine, needle puncture. However, these methods are not accepted or proved by scientific method.*

The results of observations have shown that although some students felt nervous about meeting an infected person, they were excited to have a field trip to the hospital. Many students asked questions about how to prepare themselves. Some of the students reviewed past lessons in order to have a better understanding in a new learning experience, and some of them prepared questions before the field trip. All of the students paid attention to the guest speaker during the visit to the hospital and at the village. They asked some questions and had discussions with the guests. After they returned to the university, the students worked in small groups discussing their learning experiences on this field trip, and then, each group wrote a conclusion on their worksheet. Some students were still confused about some points. (i.e. differentiation between the terms infected person and AIDS patient, and effectiveness of herbs to cure AIDS). Therefore, the students made assumptions about these, in order to make it clear. The researcher also found that the class work occurred in a good atmosphere. They showed great enthusiasm about their learning experiences outside the classroom as confirmed by typical comments as follows:

It's was very exciting when we learned from the real situation rather than learn from the textbook in the class.

This learning experience is very useful, it not only gave me new knowledge about AIDS, but also gave a chance for me to have a better understanding about other people's lives in many dimensions and these can help me to understand about my life and the world around us.

It was very interesting, I will tell my parents about these learning experiences

Listening to the doctor give me more understanding and I can change my misconcepts about AIDS

8.2.5 Learning Activity 5: Caring for or living with an HIV-infected person.

A simulated story about AIDS from a video and small group discussion were both used in this subtopic. The simulated story helped the students to imagine what living with an HIV infected person would be like. Although the students had some prior experiences from many sources, such as movies and websites, and had talked with an HIV-infected person, they had not seen a complete picture of living of an HIV-infected person. Small group discussion was used to encourage the students to reflect and discuss from their experiences with this story.

The materials used in this subtopic consisted of a video and a worksheet. (see Appendix L)

1. The learning objectives and the learning activities were explained to the students.
2. The students watch the simulated story about AIDS from video tape.
3. The students were divided into four groups of equal size.
4. The students were encouraged to think about the story and have a discussion about how to live with and take care of an HIV-infected person.
5. The students drew conclusions in the form of an essay about living with and taking care of an HIV-infected person.
6. A representative from each group presented the results of group working by role playing.
7. Finally, the students were encouraged to think about this learning activity

Assessment of effectiveness of Learning Activity 5

The assessment method used to evaluate this learning activity was to write an individual answer to two questions.

1. If you had to live with an HIV-infected person,
how could you protect yourselves from HIV infection ?
2. How can you take care of an infected person?

Results of essay writing assessment

The essays were read and summarized. The results indicated that students' found that they had learned a lot of new knowledge and they had changed their concepts as indicated in the following comments.

- If a husband or wife is getting HIV and they would like to have sex, they have to use a condom.*
- If clothes or instruments are contaminated with the blood or secretion of an infected person, we can kill an HIV by boiling the cloths, etc. in water for 30 minutes.*
- It is not necessary for a family to isolate the equipment of an HIV-infected person (such as plate, glass,).*
- An HIV-infected person should not take medicine designed to decrease immunity.*
- An HIV-infected person should take medicine and go to see the doctor at the hospital.*
- If it is not necessary, do not bring an infected person to the place which might be crowded (such as, hospital, theatre) because these place are easy to get the new agent.*
- A woman who is HIV infected should not become pregnant.*
- The family should support an HIV-infected person, such as listen to their problems.*

- *The family should not isolate a person who has HIV from the rest of family or society (such as can live in the same room, eating food made by an infected person)*
- *An HIV- infected person and their family can share the bathroom.*

Furthermore, the results from observations found that the student enjoyed this learning activity because they always demonstrated positive behaviours, such as discussing with their friends, smiling, being involved in their group activities by role playing in their presentation. They also expressed their opinions about the learning experiences as described below :

This video helped me to create a clear picture in my mind about how to live with an infected person.

At first, I could not imagine how people live in this very hard situations, but I have seen that it does not have to be hard and does not have scaring. The most important thing is that you just open your mind and give love, and then, you will know how to take care of these people.

This learning activity was enjoyable and it was very interesting to discuss this special situation, whether the story in video is truth or not.

Another new knowledge for me is that people perceive the same thing in different ways. I mean all of us saw the same story in the video, we can get the main concepts in this story and learn from them, on the other hand, we also thought in several different ways. This is very interesting and benefited our discussion

8.2.6 Learning Activity 6: The prevention of AIDS.

Demonstration and practice using a condom in simulation were used in this subtopic. This activity was devised to help the students practise how to use a condom in order to prevent themselves from getting HIV. Although some students had some

experiences is using condoms, most of the class had never used one and did not know how to use one.

The materials used in this subtopic consisted of the condom, cucumber, tissue paper, and a worksheet.

1. The learning objectives and learning activity were explained to the students.
2. The researcher asking for a student volunteer to demonstrate the method of using a condom to the class. There were two volunteers who agreed to demonstrate the process of using a condom to their friends.
3. The first volunteer stood in front of the class and gave a demonstration of the steps of using condoms to his friends, while the second volunteer described each step of the process.
4. A condom and a cucumber were provided to each students and the teacher summarized the steps of putting on a condom.
5. Each student practised putting on a condom.
6. Then, the students working in a group in order to combine similar information, generate a consensus, and negotiate differences of opinion and integrate the opinions of others into their views. Finally, the students drew conclusions on this subtopic on the worksheet.
7. The students then discussed this new knowledge and learning experience that they have gain from this learning activities.

Assessment of effectiveness of Learning Activity 6

A self-assessment was used to assess the students' skill of using a condom. Self-assessment is a positive way of encouraging reflection on learning experience. Also, the students could monitor their progress and help meet their goal. The information from self assessment was very useful for the students to improve their skill in using condoms for AIDS prevention.

A self-assessment sheet was provided to each student and the details of the criteria for assessing themselves explained. After the learning activity the students assessed themselves. There were three items with five alternative responses, Very Satisfied, Satisfied, Acceptable, Dissatisfied, and Very Dissatisfied. (See Appendix M)

The performance skills on using a condom were separated into five categories and described the qualities of each level in the scoring rubric for assessing students skills for using condoms as follows:

The scoring rubrics for assessing students' skills for using condoms

Level 5 Very satisfied

I can use a condom correctly without help or advice from the teacher and can advise or demonstrate to my friends how to use a condom.

Level 4 Satisfied

I can use a condom correctly without help or advice from the teacher, but cannot advise or demonstrate to my friends how to use a condom.

Level 3 Acceptable

I can use a condom correctly but need some help or advice from the teacher.

Level 2 Dissatisfied

I use a condom incorrectly and needs a lot of help or advice from the teacher.

Level 1 Very dissatisfied

I cannot use a condom correctly even though the teacher gives help or advice.

Results of self-assessment

As shown in Table 8.4, the results of the self-assessment indicated that a large group of students (55.6%) assessed themselves at the excellent level and 77.8% of the students believed that they could use a condom correctly in a real situation and thought that they could advise or demonstrate the method to their friends.

Table 8.4

Percentage of Students' Self-Assessment of the Skill of Using a Condom

Item	Excellent	Good	Fair	Poor	Very Poor
1. I can use a condom correctly	55.6	33.3	11.1	0.0	0.0
2. If I am in a situation that I have to use a condom, I believe I can use a condom correctly	50.0	50.0	0.0	0.0	0.0
3. I believe that I can advise or demonstrate the method to use a condom correctly	77.8	16.7	5.6	0.0	0.0

The data from informal observations showed that there were seven students who had some problems when they tried to use a condom, such as the air in the condom or not understanding about the method of removing the condom. In this case, there were some students who had experience of using a condom who helped them by explaining and demonstrating again. After that they could use it correctly. A collaborative learning environment had been used in this learning situation as the students learned from their peers and further developed their social skills.

Additional data from the discussion with the students found that 50% of students were shy about practising this activity because according to Thai culture and social norms, we believe that it is very impolite if someone talks about sex, especially single women or adolescents. Thai people believe that a single woman should not have an experience like this. The teacher solved this problem by explaining about the importance of this experience. If they were in a crisis situation this experience would be very necessary for them. Interestingly, the students wanted to close the door and the atmosphere became more relaxed. They, then tried to practise using condoms in simulation. There were many students excited about this learning activity and they said that:

I am very excited, by the way, my friends help me so much in this practicing. Although I'm very shy, I think that this is good for me to practise to use a condom.

Some students had opinions about the method of formative assessment used in these learning activities as follows:

I think it is good for me to assess myself because I really know my ability

This is fair for me to have a chance to assess myself

It was ver interesting for me to know that I have an ability to use a condom (I never thought about this point before).

These examples indicate that the students feel happy to take a role as an active participant in an assessment task. From self assessment, the students can know their ability, strength, and weakness which can be used to monitor their progress and also improve their skill.

8.2.7 Learning Activity 7: The impact of AIDS.

A self-directed learning method and a small group discussion were used for learning about the impact of AIDS. Self-directed learning was used to encourage students to use several sources, as this learning strategy can assist the students to learn and develop life long learning skills. The small group discussion was used to allow reflection and discussion on information collected by self directed learning.

The materials used in this subtopic consisted of a worksheet and a list of sources of information, such as the textbook, journals, Internet and examples of case studies about AIDS (see Appendix N).

1. The students were divided into four groups of equal size.
2. A worksheet was provided to each group the learning objectives and learning activities explained to the class.

3. Each group selected their preferred method for searching for data on the impact of AIDS. It was decided to use these four methods:
 - Group 1 website.
 - Group 2 textbook , journal.
 - Group 3 interviews an HIV infected person.
 - Group 4 learning from a case study.
4. The students were encouraged to worked in their groups. Ultimately, drawing conclusions about the impact of AIDS.
5. A representative from each group then presented the information to the class.
6. The students were encouraged to reflect on their learning in this activity.

Assessment of effectiveness of the Learning Activity 7

Peer-assessment was used for this learning activity. Peer-assessment has many advantages: it encourages students to be involved in the assessment process, feedback from peers provides a difference point of view from that of the teacher, students have to pay attention to show responsibility when someone is making a presentation, and this observation, is very useful to help students improve their presentation skills.

A peer-assessment sheet was constructed for the students to assess the presentations of their peers. The criteria for assessing and the scoring rubric were constructed by the students and the teacher together. This process was very useful since the students were required to think about the explicit criteria of a good presentation on which, they had agreed. The steps in developing the criteria were:

1. The students thought about the criteria of a good presentation and wrote them on the blackboard.
2. The students combined their ideas and described the details of each criterion.
3. The students made a peer assessment sheet containing nine items. The scoring rubric had five levels of criteria about presentation skills, Very satisfied, Satisfied, Acceptable, Dissatisfied, Very dissatisfied.

The performance skills were separated into five categories that described the qualities of each level in the scoring rubric for assessing students' presentation skills as follows:

Level 5 Very Satisfied

The student could explain/present about the impact of AIDS very clearly. He/She covered the main concepts of the topic and made connections with other contexts. He/She gave strong reasons and had a lot of information to support his/her reasons. There was a logical sequence of ideas and the ideas were focused. The presentation included two to three examples. He/She used effective and appropriate media. He/She showed a good personality and maintained eye contact with the audience. He/She could answer every question clearly. He/She encouraged the participants to get involved in the activities. He/She had a very good conclusion.

Level 4 Satisfied

The student could explain/present about the impact of AIDS clearly and covered the main concepts of the topic. He/She gave reasons and had some information to support his/her reasons. There was a sequence of ideas and the ideas were focused. The presentation included one to two examples. He/She used effective media. He/She showed a good personality and maintained eye contact with the audience. He/She could answer some questions clearly. He/She encouraged the participants to get involved in the activity. He/She had a good conclusion.

Level 3 Acceptable

The student could explain/present about the impact of AIDS clearly and covered some of the main concepts of the topic. He/She gave reasons but had little information to support the reasons. There was some sequence of ideas but the ideas were not focused. The presentation included one example. He/She used media. He/She showed a good personality and maintained eye contact with the audience. He/She could answer some questions but not clearly. He/She encouraged the participants to get involved in the activities. He/She had a fair conclusion.

Level 2 Dissatisfied

The student could not explain/present about the impact of AIDS clearly, nor understandably and covered few of the main concepts of the topic. He/She gave reasons but did not have any information to support the reason. There was no sequence of ideas and the ideas were not focused. The presentation did not included examples. He/She did not use media. He/She showed a fair personality and not maintained eye contact with the audience. He/She could answer some questions but not clearly.

Level 1 Very Dissatisfied

The student could not explain/present about the impact of AIDS clearly or understandably. The information given showed that the student lacked understanding and had misconcepts .The student could not identify nor summarize the topic. The sequence of ideas was confused. There were no reasons given or any information to support the presentation. The presentation did not include examples. He/She did not use media. He/She showed a poor personality and did not have eye contact with the audience. He/She could not answer the questions.

When the group discussion about the impact of AIDS was completed, a representative of each group presented their ideas to the whole class. Then, the peer assess the presentation of each group.

Results of peer-assessment

The results of peer-assessment indicate that the item mean scores of each group ranged from 2.83 to 3.72 and total mean scores ranged from 28.17 to 30.28. These results implied that the students assessed that all of them have abilities on presentation skills at the middle level. When looking at each criteria, the criterion that had the highest average mean scores was about using time efficiently (3.68). The next was that group members have a chance to get involved in their presentation (3.51), and the third was the presenter had good personality (3.48). In contrast, the skill of using appropriate material or media, answered the questions clearly and promoted discussion in class has average mean scored 2.71, and 2.98, respectively. The details are shown in Table 8.5

Table 8.5

Item Mean Scores of the Peer Assessment about Presentation Skill Described by Each Item and the Group (Total Score 5 points per item)

Item	Group 1	Group 2	Group 3	Group 4
1.Contents -It covered the topic -It was well constructed -There were several sources of up-to-date data	3.50	3.17	3.11	3.44
2.Used time efficiently	3.72	3.61	3.67	3.72
3.Used a clear and understandable language	3.50	3.11	3.22	3.33
4.Used appropriate material or media	2.56	2.78	2.67	2.83
5. Presentation activities interesting and appropriate to contents	3.28	2.83	2.89	3.56
6.Encouraged participants to get involved	3.00	3.06	3.06	3.17
7.Answered the questions clearly and promoted discussion in class	3.11	2.89	2.89	3.06
8. Good personality	3.56	3.67	3.22	3.50
9. The group member have a chance to get involved in their presentation	3.56	3.39	3.44	3.67
Mean total scores	29.79	28.51	28.17	30.28
Standard deviation (S.D.)	4.23	4.00	4.46	4.70

Additional information was obtained from observations in that the researcher perceived a very good learning environment in this learning activity because all of the students were interested in the results that their peers presented to the class. They participated and shared their ideas and discussed the work in order to draw a conclusion. Two groups of students selected learning sources different from the rest of the class. The students in Group 3 learned about the impact of AIDS in the real situation by interviewing an HIV-infected person at the Ban Pak Jai (the living place for an HIV-infected person located in a suburb of Udonthani). Group 4 learned by using an example of a case study about an HIV-infected person which they read in an article in the newspaper (the author is an infected person who described his story). On the other hand, the first two groups provided useful information and views on theories and findings from research results.

This learning activity had many advantages for the students. For example, students learned from different sources of information, they learned from real situations rather than from a textbook. This can help the students understand other people in the social and other dimensions. As a result, they can understand about their life and world around them. Also, the students have developed their learning skills and this can help them generally in their learning and to achieve the country's educational goals that refer to life-long learning. Furthermore, students practised their communication skills and expressed their opinions, reflected, discussed, negotiated, and presented to the class. The students accepted responsibility for their own learning and appeared to improve their higher order skills, such as critical thinking skills from analyzing situations in case studies, social skills and problem solving skills. The students provided positive feedback as confirmed by these examples of the students' opinions:

I'm very happy to have learned outside of the class because the atmosphere of learning is more relaxed and so exciting.

I was excited when we talked with the HIV-infected person. By the way, after finishing talking with him, I have a greater understanding of these people.

I preferred participatory learning (like in this topic) because these learning activities can help me to develop myself in several dimensions.

So far I'm very shy, but now I have increased my self confidence and I can speak in front of the class.

I felt good because I got a chance to have a better position to assess my friends in this subtopic.

The implementation of the intervention based on constructivist teaching approach used in the present study could be summarized as in Figure 8.1

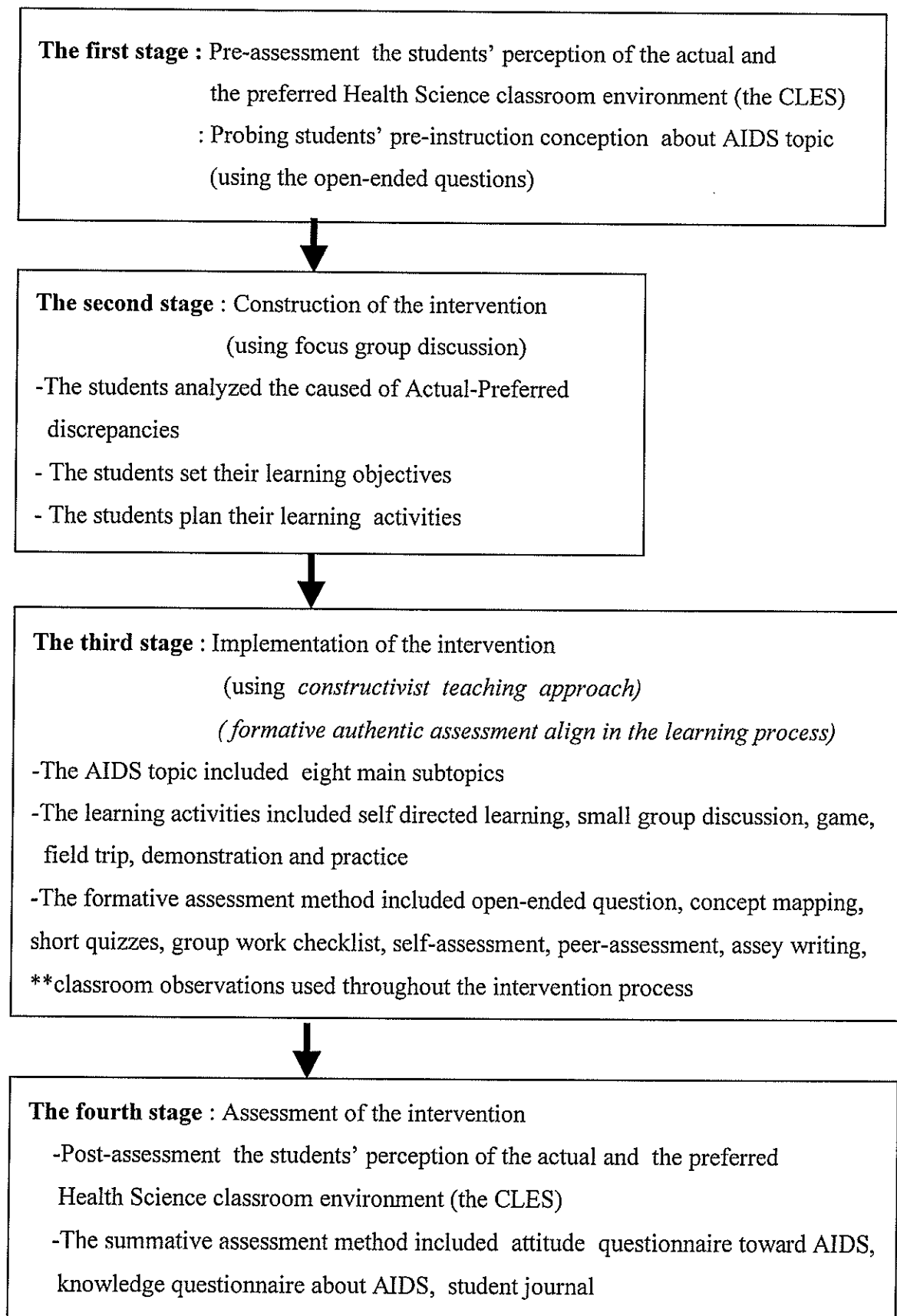


Figure 8.1. The process of the constructivist teaching approach for improving health science classroom learning environment and achievement in Thailand.

8.3 SUMMARY

This chapter has described the implementation of the learning activities used in the intervention in this action research which employed the characteristics of a constructivist approach to learning in Health Science classrooms in Thailand and formative assessment aligned to each stage of the intervention. The intervention stage was conducted during the first semester (July to September) of the academic year 2004. The topic AIDS in Health Science subject was selected as the subject content for this class. The CLES was used for assessing the learning environment and to determine whether students' concepts about AIDS were changed by this constructivist teaching approach. The learning activities included self directed learning, small group discussion, game, field trip and presentation. Formative assessment was aligned to this process and data were collected in the form of questionnaires, informal discussions and observations. After finishing the learning activities in each subtopic, the students generated conclusions about the issues that they had learned. Summative assessment of the intervention involved the use of the CLES, the ATAQ, the SKAT, and the student journal. The details of the summative assessment are described in the following chapter. Qualitative information from classroom observations and student journals also were used to investigate aspects that might have been missed by the questionnaire and to confirm the quantitative results.

CHAPTER NINE

THE POST ASSESSMENT: RESULTS OF A CONSTRUCTIVIST TEACHING APPROACH TO IMPROVE LEARNING ENVIRONMENT AND LEARNING ACHIEVEMENT

9.1 INTRODUCTION

This study was carried out over the course of the first semester of 2004 at undergraduate level at Udonthani Rajabhat University in Thailand. One Health Science classroom was selected for a case study in which a constructivist teaching approach was used. The previous chapter described the details of the constructivist learning activities used in this intervention process. This chapter describes the assessment method used for assessing the intervention and is composed of three main sections. The first section presents a summary of the assessment methods used in this research; the second presents the results of the post-assessment of the students' perceptions of their classroom learning environment; and the third contains the results of the assessment of the students' achievement of the AIDS topic using the ATAQ and the SKAT.

9.2 ASSESSMENT METHOD

9.2.1 Authentic assessment

A process of authentic assessment was used for the intervention for three main reasons appropriate to the constructivist teaching approach. First, authentic assessment assesses student learning in the context of teaching. It is a continuous process aligned with classroom activity. In other words, it takes place in a real-life situation. For example, from the constructivist perspective, it is important for teachers to know what students truly understand rather than the scores students gain after responding to a multiple choice test. Sometime the students can do well on multiple choice tests because they can guess, but may lack understanding. Secondly, authentic assessment involves multiple skills, such as higher-order thinking skills. Thirdly, authentic

assessment provides students with an opportunity to monitor and evaluate themselves and therefore take an active responsibility for their own learning (Gay, 2001; Grant, 1990; Kerka, 1995).

9.2.2 Formative and summative assessment

Both formative and summative assessment were used in this research. Importantly, the teacher can use the information from formative assessment to improve the learning process. For instance, if students have problems, the instructor can know immediately, and from reflection and discussion, how the learning activities and processes are going. Therefore, the teacher can solve any problems or adjust the learning process immediately in an appropriate way. Summative evaluation provides information on the achievement of the students and, therefore, the success of the intervention results.

This research also used both quantitative and qualitative data in the formative and summative assessment to provided a comprehensive picture. Quantitative data were obtained from the Actual Form of the CLES when the intervention process was completed in order to re-assess students' perceptions of their Health Science classroom learning environment. In order to assess students' learning achievement, the Students' Knowledge of AIDS Test (SKAT) and the student Attitude Towards AIDS Questionnaire (ATAQ) were used to provided data on achievement of cognitive and affective outcomes, respectively. Additionally, classroom observation, focus group discussion and students' journals were also used to collect qualitative data. The methods used in both formative and summative assessment of this research are summarized and shown in Table 9.1

Table 9.1

Learning Activities and Assessment Methods Used for Each Topic.

Topic/contents	Learning activities	Assessment method
		Formative assessment (Classroom observations were used during the intervention process)
1.The history of AIDS.	-Self-direct learning (from several sources, such as textbook, search information via internet, journal, newspaper) -Small group discussion	Group work checklist -student assess themselves -student assess their group when working together
2.The cause of AIDS.	-Game -Small group discussion	Concept mapping
3.The transmission of AIDS.	-Game -Small group discussion	Short quizzes
4.The signs and symptoms of AIDS. 5.The treatments of AIDS.	-Field trip -Guest speaker (meet with an HIV infected person and a doctor)	Open-ended question
6.How to take care of and live with an HIV infected person	-Search data from many sources, such as internet, textbook, journal, newspaper -Small group discussion	Essay writing
7.The prevention of AIDS	-Demonstration and practice -Small group discussion	Self assessment
8. The impact of AIDS	-Search data from many sources, such as internet, textbook, journal, newspaper. -Interviews with HIV infected person -Small group discussion about example of scenario	Peer assessment
All of the above		Summative assessment -the ATAQ -the SKAT -the CLES -student journal

9.3 POST-ASSESSMENT OF THE INTERVENTION

9.3.1 Quantitative data

The results were analysed, in order to confirm whether there were changes in students' perceptions of their actual classroom learning environment, and are presented in this section.

On completion of the intervention, the results indicated that the post-actual item mean scores of each scale had increased from the pre-actual. The scale which has the highest mean difference is Shared Control (0.80); the others in descending order were Critical Voice (0.78), Student Negotiation (0.56), Uncertainty (0.39), and Personal Relevance (0.32).

Paired-sample t-tests were used to determine statistical significance between the pre-actual and the post-actual learning environment. The results indicated that there were significance differences between pre and post actual on all scales of the CLES. These results are presented in Table 9.2 and Figure 9.1

Table 9.2

Average Item Mean Scores and Standard Deviations for Students' Pre-Actual and Post-Actual Perceptions for Each Scale of the CLES

Scale	Mean		Standard Deviation		Mean Difference	t
	Pre-Actual	Post-Actual	Pre-Actual	Post-Actual		
Personal Relevance	3.62	3.94	0.51	0.52	0.32	1.91*
Uncertainty	3.56	3.93	0.62	0.39	0.37	2.81**
Critical Voice	3.59	4.37	0.68	0.46	0.78	3.87***
Share Control	3.00	3.80	0.51	0.68	0.80	3.35***
Student Negotiation	3.62	4.18	0.50	0.49	0.56	3.68***

* $p < 0.05$, ** $p < 0.01$ *** $p < 0.001$

n=18

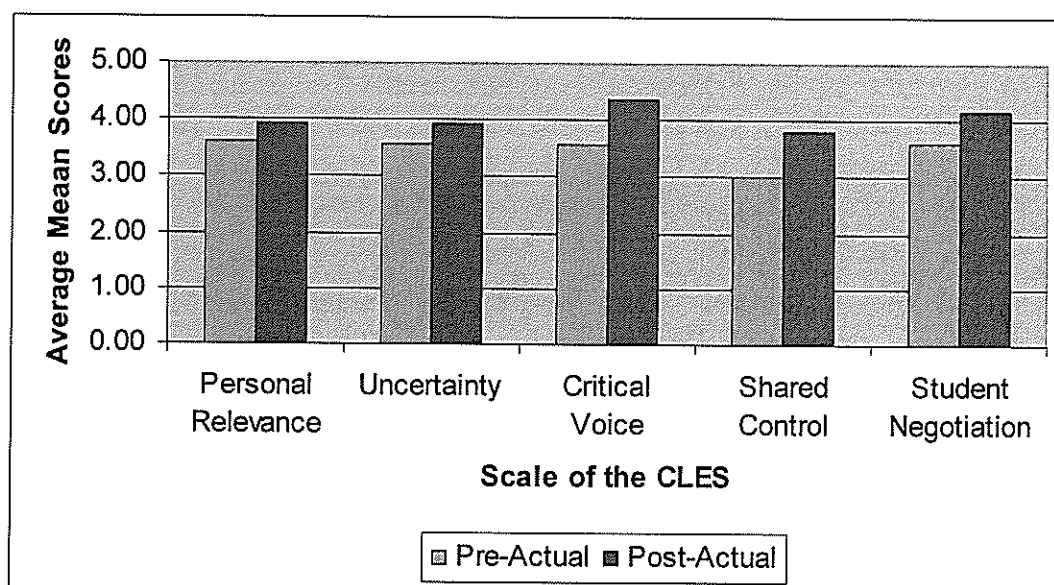


Figure 9.1. Comparison of student perceptions of Pre-Actual and Post-Actual means for each scale of the CLES.

When comparing the average item means of each CLES scale between the preferred learning environment (before intervention) and the post-actual (after intervention), it is clear that the discrepancies between post-actual and preferred perceptions mean scores decreased on all scales (see Table 9.3 and Figure 9.2). However, paired t-tests indicated that there were no statistically significant differences between these mean scores for all the CLES scales.

Table 9.3

Average Item Mean Scores and Standard Deviations for Each Scale of the CLES Post-Actual and Preferred

Scale	Mean		Standard Deviation		Mean Difference	t
	Post-Actual	Preferred	Post-Actual	Preferred		
Personal Relevance	3.94	4.30	0.52	0.48	0.36	2.41
Uncertainty	3.93	3.82	0.39	0.50	-1.10	0.71
Critical Voice	4.37	4.37	0.46	0.46	0.00	1.76
Share Control	3.80	4.18	0.68	0.50	0.38	2.08
Student Negotiation	4.18	4.47	0.49	0.48	0.29	2.22

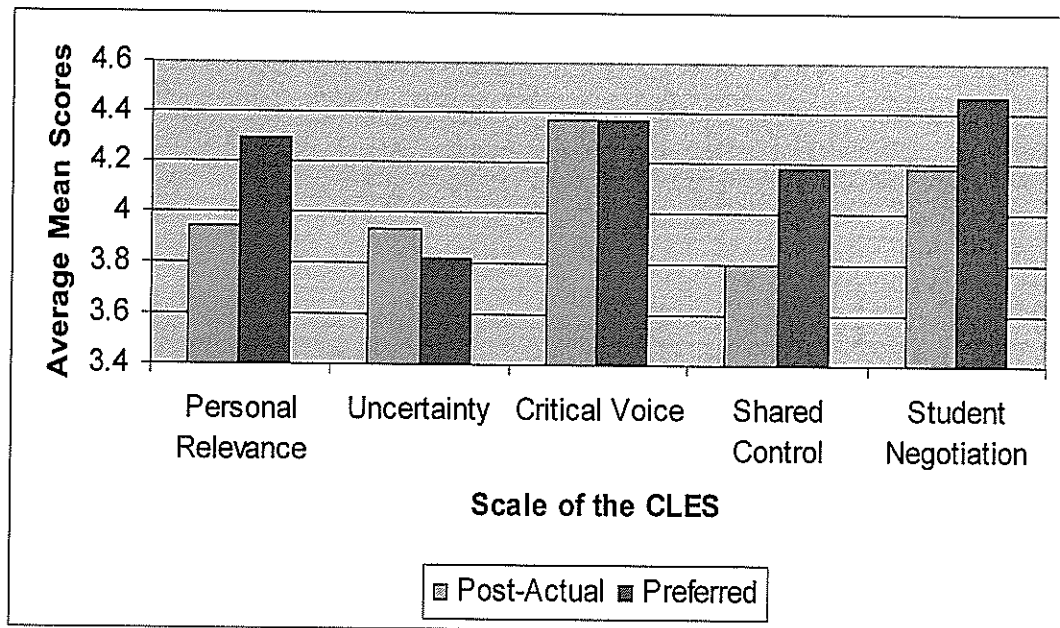


Figure 9.2 Differences between student perceptions of Post-Actual and Preferred means for each scale of the CLES.

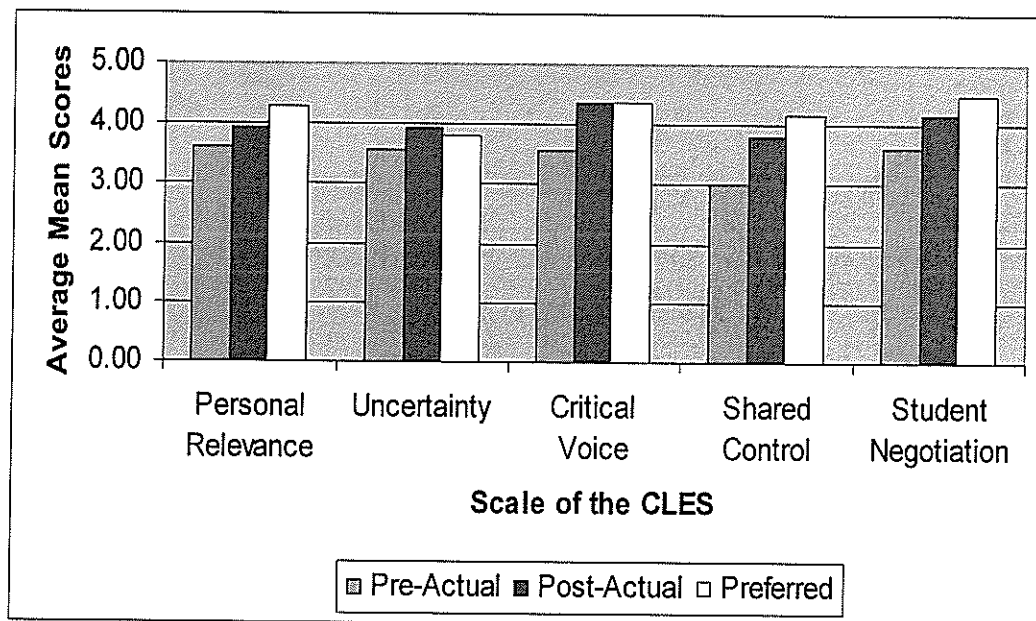


Figure 9.3 Differences between student perceptions of Pre-Actual, Preferred and Post-Actual means for each scale of the CLES.

Overall, the results implied that the intervention based on the constructivist teaching approach can improve the learning environment in the Health Science classroom. This is clear in Figure 9.3.

9.3.2 Qualitative data

During the classes, it was observed that the students were not only studying in the normal classroom, but also learning in other classroom structures and different places. For example, in the normal classroom they arranged the desk settings in a different format in order to make it more appropriate for different learning activities, such as having small group discussions, games, presentations, or role plays. Other places used for learning were the library (learning from textbooks, journals, etc.) and the Internet. Furthermore, the students learned in real life situations on the field trip, at the hospital, and during a visit to the village.

The results from the assessment of the pre and post actual means of the CLES were used as a guideline for the researcher and students to have a focus group discussion in order to reflect and discuss the process and results of the intervention for improving their learning environment and achievement. The students' journal was assigned to students in order to write their opinions about these experiences along the period of the intervention.

When the focus group discussion started, the researcher told the students about the objectives of this focus group discussion, and encouraged the students to think about the duration of time of the learning activity. The researcher again reviewed the rules for group discussion. The researcher used open-ended question to encourage the students to think about the results and share their opinions. The researcher then made a list of the students' opinions and wrote these on the chalkboard. The students were then told to review it again in order to summarize the main concepts. Finally, the researcher thanked the students who had participated in the classroom action research in order to improve their learning environment and learning achievement.

The results from focus group discussion and students journal

The results from the comment made in the focus group discussion and in the students' journals indicated that most students agreed that there had been change between the post-actual and the preferred learning environment. The students noted that the gap has decreased on all scales of the CLES, meaning that after the intervention, improvement had occurred in students' perception of their learning environment. The

students expressed commented about the intervention process based on constructivism theory as follows:

I think the constructivist learning process can empower students and I feel so good to have been involved in this learning process. The teacher provided a chance for students to become involved in the learning process at many stages of the study. For example, in the first stage, the teacher encouraged me to thought about our expectations of the unit, we also thought about the roles and responsibilities of the teacher and the students in this class. In my opinion, this is very useful for us because we set our goals and we have to participate in the active learning process in an attempt to achieve this goal.

In the new approach, the teacher provides the chance for students to set their learning objectives, plan about the content, learning activities, and time. Each learning activity always encourages the students to think, express and share their opinions with friends. Therefore, this can develop the students in many dimensions, not only about AIDS issues.

I like that the teacher assessed my prior knowledge about AIDS because we can know how much knowledge we have about AIDS. We can benefit from this information, as a basic guideline for planning about our learning activities. I think this method helped us to learn the things of relevance to our background.

The teacher provided a chance for us to be involved in the assessment process and used the data from formative assessment to improve our understanding about AIDS by indicating some points that we did not have a clear concepts about. The teacher paid more attention to students' understanding. Therefore, we have learned so much about AIDS more than we would have in a traditional lecture.

They also stated that the constructivist learning approach provided various sources of learning. They found the learning activities to be very interesting, encouraged them to participate actively and to be responsible for their own learning as indicated in the following sentences.

We have searched for information about AIDS from several sources. We also discussed and thought about how we can present information by role playing and making our peers understand what we presented. I think that I have quite an insightful understanding about AIDS from these process.

I think that the constructivist learning activities encouraged me to learn from many sources, not only from the lecturer or text. We also learned from the website, discussions with our friends, having a field trip, interviewing an HIV-infected person, and talking to the guest.

I think this learning strategy is good because we have a chance to learn from several sources, such as practice by ourselves, discussing and negotiating with our peers, searching for information from a website or journal, and interviewing an HIV-infected person. These methods can help us construct new knowledge based on our past experience. We also were involved in the assessment process too. We are enjoying learning because there are many activities and it makes a good learning environment, better than in the traditional classroom.

We have learned from various activities, such as small group discussions, field trips, and games. So, I enjoy learning so much and could not wait for this class.

I have learned from various methods, such as textbooks, newspapers, websites, and discussions in a small group. This is not boring and can motivate me to be more interested in the lesson. I wait for this class every week.

It is apparent that a constructivist teaching approach can improve the students' learning environment in Health Science classrooms and students enjoy their learning experiences. Further support for this assertion is provided in the following opinions.

I could say that this teaching method improves the learning environment, We are enjoying learning, especially, playing the game about AIDS transmission, having a field trip into the community and to the hospital. Although, I have to express my opinions to my friends or present then in front of the class, I still feel relaxed about it.

I think that the constructivist teaching approach can create a relaxing learning environment. I feel free to tell the teacher or my friends about what I am thinking or how I am feeling.

The learning environment of this class makes me feel relaxed, there is no pressure. Therefore, I have gained self confidence and am not shy to express my opinions. I pay attention in learning activities and I am happy to learn in this class.

I was very excited and very happy when we played a game about transmission of AIDS, played the role of living with an HIV-infected person and practising to using a condom.

The learning environment was very interesting and exciting. It was a great enthusiastic atmosphere for learning. I'm very excited when we have practised using a condom in a simulation situation. Although we are shy, we enjoyed it and my friend (male) explained and demonstrated the method for me to do it correctly.

We had active participation when working in the constructivist classroom and I think this learning approach can create a good learning environment. All of us are happy to learn in this class. The learning environment was good and not boring because we had active learning and learned from various sources.

We talked about the learning activities and the atmosphere in this class and we agreed that this new teaching method can improve the learning environment and also help us to have effective learning outcomes.

I think that we have effective learning outcomes in this class because we are involved in the learning activities that are based on our prior knowledge or past experience about AIDS. So, it's appropriate and easy for us to construct new knowledge.

Additionally, the students indicated the benefit of this learning process for developing higher order thinking skills.

The constructivist learning process not only provided knowledge about AIDS, but also developed our higher order thinking skills, such as we developed analytical thinking skills from analyzing the situation about AIDS.

When we had different ideas in a group, I learned about conflict management. I think that the group process can improve us in accepting other people opinions.

These new learning activities helped me to improve my self-confidence for expressing my opinions and presenting to the class. We also had a good relationship with our peers and the lecturer.

Negotiating my own learning plan for this class helped me to plan about my life.

I was very appreciative that I had a chance to learn in this class. We not only learned about AIDS, but we also learned many things which developed ourselves as human beings, such as social skills to work or live with others; thinking skills (critical thinking, analytical thinking, creative thinking); caring for other people's feeling; and problem solving skills.

Moreover, the students could see relevance in what they were doing and linked these learning experiences to their real life, as shown in the following statements:

I'm very surprised to know that the number of teenagers infected is increasing. I think that these learning experiences are very useful for preventing myself from getting HIV and I will tell my friends about AIDS. Also, I can tell my family or people in my village about how to prevent themselves from AIDS.

I'm very satisfied with my learning outcomes because I not only learned by remembering the content which the teacher told us (in one way or passive process), but I can understand and integrate my knowledge about AIDS and apply it into my life.

I think that these learning experiences are very useful. Especially, as we can use this knowledge when we are going to the hospital or the community health centre in the next semester for professional experiences training program. For example, it provides health education for the family who live with an HIV-infected person and helps develop health education programs for the prevention of AIDS in the teenager group.

I will be use these learning experiences in my life by providing Health education to HIV-infected persons and their families how to live together, how the family can prevent themselves from being infected and how they can take care of the patient.

I will give AIDS education to my family, my neighbours, and to any HIV- infected person and their families in my community.

Learning activities about AIDS in this class helped me to gain self confidence and I think that I can take on a role as a counsellor for an HIV infected person.

I will take my boyfriend to take the test for HIV infection.

Another interesting point is that the students said that the constructivist teaching approach changed their learning behaviours from passive to active learning and they became responsible for their own learning rather than waiting to receive the knowledge from the teacher. Some students think that this can give them skills for life- long learning which is an the educational goal of our country.

After I finish the class, I want to have further study on other issues related to AIDS and I know how I can learn and where I can get the information. I think this skill will enable me to learn many things in the future which can improve my quality of life. I not only learned about AIDS, but I also learned how to learn. I think this will help me to develop my life in the future.

In the past, I waited to listen to the teacher in the class, but now, I prepare myself for learning before the class. For example, I searched for information related to AIDS issues and prepared to discuss this with my friend.

However, all of the students agreed that these changes are not sustainable. They may occur only in this class because the learning activities in this class were organized based on the constructivist teaching approach. Therefore, these activities encouraged them to changed their style of learning. They also suggested that we should have a constructivist approach to teaching and learning in every subject, as we can see in the following comments :

I think this is good for me to change my learning, but I'm afraid that it is a temporary . It will be good if it is a permanent change.

Although, I'm not so sure that my learning is a fixed change or not, but I'm still happy with this change. This means I have developed myself.

I'm agreed with A and I think that we need time to improve every thing in the world.

When I was studying in other subjects which are based on the traditional lecture method, my learning is the same as in the past. I would suggest that other teachers in our university should change their teaching too.

You should promote your ideas, I mean expand the concepts of constructivist teaching approach to other teachers and encourage them to use this approach in order to improve teaching and learning in our university.

Some students raised the problem of the management of learning activities and recommended effective methods for doing this in the class.

I think that there are some points needed to be adjusted in order to make an effective classroom and we can gain more benefit from our learning. We have worked in small group discussions, and I think this learning activity is very useful, since we learned so much from our group members. However, when the teacher told us to present the results to the class, I had the chance to present in front of the class three times. My peers gave the reason that I have the character of a good presenter and I have abilities in public speaking. My suggestion is that we should provide an equal chance and opportunity for every member of the group to present.

In conclusion, the qualitative results from focus group discussions and students' journals supported the quantitative results from the CLES questionnaires. The main themes apparent in the qualitative results are that the students' approved of the constructivist teaching approach and believe that this approach did improve their learning environment and learning achievement. The comments show that they have gained knowledge about AIDS and have positive attitudes towards the disease. The students also suggested that the constructivist teaching approach appeared to develop their higher order thinking skills. Also, their comments indicated that they intend to apply or link these learning experiences into their real life situations in order to protect themselves against getting HIV. Finally, it seems that they will use this knowledge to provided health education for their family, community, and any HIV-infected person.

9.4 RESULTS OF A CONSTRUCTIVIST TEACHING APPROACH TO IMPROVE LEARNING ACHIEVEMENT

9.4.1 Students' attitude towards AIDS

The student attitude toward AIDS questionnaire (ATAQ) was constructed in order to assess affective domain of students learning achievement and was administrated to the students after the intervention. The results from the use of the ATAQ are presented in this section.

The quantitative data about students' attitude toward AIDS

The results indicated that the total mean scores of students' attitude toward AIDS was 77.61 and the standard deviation was 9.14. The total mean scores and standard deviations were then used as a criterion for dividing the students into three groups. The first group were classified as high level (Mean+ one SD or scores ≥ 86.75). The second group as middle level (Mean - one SD to Mean+ one SD or scores 68.48-86.74). The third group as low level (Mean- one SD or scores ≤ 68.47). The results indicated that the largest group of students had an attitude in the middle level (72.20%). There are 16.70 % of students in the high level and 11.11 % in the low level. The details are shown in Table 9.4.

Table 9.4

Number and Percentage of Students Described by Level of Attitude

The level of attitude total scores	Number	Percent
High level (Mean + one SD) Scores ≥ 86.75	3	16.70
Middle level (Mean - one SD to Mean + one SD) Scores 68.48 - 86.74	13	72.20
Low level (Mean - one SD) Scores ≤ 68.47	2	11.10

The results were then considered item by item as presented in Table 9.5 and discussion of these results follows.

Table 9.5

Percentage of Student Responses to Each Item of the ATAQ

Item	The Students' Opinions				
	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1. Having sex with a peer is not a risk of becoming infected with AIDS.	16.7	5.6	11.1	27.8	38.9
2. If you have sex only once, you cannot become infected with AIDS.	0.0	11.1	11.1	44.4	33.3
3. A person who has good health has no chance of being infected with AIDS.	0.0	16.7	5.6	44.4	33.3
4. Donating blood may be a cause AIDS.	0.0	0.0	22.2	55.6	22.2
5. Drug users who share needles are a risk of HIV infection.	50.0	44.4	0.0	0.0	5.6
6. Signs and symptoms of HIV infected persons are horrible.	33.6	16.7	16.7	33.3	0.0
7. AIDS cannot easily spread, therefore it is not necessary to prevent AIDS.	0.0	0.0	11.1	44.4	44.4
8. Having sex with a condom gives you a bad feeling.	5.6	11.1	16.7	33.3	33.3
9. Not using drugs can prevent AIDS.	27.8	5.6	16.7	27.8	22.2
10. Every person who wants to donate blood has to have a blood test for HIV. This can prevent HIV infection because from donating blood.	66.7	16.7	11.1	5.6	0.0
11. The first stage of AIDS can be cured.	5.6	11.1	5.6	44.4	33.3
12. An infected person who is in "full bound AIDS" stage should not be cured because there is no way to get well.	11.1	16.7	5.6	38.9	27.8
13. A person who has HIV is pitiful.	61.1	27.8	5.6		5.6
14. We should not isolate a person who has HIV from family or society.	50.0	27.8	16.7	5.6	0.0
15. We should listen to the problems of a person who has HIV.	77.8	11.1	11.1	0.0	0.0
16. We should not live with a person who has HIV.	5.6	5.6	16.7	33.3	38.9
17. A person who has HIV is worthless.	16.7		11.1	27.8	44.4
18. AIDS has an impact on the economic system.	16.7	11.1	33.3	33.3	5.6
19. A person who has HIV is a social problem.	16.7	22.2	11.1	44.4	5.6
20. AIDS has an impact on social development.	50.0	38.9	5.6	5.6	0.0

The attitude toward risk behaviour of becoming infected with AIDS

The results showed that a large group of students agreed that they can get HIV from many risk behaviours. For example, drug users who share needles with others are at risk of HIV infection (94.4%), a healthy person has a chance of being infected with AIDS (77.7%), having sex only once can still result in becoming infected with AIDS (77.7%), and having sex with a peer is a risk of becoming infected with AIDS (66.7%).

The attitude toward AIDS prevention

The results indicated that a large group of students (88.8%) agreed that it is necessary to prevent AIDS, even if AIDS is not easily spread. Also, 83.4% of the sample thought that they could prevent the spread of HIV by having a blood test for HIV before donating blood.

The attitude toward cure of AIDS

This study found that 77.7% of the students agreed that AIDS cannot be cured and 66.7% agreed that the doctor should still attempt to cure an infected person who is in the last stage of AIDS. A large group of students also agreed that we should listen to the problems of a person who has HIV (88.9%). They thought a person who has HIV is to be pitied (88.9%), the family or neighbours should not be isolated from an infected HIV person (77.8%), and AIDS has an impact on social development (88.9%).

The results also show that after completing the intervention, some students still have unfavourable or negative attitudes toward AIDS in some items. For example 50.3% of the student agreed that the signs and symptoms of an HIV-infected person are horrible.

It was interesting to note that there were two items about which the students were equally divided between favourable and unfavourable. The first question is about the prevention of AIDS by not using drugs (strongly agree and agree 33.4 %, strongly disagree and disagree 50.0 %). The second question is about the impact of AIDS as a social problem. (strongly agree and agree 38.9 %, strongly disagree and disagree 50.0 %). Also, there are two items for which a large group of students selected the “not

sure” response. These questions were about the impact of AIDS on the economic system of the country about which 33.3 % were not sure and 22.2% of the student are not sure about donating blood as it may be a cause of getting AIDS.

Students’ comments about their attitude toward AIDS

The researcher used the focus group discussion in order to collect qualitative data for describing and discussing some interesting points. The results found that the constructivist teaching approach which was used in this study can improve students’ attitude toward AIDS. The students also gained and improved awareness about AIDS as we can see in the following student quotes.

*An HIV- infected person is very pitiful and AIDS is not easy to spread.
I think that we should not be afraid of these people.*

*The field trip helped me to understand about how people live with
AIDS, and made me have a more positive attitude toward AIDS than
in the past.*

*I think that we should provide chances for an HIV-infected person
in many ways, such as providing a job and finding roles in social
activity.*

*I think that I should be responsible and become involved in the
AIDS problem, such as campaigning about AIDS in our university.*

*I will always keep in my mind that AIDS cannot be cured. The best
way is to prevent myself from getting HIV.*

*I discussed AIDS with my friends outside the class and talked to my
family at home. The learning experience in this class made me
aware about getting HIV.*

*This was the first time for me to think about AIDS as an important
social problem of our community. Sometimes, I pretend and ask*

myself what if I or my relatives get HIV. So what can I do? I found that it is difficult to answer this question. Anyway, I believe that the learning experiences in this class can help me.

AIDS is very deep and wild; there are many dimensions related to AIDS, and many factors affect this problem. In order to solve this problem, I think that the family and society should take on the very important role of taking care an HIV- infected person.

9.4.2 The students' knowledge of AIDS test (SKAT)

The Students' Knowledge of AIDS Test (SKAT) was constructed in order to assess cognitive aspects of students achievement. The SKAT was constructed as a two-tier test with the initial format response as true or false, and the second as an open-ended response where the students had to provide reasons for their first response. This instrument was administrated to the students after the intervention. The results of the SKAT are presented in this section.

The quantitative data about students' knowledge about AIDS

The results of the students' knowledge about AIDS assessed by the SKAT indicated that the total mean scores of students' knowledge about AIDS was 25.44 with a standard deviation of 1.58 The total mean scores and standard deviation were used as criteria for dividing students into three groups. The first group were classified as high level (Mean + one SD or scores ≥ 27.02). The second group as middle level (Mean - one SD to Mean + one SD or scores 23.87-27.01). The third group as low level (Mean - one SD or scores ≤ 23.86). The results indicated that the largest group of students have an knowledge total mean scores at the middle level (66.70%). The next in order is the high level (27.8%) and then the low level (5.6%).The details are shown in Table 9.6.

Table 9.6

Number and Percentage of Student Scores on the SKAT at Three Levels

The level of knowledge total scores	Number	Percent
High level (Mean + one SD) Scores ≥ 86.75	5	27.8
Middle level (Mean - one SD to Mean + one SD) Scores 68.48 - 86.74	12	66.7
Low level (Mean - one SD) Scores ≤ 68.47	1	5.6

When considering the percentage of students described for each item of the SKAT and the students' answers, the results show that a large group of students (88.90%) could answer the questions correctly, except for question 8 which asks about the duration of AIDS transmission. There were only 16.7% of the students that can answer this question correctly and 83.3% gave a wrong answer. The next two questions which 22.2% of the students answered incorrectly were item number 15 about the diagnosis of HIV infected persons, and item number 26 about taking medicine in an HIV infected. There were 16.7% of the students who incorrectly answered about the chance of getting HIV from blood donation (item number 4), symptomatic and asymptomatic stage of AIDS (item number 9, 16), and medical technology about vaccination to prevent people from getting HIV (item number 18). These results indicated that after the intervention some students who were involved in learning activities based on a constructivist approach, still had some misconceptions and needed to change them in order to develop a better understanding about AIDS topics. The details of these results as shown in Table 9.7.

Table 9.7

Percentage of Students Answering Each Item on the SKAT Correctly

item	answer	
	correct	incorrect
1.AIDS is a syndrome that is caused by HIV which attacks and destroys the body's immune system	100.0	0.0
2.A person who is infected with HIV has low immunity because HIV destroys the white blood cells	100.0	0.0
3.HIV can be spread by receiving blood with HIV	100.0	0.0
4.A person who donates blood has a chance of getting HIV	83.3	16.7
5. HIV can be spread by mosquitoes	100.0	0.0
6. HIV can be transmitted through sharing the bathroom /bathing together	100.0	0.0
7.Having sexual intercourse with many different partners without a condom, can be the cause of HIV infection	94.4	5.6
8. Only people who have a positive result of the HIV antibody test can transmit AIDS	16.7	83.3
9.A person who is in the asymptomatic period cannot transmit AIDS	83.3	16.7
10.Dry kissing with a person who has been HIV infected make a very high risk for transmission	94.4	5.6
11.Touching someone who has been HIV infected can transmit AIDS	100.0	0.0
12. Washing sexual organs after having sex can reduce the risk of being infected with HIV	94.4	5.6
13.A pregnant woman who has HIV can 100 % for sure pass AIDS to her new born baby	94.4	5.6
14.An AIDS infected mother can pass the infection to the baby by breast feeding	100.0	0.0
15.People who have taken the HIV antibody test which the result is negative are not HIV infected	77.8	22.2
16.The first stage of AIDS has no symptoms	83.3	16.7
17. A person who has been HIV infected usually dies from opportunistic infections	94.4	5.6
18.Nowadays, we can prevent AIDS by vaccine	83.3	16.7
19.Using disposable needles can prevent AIDS	100.0	0.0
20.Blood transfusion can exclude HIV from blood vessels	94.4	5.6
21.The first stage of AIDS can be cured	100.0	0.0
22.There are some herbs that can cure AIDS	88.9	11.1
23.Pregnant women who receive medicine for treatment of AIDS can reduce risk of giving HIV to their babies	94.4	5.6
24. If clothes or instruments are contaminated with the blood of an infected person, we can kill HIV by boiling them in water for 30 minutes	94.4	5.6
25.It is not necessary for a family to isolate the instruments of an HIV infected person	94.4	5.6
26.An HIV infected person should not take medicine that has an action to decrease immunity	77.8	22.2
27.The family should support HIV an infected person	100	0.0
28.An HIV- infected person has the right to decision making about his/her own life, such as to keep secret, to select the method of treatment, and to be pregnant or have an abortion	100	0.0

Qualitative data about students' knowledge about AIDS

The researcher used the focus group discussions and the student journals to collect qualitative related to students' knowledge about AIDS. The results found that the constructivist teaching approach which was used in this study can increase students' knowledge about AIDS. The following sentences support this result.

After finishing the class, I have a better understanding about AIDS.

We learned many things from several sources of learning and discussed with our peers. We also learned in the real situation, such as when we meet an HIV-infected person and listen to the doctor.

I think that I have a better understanding about AIDS now than before I attended the class.

I have learned so much about AIDS, such as the cause of AIDS, symptoms of AIDS, prevention of AIDS, and the impact of AIDS. I also learned how to use a condom.

The teacher encouraged me to think about the simulation story in various situations and discuss in small group. This developed my analytical thinking skills and I have much more understanding about the many dimensions of AIDS.

9.6 SUMMARY

This chapter has presented the results of the pre-assessment and post-assessment of the students' perception of their classroom learning environment by using the CLES. The results found that there were discrepancies between student perceptions of Pre-Actual and Preferred classroom learning environment on each scale of the CLES before intervention. The pre-actual and preferred discrepancies in average item means of each scale of the CLES ranged from 0.26 to 1.18. The results from the application of t-tests indicated that there were significance differences between the mean scores of

the Pre-Actual and Preferred on four scales of the CLES, Personal Relevance, Critical voice, Shared Control and Student Negotiation. There was no significant difference on the Uncertainty scale. After the intervention had been completed, the item mean score of each scale of the post-actual of the CLES was increased, thus, the discrepancies between pre-actual and preferred learning environment were decreased in all scales. The results from comparison of the average item means of each scale of the CLES between pre-actual and post-actual learning environment by using t-test found that there were significance differences between the mean scores of the Pre-Actual and Post-Actual on all scales of the CLES. The results of assessing the students' attitude toward AIDS by using the ATAQ indicated that the large groups of students have an attitude total scores in the high level (55.66%) and the middle level (33.33%), respectively. The results from the SKAT found that a large group of students have knowledge total score in the high level (88.90%) and only 11.11% at the middle level. This chapter also described the qualitative data from observation and focus group discussion. These results suggest that the CLES and the constructivist teaching approach can be used as a tool for improving the learning environment and students' learning achievement in the Health Science classroom. The qualitative data from classroom observation, focus group discussions and students journals support the quantitative data from the questionnaires. The main themes of qualitative results indicated that the students comments are related to the process of constructivist teaching approach and the results of this approach attempt to improve their learning environment and learning achievement. The results show that they are satisfied in this approach. They have gained their knowledge about AIDS and have a more positive attitude toward AIDS. They also developed their higher order thinking skills and they can apply these learning experiences into their real life in order to prevent them from getting HIV, provided health education to their family, neighbour, and an HIV-infected person.

CHAPTER TEN

CONCLUSION

10.1 OVERVIEW OF THE STUDY

This classroom action research aimed to improve student learning environment and outcomes in Health Science classrooms in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire. A sample of 20 fourth-year undergraduate students were selected by using a purposive sampling technique. The Thai version of the CLES was validated with 100 undergraduate students in a faculty of Science and Technology. The CLES was then modified in order to make it appropriate for use in the Thai socio-cultural context before it was used in an action research process. The action research process involved four main stages:

1. assessment of students' perceptions of the degree of the constructivism in actual and preferred classroom environments to identify actual–preferred differences, by used the CLES and students' pre-instruction concepts about AIDS by open-ended questions;
2. developing intervention strategies designed to bring about change in the learning environment and learning outcomes;
3. actual implementation of the intervention strategies; and
4. evaluation of the intervention.

The research combined quantitative and qualitative methods. The collection of quantitative data was achieved through the use of the CLES, the Students' Attitude Towards AIDS Questionnaire (ATAQ) and the Students' Knowledge of AIDS Test (SKAT). Relevant statistical methods such as means, standards deviations, and paired t-tests were used to analyse the quantitative data from the questionnaires. Qualitative data were obtained from classroom observations, focus group discussions and student journals and were analysed by content analysis and categorizing information to find

patterns and generate assertions. The content of this thesis was organized into ten chapters as described in the following paragraphs.

Chapter 1 describes the overview of this research including the context of the study, the purpose and the research questions, the research objectives, an overview of research method, and the significance of the research.

Chapters 2 to 4 present a review of literature related to the implementation of a constructivist approach to improving students' perceptions of health science classroom learning environments and learning outcomes. Chapter 2 presents the theory of learning environments, Chapter 3 provides the constructivism theory and constructivist teaching approach, and the process of action research is described in Chapter 4.

The fifth chapter provides information about how the research was conducted, including the research method, the research design, the sample for the study, the instruments (CLES, ATAQ, and SKAT), the administration of these instruments and their scoring procedures, data collection, data analysis, methods of statistical analysis, and details of the five stage process

Chapter 6 describes the method and results of the validation and determination of the reliability of the Thai versions of Actual and Preferred Forms of the CLES for use in Health Science classrooms with a sample of 100 undergraduate students undertaking Health Science classes in the Faculty of Science and Technology at Udonthani Rajabhat University, Thailand. This chapter also describes the qualitative information obtained from student interviews on how to adjust the questionnaire in order to make it appropriate for used in Thailand.

Chapter 7 presents the results of the pre-assessment of students' perception of their classroom learning environment and the results of pre-assessment of students' knowledge about AIDS. This chapter also describes the results of focus group discussions used to determine intervention strategies.

The eighth chapter describes the details of the action research involving the use of the CLES and constructivist teaching approach. This chapter contains the details of each stage of the intervention including the method of constructivist teaching, the use of instruments, and the results of formative assessment in the learning process.

Chapter 9 presents the assessment method and the results of the post-assessment of the constructivist teaching approach for improving the students' learning environment and outcomes using the CLES, the ATAQ, and the SKAT. The in-depth qualitative data based on observations and focus group discussions and students' journals about the process and the results of the intervention are also discussed in this chapter.

This concluding chapter presents a discussion about the process and the results of the action research cycle using a constructivist teaching approach to develop a better learning environment and outcomes. The chapter also provides a summary of the overall major findings in this research study, limitations of the study, and recommendations for further research study and implications to used constructivist approach in Thailand.

10.2 RESEARCH OBJECTIVE

The main objective of this thesis was to improve the student learning environment and learning outcomes in Health Science classrooms in Thailand through the use of a constructivist approach to learning and a learning environment questionnaire named the Constructivist Learning Environment Survey (the CLES).

10.3 THE STAGES OF ACTION RESEARCH

Stage 1: Validation of the Thai versions of the Actual and Preferred Forms of the CLES

The first stage was conducted before the implementation of the action research cycle (January to May, 2004). The Thai version of the CLES was validated with a sample of 100 students from the Faculty of Science at the Udonthani Rajabhat University, Thailand. It was considered that the students were typical of science students (including health science) throughout Thailand. Also, during this stage interviews were used to collect qualitative data from students about the validity of the CLES. The processes adopted in this stage enabled the establishment of the reliability and validity of the

Actual and Preferred Forms of the CLES and identified any minor modifications needed to be made to the questionnaire in order to make it more appropriate for use in the Thai socio-cultural context before using it in the second stage.

Stage 2: Pre-assessment of the students' learning environment perceptions and students' pre-instruction concepts about AIDS

The second stage was conducted during the duration of the first month of the semester (June, 2004). A purposive sampling technique was used to select one Health Science classroom with 18 fourth-year undergraduate students. There were three main instruments used for this stage. The modified Thai versions of the Actual and Preferred Forms of the CLES were used to assess the students' perception of their learning environment. Open-ended questions were used to assess students' pre-instruction concepts about AIDS. Focus group discussions were used for discussing and reflecting about the results from the CLES and students' pre-instruction concepts on AIDS.

Stage 3: Construction of the intervention

The third stage also was conducted in June, 2004. In this stage, a focus group discussion was again used to collect qualitative data about the construction of appropriate intervention strategies built on constructivist principles, to attempt to improve students' learning environment and learning outcomes.

Stage 4: Implementation of the intervention

The fourth stage was conducted during the duration of three months of the semester (July to September, 2004). Classes were observed throughout the intervention by the researcher. The information gained from observations, checklists and field notes was used to determine what might have been missed and used to confirm and support the findings from the questionnaire.

Stage 5: Evaluation of the intervention

The purpose of this stage was to obtain an understanding of whether the teacher as researcher and the students were able to respond to the constructivist teaching approach and use the Actual Form of the CLES as a tool for assessment of the changing classroom learning environment. The ATAQ and the SKAT were used in this stage as measures of student outcomes.

10.4 DATA ANALYSIS

Relevant statistical methods such as means, standards deviations, paired t-tests, and Pearson product moment correlation were used to analyse the quantitative data from the questionnaires. Qualitative data were obtained from classroom observations, focus group discussions and student journals were analyzed by content analysis and categorizing the information in order to find patterns and generate assertions.

10.5 RESEARCH RESULTS AND DISCUSSION

This section provides answers to the research questions that were previously proposed.

10.5.1 Validity and reliability of the CLES for use in Health Science classrooms in Thailand

Research Question 1 emphasized the validation of the CLES in Health Science classrooms at the university level in Thailand. The modified Thai version of the CLES was validated with a sample of 100 third-year undergraduate students in the Faculty of Science, Udonthani Rajabhat University, Thailand. The results of factor analyses indicated that the Actual Form of this instruments has five scales that are able to assess five unique aspects of a constructivist classroom environment. The item factor loading in their *a priori* scale ranged from 0.40 to 0.87 and 67.05% of the variance could be accounted for by the five factors. The Preferred Form produced a similar result. The alpha reliability values of the Actual Form, ranged from 0.82 to 0.91 and from 0.65 to 0.91 on the Preferred Form. For discriminant validity, it was found that the mean correlation of one scale with the other four scales of the Actual Form ranged from 0.40 to 0.54 and ranged from 0.41 to 0.62 for the Preferred Form. These satisfactory results are very similar to previous research studies. (Fraser, Dryden, & Taylor, 1998; Lee & Fraser, 2000;. Mogkoko, 2003; Puacharearn & Fisher, 2004; Taylor, Fraser, & Fisher, 1997; Wanpen & Fisher, 2004). However, the wording in 11 items was slightly modified based on the responses of students' recommendation in order to make them more appropriate for use in a Thai Health Science class.

10.5.2 The intervention based on a constructivism theory in a Health Science class at the university level in Thailand

Research Question 2 focused on the characteristics of a constructivist learning approach in a Health Science class at the university level in Thailand. The constructivist learning approach described in this study comprised four main stages and involve seven learning activities covering eight main content areas about AIDS (see the details of construction of the intervention in Chapter 5 and the details of implementation of the intervention in Chapter 6). One of the most important things in these processes was that the instructor encouraged students to be involved in every step of the learning. The first step involved assessing and exploring students' pre-instruction concepts about AIDS. Then, the students were encouraged to set their own learning objectives related to AIDS issues in order to learn the things that they want to achieve. In the next step, the instructor provided an opportunity for the students to become involved in planning their own preferred learning activities and making their own personal study plan. In this step, each student could use different methods and use a variety of resources inside and outside the classroom. Consequently, the learning activities consisted of self-directed learning, small group discussions, games, field trips and hearing from an invited guest speaker. The process of the constructivist teaching approach used to try to improve the health science classroom learning environment and learning outcomes in Thailand as is summarised in Figure 10.1

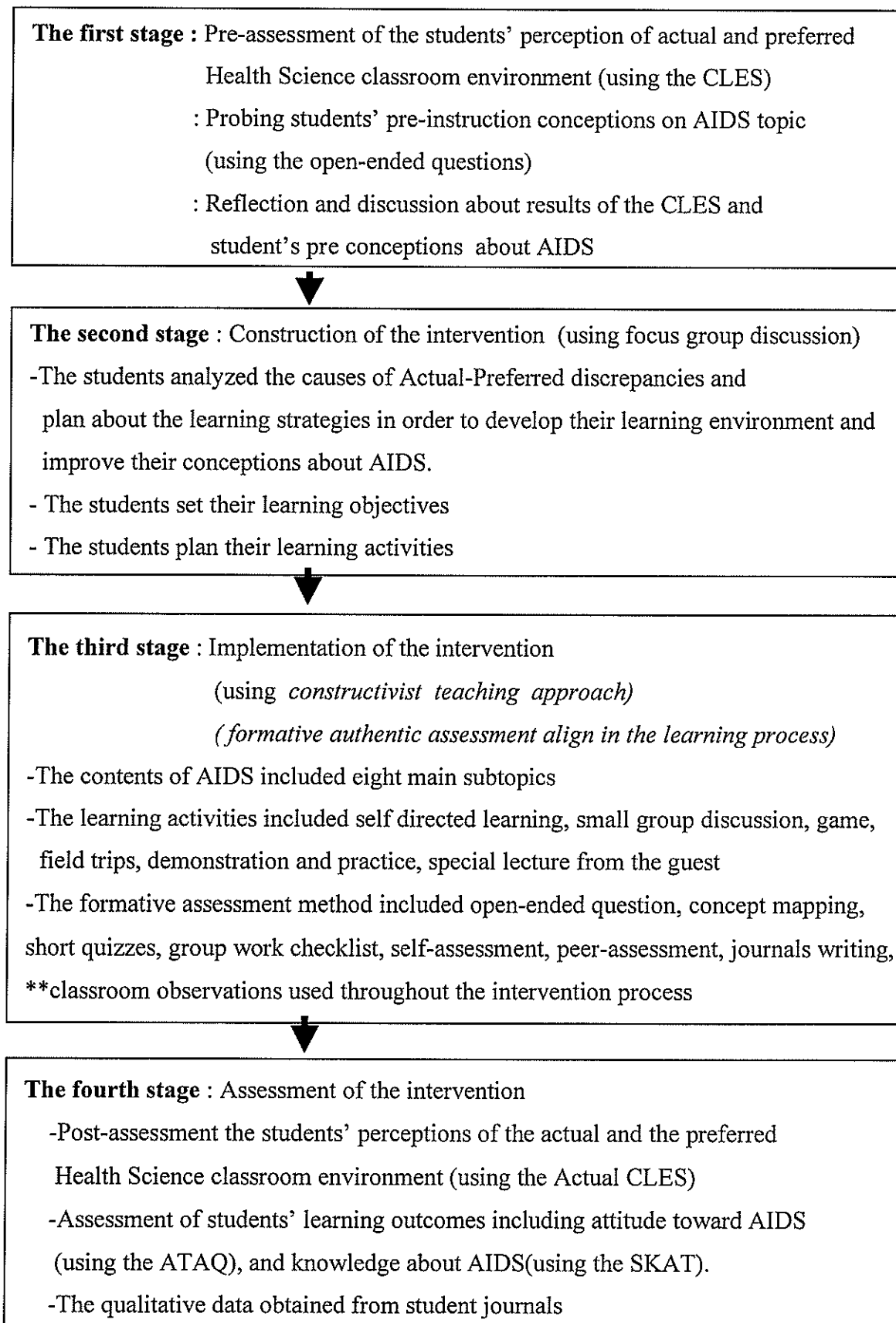


Figure 10.1. The process of the constructivist teaching approach to improve a health science classroom learning environment and learning outcomes in Thailand.

10.5.3 The intervention process

One of the most important aspects of assuring the effectiveness of the action research process employed in this study was deciding on the most appropriate intervention. First, the teacher used the CLES to assess student's perceptions of their learning environment. These responses were used as a basic guideline for constructing the intervention. Secondly, student's understanding was probed in order to assess their prior knowledge and past experiences related to AIDS. This stage was very important because all students had different backgrounds, experiences and pre-instructional concepts. This information assisted the teacher/researcher to be more effective. In other words, if I had not known what views the students held, I may have taught things that were not suitable, appropriate or relevant to the students' needs. There are many methods of finding out students' prior knowledge. In this study, open-ended questions were used.

In the next step, the teachers and students use this information as a guide for setting the learning objectives and planning their preferred learning activities based on constructivism theory and relevance to their need.

A key feature of the implementation of the intervention was the use of collaborative working in small groups for a lot of the time. Collaborative learning has many advantages as it encourage students to participate in the learning process, developing their abilities to work with others, to listen carefully, and to share ideas. Also, students have the chance to practise negotiation and persuasion and to learn how to integrate the opinions of others into their views. This teaching method also develops student bonding and creates a good learning environment. Another teaching strategy that was used related to the real world outside the classroom, and included field trips to a hospital and a local community. The students have a chance to talk with an HIV infected and listen to a brief presentation about AIDS from a doctor. They also talk to the family of an HIV infected person. These activities led to a better understanding about HIV and AIDS because they learned from real life situations. These situations also worked as role models for the students in learning about how to prevent themselves from getting HIV.

10.5.4 Use of an authentic assessment technique

An aim of this study was to use authentic assessment both in a formative and summative manner to assess the students. The SKAT with its two-tiered format provided valuable information about the students, knowledge and understanding of AIDS. However, it did not provide information on how the students learned about AIDS and what they felt about AIDS. Therefore, the students' journals were used to provide qualitative data to complete the assessment. Also, students' journals can developed higher order thinking skills in the students like encouraging thinking skills and developing a responsibility for one's own learning. The students were successfully encouraged to become involved in the assessment process. Both the teacher and the students found this to be helpful and useful. Overall, the assessment methods added to the creation of a good learning environment.

10.5.5 Results of a constructivist teaching approach to improve the learning environment

Research Questions 3 and 4 related to the students' actual and preferred perceptions of the constructivist classroom environment in Health Science classroom in Thailand. Results of paired sample t-tests indicated that there were statistically significant differences between the mean scores of the Actual and Preferred Forms on four scales of the CLES, Personal Relevance ($p < 0.001$), Critical Voice ($p < 0.05$), Shared Control ($p < 0.001$) and Student Negotiation ($p < 0.001$). In each case, students would prefer higher levels of these aspects of the learning environment. The difference in means for the Uncertainty scale was not significant.

At the completion of the intervention, the results from post-assessment with the Actual Form of the CLES indicated that the item mean scores of all scales had increased. The t-test analyses indicated that these differences were statistically significant ($p < 0.001$). Therefore, there had been an improvement in the constructivist learning environment.

When comparing the preferred learning environment (before intervention) with the actual environment (after intervention), it was clear that the differences between them had decreased on all scales. Analyses with t-tests indicated that there were now no significant differences between these mean scores.

These results suggested that there had been improvement occurring in students' perception of their learning environment on all scales of the CLES. These results implied that the intervention based on the constructivist teaching approach did improve the learning environment in the Health Science classroom.

10.5.6 Results of a constructivist teaching approach to improve students' attitude towards AIDS and students' knowledge about AIDS

Research Question 6 was about the effectiveness of the intervention on improving students' attitudes toward AIDS and students' knowledge about AIDS. The results from the ATAQ and the SKAT are discussed separately.

The ATAQ was administrated to the students on completion of the intervention. The results of the ATAQ indicated that most students have attitude total scores at the high level (55.66% of students) and middle level (33.33%), respectively. That is, a large group (88.90%) of students have a positive attitude about AIDS. The results from students journals confirmed the results from the questionnaire with students clearly indicating how they had changed their attitude about AIDS and the people who were victims of it. As we can see from the results, it can be suggested that constructivist learning activities can result in students' thinking more positively about AIDS.

The SKAT was administrated to the students on completion of the intervention. The results of the SKAT indicated that most students have a knowledge score at the high level (88.90% of students) and the remaining 11.11% achieved at the middle level. This result implied that after the lessons the large group of students have a good knowledge and understanding of AIDS. They had some prior knowledge of the topic and were able to construct new knowledge from the constructivist learning process. As we can see from their writing in the journals, students have learned about AIDS from multiple

sources, such as their friends (social interaction, brainstorming in the group work, listening to their friends' presentation), their teacher, the field trip to the hospital (listening and discussing with the doctor), visit to a community and talking with an HIV infected person. They also learned from other media (newspaper, television, radio, journals, and the Internet). The students stated that the constructivist learning experiences were very useful for them. They not only learned about the subject itself, but they also developed themselves in many ways.

10.5.7 Summary of results

In conclusion, the constructivist teaching approach is effective in improving students' learning outcomes (attitude toward AIDS and knowledge about AIDS) and the learning environment in Health Science classes at the undergraduate level in Thailand. The major finding of this research study can be summarized as following.

1. The Constructivist Learning Environment Survey (CLES) is a valid and reliable questionnaire for used in Thailand
2. Teachers as researchers can use the students' responses to the CLES as a guide for constructing appropriate intervention strategies to use in an attempt to improve their own teaching and create a good learning environments.
3. A constructivist teaching approach on the AIDS topic can improve students' knowledge of and attitude towards AID.
4. Students are satisfied with the constructivist teaching approach and enjoy students learning in that way. Therefore, the use of constructivist teaching approaches is effective in improving the learning environment and consequently students' learning outcomes.

10.6 LIMITATIONS

There are some limitations in the process of this study, such as the sampling method, data analysis, and interpretation of the results, and the limited period of time allowed for the study. However, each limitation was addressed in order to ensure that the present

study was as accurate and valid as possible. However, I would like to discuss each of these limitation.

As there is only one class of 18 students which majors in Health Education in this particular Rajabhat Institute, it had to be selected for this study. Thus, a purposive sampling method was used. It is not clear how representative of all the students in Health Science in Thailand the sample is. In other words, care needs to be taken when generalising from this sample. However, the researcher overcame this to some extent by including other science students for the validation of the CLES.

Moreover, this type of sampling technique is appropriate to the main purpose of an action research design that was used in this study. McMillan (1992) mentioned that the purpose of action research in education is to solve a specific classroom problem or make a decision at a local site in order to improve practice immediately within one or more classrooms.

Because there were 18 students involved in this study, some limitations applied to the use of statistical methods. It was not possible to use complex statistics or a variety of analytical techniques. In this case, I minimised this limitation by using both quantitative and qualitative data. Also, I used a triangulation technique in order to confirm that the results were similar from different methods.

Although the first assumption in this study is that the samples provided truthful and accurate information on the questionnaires and during the focus group discussion, Thai students are accustomed to a traditional teaching style, in which the teacher tells them “what to do”. It is possible that some students provided inaccurate responses (i.e., not giving the 100% true answer) and this could have an effect on the interpretation of the results.

I believe that this limitation was minimised because the students were encouraged to become involved in every step of the process and they were told of the importance of data quality of the answers to the questionnaires, which were be used as the basis for developing the intervention attempts to improve the Health Science classroom

environment. Furthermore, informal observations were used throughout the process to confirm the results from the questionnaires.

The other limitation was the short period of time allowed for the study. Because the Health Science curriculum that contains the AIDS topics is restricted to semester one, only one semester was available for preparing the instruments and one semester available for planning, implementing the intervention and collecting the data.

In order to decrease this limitation, I attempted to solve this problem by maximising the effective management of the time available.

10.7 IMPLICATIONS

There are some interesting findings from this study which can be useful for future researchers and particularly for teachers. The experience of using a constructivist teaching approach in this study suggests that there are some important things to consider before implementing the constructivist teaching approach in Thailand as following.

When using a constructivist teaching approach for the first time, it is very important to have commitment from the stakeholders, such as teachers, students, parents, and administrators. The teacher should inform the class about the proposed teaching methods, rationale and the benefits that students could receive from the new learning. This technique can create an acceptable cooperative learning environment and decrease any student resistance.

Teachers need time to prepare for this new approach because constructivist teaching is not familiar to teachers in Thailand. Teachers will need time to prepare an instructional plan and simultaneously an assessment plan. These plans should be appropriate for the learning objectives and constructivist teaching.

To plan and teach in this way, teachers must have a good understanding of how to use a constructivist teaching approach. In Thailand, there are some teacher who do not understand this approach, therefore, professional development will be required. Such

professional development should focus on the factors affecting teaching and learning, like methods for changing students' misconceptions. It is also important for teachers to know how to use examples from real world problems and situations that are relevant to the students. This can help students understand new knowledge by building on their past experiences.

This study involved authentic assessment processes. This type of assessment encourages the students to get involved in the assessment process and have opportunities to demonstrate their competence or knowledge in diverse ways, such as, concept mapping, social skills when working in a group, presentation skills, peer-assessment and self-assessment. Authentic assessment can assess multiple skills and higher-order thinking skills and integrate assessment into the daily instruction and classroom activities. However, there are some specific suggestions about how to use authentic assessment in order to assess student's learning outcomes that became clear in the study.

1. When using a new assessment technique, (for instance, concept mapping) the teacher first should provide enough time for students to learn how to write concept maps.
- 2 The teacher should provide opportunities for students to be involved in the process of constructing assessment instruments, for instance, the process of making a scoring rubric. For students, this process can encourage their thinking skills, empowerment them, and assist them to accept the results of the assessment.
- 3 Open-ended questions should be used in paper form and be given to each student to complete rather than being given orally to the whole class. It is easy for students to use this instrument and easy for the teacher to analyse and interpret the results for each student or for the whole class.
- 4 Sometimes students do not accept feedback from their peers because they are all in the same position. The teacher should explain the objective of using peer-assessment to the students so that they understand the aims and advantages of

this form of assessment, and should advise them to be open-minded and considerate about peer feedback. The second problem is that it is difficult for the students to give sensitive feedback or a critical message because this may cause bad feeling among their peers. The teacher should provide guidelines for giving feedback, for example, making suggestions for improvement without making value judgments and to be careful with sensitive feedback or critical messages.

5 When using self assessment, the teacher needs to be aware about possible biased data because the students may not be honest with themselves. They need to be informed of the importance of data quality and they should be honest to themselves.

In future research studies, it would be good to see the constructivist teaching approach being applied in other contexts, such as, different countries, different areas (urban, rural), different years of study or different study majors (nursing, education, management, etc.). Other studies could use different teaching methods, creating new teaching strategies.

Other research studies could involve larger groups samples of teachers and it would be useful to see the effect of a constructivist teaching approach implemented over longer periods of time or conducting action research through many cycles.

8.8 CONCLUSIONS

The learning environment is very important in the teaching/learning process and has a considerable effect on students' learning outcomes. The Constructivist Learning Environment Survey was used in this action research as a valid tool for assessing students' perceptions of their Health Science learning environment at undergraduate level in Thailand. The results from the CLES were then used as a guideline for developed a new constructivist teaching strategy designed to bring about changes in students' misconceptions on the topic of AIDS. Although the theory of constructivism has been known for a long time, the constructivist teaching approach is an innovative model in Thailand. The Ministry of Education encourages teachers and educators to use this new model as an important strategy of educational reform in order to improve

Thailand's education system. I hope that this research can encourage teachers, educators and researchers in Thailand to pay attention to the learning environment and the constructivist teaching model and that the suggestions in this study can guide them to use the CLES to monitor and improve their own teaching and consequently students' learning outcomes. I also hope that this learning model will become a model for application in other subjects at all levels of education in Thailand.

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Appendices

LIST OF APPENDICES

- Appendix A:** The Constructivist Learning Environment Survey (CLES)
A1 : The CLES Original Version (Fisher, Taylor & Fraser, 1997)
(Actual Form and Preferred Form)
A2 : The CLES Adapted Thai Version (English Language)
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- Appendix B:** The Attitude toward AIDS Questionnaire (ATAQ)
- Appendix C:** The Student's Knowledge of AIDS Test (SKAT)
- Appendix D:** The Constructivist Learning Environment Observation Checklist
- Appendix E:** A Guideline question for focus group discussion
- Appendix F:** A Guideline question for student's journal
- Appendix G:** A worksheet for learning activity 1: The history of AIDS
- Appendix H:** Assessment sheet for learning activity 1: Group work check list
- Appendix I:** A worksheet for learning activity 2: The causes of AIDS
- Appendix J:** A worksheet for learning activity 3: The transmission of AIDS
- Appendix K:** A worksheet for learning activity 4: Signs, symptoms and treatments of AIDS.
- Appendix L:** A worksheet for learning activity 5: How to live with an HIV-infected person.
- Appendix M:** A worksheet for learning activity 6: AIDS Prevention and Self-assessment checklist for using condom.
- Appendix N:** A worksheet for learning activity 7: The impact of AIDS and Peer assessment checklist for Presentation Skill.

Appendix A

The Constructivist Learning Environment Survey (CLES) Original version : Actual Form

DIRECTIONS

1. Purpose of the Questionnaire

This questionnaire asks you to describe important aspects of the science classroom which you are in right now. There are no right or wrong answers. This is not a test and your answers will not affect your assessment. Your opinion is what is wanted. Your answers will enable us to improve future science classes.

2. How to Answer Each Question

On the next few pages you will find 30 sentences. For each sentence, circle only one number corresponding to your answer. For example:

		Almost Always	Often	Sometimes	Seldom	Almost Never
In this class . . .						
8	The teacher asks me questions.	5	4	3	2	1

- If you think this teacher *almost always* asks you questions, circle the 5.
- If you think this teacher *almost never* asks you questions, circle the 1.
- Or you can choose the number 2, 3 or 4 if one of these seems like a more accurate answer.

3. How to Change Your Answer

If you want to change your answer, cross it out and circle a new number, For example:

8	The teacher asks me questions.	5	④	3	2	1
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Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
1	I learn about the world outside of school.	5	4	3	2	1
2	My new learning starts with problems about the world outside of school.	5	4	3	2	1
3	I learn how science can be part of my out-of-school life.	5	4	3	2	1

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
4	I get a better understanding of the world outside of school.	5	4	3	2	1
5	I learn interesting things about the world outside of school.	5	4	3	2	1
6	What I learn has <u>nothing</u> to do with my out-of-school life.	5	4	3	2	1
Learning about science		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
7	I learn that science <u>cannot</u> provide perfect answers to problems.	5	4	3	2	1
8	I learn that science has changed over time.	5	4	3	2	1
9	I learn that science is influenced by people's values and opinions.	5	4	3	2	1
In this class . . .						
10	I learn about the different sciences used by people in other cultures.	5	4	3	2	1
11	I learn that modern science is different from the science of long ago.	5	4	3	2	1
12	I learn that science is about <u>inventing</u> theories.	5	4	3	2	1
Learning to speak out		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
13	It's OK for me to ask the teacher "why do I have to learn this?"	5	4	3	2	1
14	It's OK for me to question the way I'm being taught.	5	4	3	2	1
15	It's OK for me to complain about activities that are confusing.	5	4	3	2	1
In this class . . .						
16	It's OK for me to complain about anything that prevents me from learning.	5	4	3	2	1
17	It's OK for me to express my opinion.	5	4	3	2	1
18	It's OK for me to speak up for my rights.	5	4	3	2	1

Learning to learn		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
19	I help the teacher to plan what I'm going to learn.	5	4	3	2	1
20	I help the teacher to decide how well I am learning.	5	4	3	2	1
21	I help the teacher to decide which activities are best for me.	5	4	3	2	1
In this class . . .						
22	I help the teacher to decide how much time I spend on activities.	5	4	3	2	1
23	I help the teacher to decide which activities I do.	5	4	3	2	1
24	I help the teacher to assess my learning.	5	4	3	2	1
Learning to communicate		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
25	I get the chance to talk to other students.	5	4	3	2	1
26	I talk with other students about how to solve problems.	5	4	3	2	1
27	I explain my ideas to other students.	5	4	3	2	1
In this class . . .						
28	I ask other students to explain their ideas.	5	4	3	2	1
29	Other students ask me to explain my ideas.	5	4	3	2	1
30	Other students explain their ideas to me.	5	4	3	2	1

The Constructivist Learning Environment Survey (CLES)

Original version : Preferred Form

DIRECTIONS

1. Purpose of the Questionnaire

This questionnaire asks you to describe important aspects of the science classroom which you are in right now. There are no right or wrong answers. This is not a test and your answers will not affect your assessment. Your opinion is what is wanted. Your answers will enable us to improve future science classes.

2. How to Answer Each Question

On the next few pages you will find 30 sentences. For each sentence, circle only one number corresponding to your answer. For example:

	Almost Always	Often	Sometimes	Seldom	Almost Never
In this class I wish that . . .					
8 The teacher asks me questions.	5	4	3	2	1

- If you think this teacher *almost always* asks you questions, circle the 5.
- If you think this teacher *almost never* asks you questions, circle the 1.
- Or you can choose the number 2, 3 or 4 if one of these seems like a more accurate answer.

3. How to Change Your Answer

If you want to change your answer, cross it out and circle a new number. For example:

8	The teacher asks me questions.	5	④	3	2	1
---	--------------------------------	--------------	---	---	---	---

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that. . .						
1	I learned about the world outside of school.	5	4	3	2	1
2	My new learning starts with problems about the world outside of school.	5	4	3	2	1
3	I could learn how science can be part of my out-of-school life.	5	4	3	2	1

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that. . .						
4	I would get a better understanding of the world outside of school.	5	4	3	2	1
5	I learned interesting things about the world outside of school.	5	4	3	2	1
6	What I learn has <u>nothing</u> to do with my out-of-school life.	5	4	3	2	1
Learning about science		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that . . .						
7	I learned that science <u>cannot</u> provide perfect answers to problems.	5	4	3	2	1
8	I learned that science has changed over time.	5	4	3	2	1
9	I learned that science is influenced by people's values and opinions.	5	4	3	2	1
In this class I wish that. . .						
10	I learned about the different sciences used by people in other cultures.	5	4	3	2	1
11	I learned that modern science is different from the science of long ago.	5	4	3	2	1
12	I learned that science is about <u>inventing</u> theories.	5	4	3	2	1
Learning to speak out		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that. . .						
13	It was OK for me to ask the teacher "why do I have to learn this?"	5	4	3	2	1
14	It was OK for me to question the way I'm being taught.	5	4	3	2	1
15	It was OK for me to complain about activities that are confusing.	5	4	3	2	1
In this class I wish that. . .						
16	It was OK for me to complain about anything that prevents me from learning.	5	4	3	2	1
17	It was OK for me to express my opinion.	5	4	3	2	1
18	It was OK for me to speak up for my rights.	5	4	3	2	1

Learning to learn		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that. . .						
19	I could help the teacher to plan what I'm going to learn.	5	4	3	2	1
20	I could help the teacher to decide how well I am learning.	5	4	3	2	1
21	I could help the teacher to decide which activities are best for me.	5	4	3	2	1
In this class I wish that. . .						
22	I could help the teacher to decide how much time I spend on activities.	5	4	3	2	1
23	I could help the teacher to decide which activities I do.	5	4	3	2	1
24	I could help the teacher to assess my learning.	5	4	3	2	1
Learning to communicate		Almost Always	Often	Some- times	Seldom	Almost Never
In this class I wish that. . .						
25	I got the chance to talk to other students.	5	4	3	2	1
26	I could talk with other students about how to solve problems.	5	4	3	2	1
27	I had the chance to explain my ideas to other students.	5	4	3	2	1
In this class I wish that. . .						
28	I could ask other students to explain their ideas.	5	4	3	2	1
29	Other students would ask me to explain my ideas.	5	4	3	2	1
30	Other students would explain their ideas to me.	5	4	3	2	1

The Constructivist Learning Environment Survey (CLES)

Adapted Thai version : Actual Form

DIRECTIONS

1. Purpose of the Questionnaire

This questionnaire asks you to describe important aspects of the science classroom which you are in right now. There are no right or wrong answers. This is not a test and your answers will not affect your assessment. Your opinion is what is wanted. Your answers will enable us to improve future science classes.

2. How to Answer Each Question

On the next few pages you will find 30 sentences. For each sentence, circle only one number corresponding to your answer. For example:

		Almost Always	Often	Sometimes	Seldom	Almost Never
In this class . . .						
8	The teacher asks me questions.	5	4	3	2	1

- If you think this teacher *almost always* asks you questions, circle the 5.
- If you think this teacher *almost never* asks you questions, circle the 1.
- Or you can choose the number 2, 3 or 4 if one of these seems like a more accurate answer.

3. How to Change Your Answer

If you want to change your answer, cross it out and circle a new number, For example:

8	The teacher asks me questions.	5	④	3	2	1
---	--------------------------------	--------------	---	---	---	---

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
1	I learn about the world outside of school.	5	4	3	2	1
2	My new learning starts with problems about the world outside of school.	5	4	3	2	1
3	I learn how science can be part of my out-of-school life.	5	4	3	2	1

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
4	I get a better understanding of the world outside of school.	5	4	3	2	1
5	I learn interesting things about the world outside of school.	5	4	3	2	1
6	What I learn has <u>nothing</u> to do with my out-of-school life.	5	4	3	2	1
Learning about science		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
7	I learn that <i>health science</i> <u>cannot</u> provide perfect answers to problems.	5	4	3	2	1
8	I learn that <i>health science</i> has changed over time.	5	4	3	2	1
9	I learn that <i>health science</i> is influenced by people's values and opinions.	5	4	3	2	1
In this class . . .						
10	I learn about the different <i>health sciences</i> used by people in other cultures.	5	4	3	2	1
11	I learn that modern <i>health science</i> is different from the <i>health science</i> of long ago.	5	4	3	2	1
12	I learn that <i>health science</i> is about <u>inventing</u> theories.	5	4	3	2	1
Learning to speak out		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
13	It's OK for me to ask the teacher "why do I have to learn this?"	5	4	3	2	1
14	It's OK for me to question the way I'm being taught.	5	4	3	2	1
15	It's OK for me to <i>talk</i> about activities that are confusing.	5	4	3	2	1
In this class . . .						
16	<i>I can talk about the obstacles to my learning.</i>	5	4	3	2	1
17	<i>I can express my opinion to my teacher.</i>	5	4	3	2	1
18	<i>I can speak up for my rights.</i>	5	4	3	2	1

Learning to learn		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
19	I help the teacher to plan what I'm going to learn.	5	4	3	2	1
20	I help the teacher to decide how well I am learning.	5	4	3	2	1
21	I help the teacher to decide which activities are best for me.	5	4	3	2	1
In this class . . .						
22	I help the teacher to decide how much time I spend on activities.	5	4	3	2	1
23	I help the teacher to decide which activities I do.	5	4	3	2	1
24	I help the teacher to assess my learning.	5	4	3	2	1
Learning to communicate		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
25	I get the chance to talk to other students.	5	4	3	2	1
26	I talk with other students about how to solve problems.	5	4	3	2	1
27	I explain my ideas to other students.	5	4	3	2	1
In this class . . .						
28	I ask other students to explain their ideas.	5	4	3	2	1
29	Other students ask me to explain my ideas.	5	4	3	2	1
30	Other students explain their ideas to me.	5	4	3	2	1

The Constructivist Learning Environment Survey (CLES)

Adapted Thai version : Preferred Form

DIRECTIONS

1. Purpose of the Questionnaire

This questionnaire asks you to describe important aspects of the science classroom which you are in right now. There are no right or wrong answers. This is not a test and your answers will not affect your assessment. Your opinion is what is wanted. Your answers will enable us to improve future science classes.

2. How to Answer Each Question

On the next few pages you will find 30 sentences. For each sentence, circle only one number corresponding to your answer. For example:

	Almost Always	Often	Sometimes	Seldom	Almost Never
In this class I wish that . . .					
8 The teacher asks me questions.	5	4	3	2	1

- If you think this teacher *almost always* asks you questions, circle the 5.
- If you think this teacher *almost never* asks you questions, circle the 1.
- Or you can choose the number 2, 3 or 4 if one of these seems like a more accurate answer.

3. How to Change Your Answer

If you want to change your answer, cross it out and circle a new number. For example:

8	The teacher asks me questions.	5	④	3	2	1
---	--------------------------------	--------------	---	---	---	---

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
1	<i>I wish that</i> learned about the world outside of school.	5	4	3	2	1
2	<i>I wish that</i> my new learning starts with problems about the world outside of school.	5	4	3	2	1
3	<i>I wish that</i> I could learn how science can be part of my out-of-school life.	5	4	3	2	1

Learning about the world		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
4	<i>I wish that</i> I would get a better understanding of the world outside of school.	5	4	3	2	1
5	<i>I wish that</i> I learned interesting things about the world outside of school.	5	4	3	2	1
6	<i>I wish that</i> what I learn has <u>nothing</u> to do with my out-of-school life.	5	4	3	2	1
Learning about science		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
7	<i>I wish that</i> I learned that <i>health science</i> <u>cannot</u> provide perfect answers to problems.	5	4	3	2	1
8	<i>I wish that</i> I learned that <i>health science</i> has changed over time.	5	4	3	2	1
9	<i>I wish that</i> I learned that <i>health science</i> is influenced by people's values and opinions.	5	4	3	2	1
In this class . . .						
10	<i>I wish that</i> I learned about the different <i>health sciences</i> used by people in other cultures.	5	4	3	2	1
11	<i>I wish that</i> I learned that modern <i>health science</i> is different from the science of long ago.	5	4	3	2	1
12	<i>I wish that</i> I learned that <i>health science</i> is about <u>inventing</u> theories.	5	4	3	2	1
Learning to speak out		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
13	<i>I wish that</i> It was OK for me to ask the teacher "why do I have to learn this?"	5	4	3	2	1
14	<i>I wish that</i> It was OK for me to question the way I'm being taught.	5	4	3	2	1
15	<i>I wish that</i> It was OK for me to <i>talk</i> about activities that are confusing.	5	4	3	2	1
In this class . . .						
16	<i>I wish that I can talk about the obstacles to my learning.</i>	5	4	3	2	1
17	<i>I wish that I can express my opinions to my teacher.</i>	5	4	3	2	1
18	<i>I wish that I can speak up for my rights.</i>	5	4	3	2	1

Learning to learn		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
19	<i>I wish that</i> I could help the teacher to plan what I'm going to learn.	5	4	3	2	1
20	<i>I wish that</i> I could help the teacher to decide how well I am learning.	5	4	3	2	1
21	<i>I wish that</i> I could help the teacher to decide which activities are best for me.	5	4	3	2	1
In this class I wish that. . .						
22	<i>I wish that</i> I could help the teacher to decide how much time I spend on activities.	5	4	3	2	1
23	<i>I wish that</i> I could help the teacher to decide which activities I do.	5	4	3	2	1
24	<i>I wish that</i> I could help the teacher to assess my learning.	5	4	3	2	1
Learning to communicate		Almost Always	Often	Some- times	Seldom	Almost Never
In this class . . .						
25	<i>I wish that</i> I got the chance to talk to other students.	5	4	3	2	1
26	<i>I wish that</i> I could talk with other students about how to solve problems.	5	4	3	2	1
27	<i>I wish that</i> I had the chance to explain my ideas to other students.	5	4	3	2	1
In this class . . .						
28	<i>I wish that</i> I could ask other students to explain their ideas.	5	4	3	2	1
29	<i>I wish that</i> other students would ask me to explain my ideas.	5	4	3	2	1
30	<i>I wish that</i> other students would explain their ideas to me.	5	4	3	2	1

Appendix B

The Attitude Toward AIDS Questionnaire (ATAQ)

Item	The level of opinions				
	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1. Having sex with a peer is not a risk of becoming infected with AIDS.					
2. If you have sex only once, you cannot become infected with AIDS.					
3. A person who has good health has no chance of being infected with AIDS.					
4. Donating blood may be a cause AIDS.					
5. Drug users who share needles are a risk of HIV infection.					
6. Signs and symptoms of HIV infected persons are horrible.					
7. AIDS cannot easily spread, therefore it is not necessary to prevent AIDS.					
8. Having sex with a condom gives you a bad feeling.					
9. Not using drugs can prevent AIDS.					
10. Every person who wants to donate blood has to have a blood test for HIV. This can prevent HIV infection because from donating blood.					
11. The first stage of AIDS can be cured.					
12. An infected person who is in "full bound AIDS" stage should not be cured because there is no way to get well.					
13. A person who has HIV is pitiful.					
14. We should not isolate a person who has HIV from family or society.					
15. We should listen to the problems of a person who has HIV.					
16. We should not live with a person who has HIV.					
17. A person who has HIV is worthless.					
18. AIDS has an impact on the economic system.					
19. A person who has HIV is a social problem.					
20. AIDS has an impact on social development.					

Appendix C

The Student's Knowledge of AIDS Test (SKAT)

Item	Answer	
	correct	incorrect
1. AIDS is a syndrome that is caused by HIV which attacks and destroys the body's immune system reasons.....		
2. A person who is infected with HIV has low immunity because HIV destroys the white blood cells reasons.....		
3. HIV can be spread by receiving blood with HIV reasons.....		
4. A person who donates blood has a chance of getting HIV reasons.....		
5. HIV can be spread by mosquitoes reasons.....		
6. HIV can be transmitted through sharing the bathroom /bathing together reasons.....		
7. Having sexual intercourse with many different partners without a condom, can be the cause of HIV infection reasons.....		
8. Only people who have a positive result of the HIV antibody test can transmit AIDS reasons.....		
9. A person who is in the asymptomatic period cannot transmit AIDS reasons.....		
10. Dry kissing with a person who has been HIV infected make a very high risk for transmission reasons.....		
11. Touching someone who has been HIV infected can transmit AIDS reasons.....		
12. Washing sexual organs after having sex can reduce the risk of being infected with HIV reasons.....		
13. A pregnant woman who has HIV can 100 % for sure pass AIDS to her new born baby reasons.....		
14. An AIDS infected mother can pass the infection to the baby by breast feeding reasons.....		

Item	Answer	
	correct	incorrect
15. People who have taken the HIV antibody test which the result is negative are not HIV infected reasons.....		
16. The first stage of AIDS has no symptoms reasons.....		
17. A person who has been HIV infected usually dies from opportunistic infections reasons.....		
18. Nowadays, we can prevent AIDS by vaccine reasons.....		
19. Using disposable needles can prevent AIDS reasons.....		
20. Blood transfusion can exclude HIV from blood vessels reasons.....		
21. The first stage of AIDS can be cured reasons.....		
22. There are some herbs that can cure AIDS reasons.....		
23. Pregnant women who receive medicine for treatment of AIDS can reduce risk of giving HIV to their babies reasons.....		
24. If clothes or instruments are contaminated with the blood of an infected person, we can kill HIV by boiling them in water for 30 minutes reasons.....		
25. It is not necessary for a family to isolate the instruments of an HIV infected person reasons.....		
26. An HIV infected person should not take medicine that has an action to decrease immunity reasons.....		
27. The family should support HIV an infected person reasons.....		
28. An HIV infected person has the right to decision making about his/her own life, such as to keep secret, to select the method of treatment, and to be pregnant or have an abortion reasons.....		

Appendix D

The Constructivist Classroom Learning Environment Observation Checklist

Observer name.....

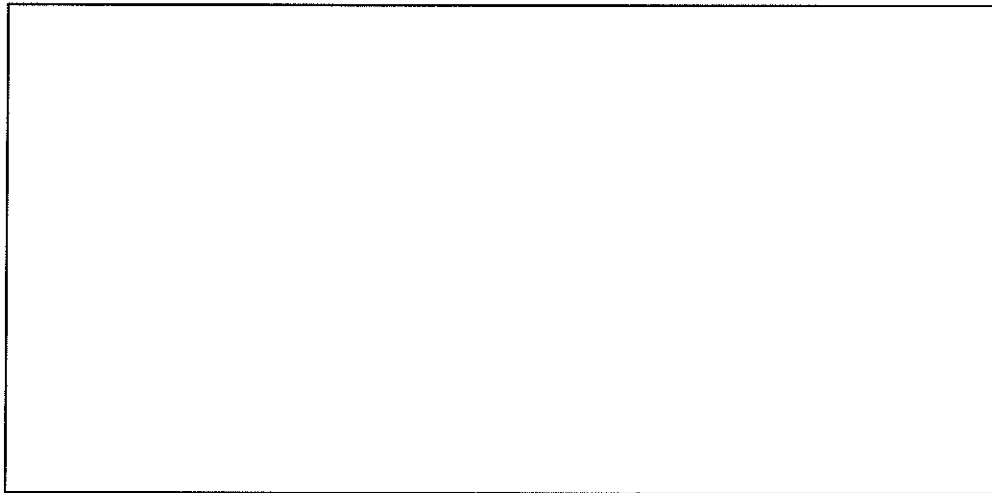
Class.....

Date/Month/Year..... Time.....

1. *Size of classroom*.....

2. *Size of class (number of students, male and female)*.....

3. *Set up (number and draw diagram of chair and table setting)*



4. *Lighting*.....

.....

5. *Displays*.....

.....

6. *Sound*.....

.....

7. *Movement*.....

.....

8. *Climate /atmosphere*.....

.....

9. *Teacher and Students' behaviour (as shown in the table)*

9. Teacher and Student's behaviour	Always	Often	Sometime	Seldom	Never
1.The teacher starts the lesson with a problem about the real world outside of school					
2.The teacher provides the correlation between Health Science lessons and daily experiences.					
3.The teacher give an example from everyday life in their teaching					
4.The teacher asks questions to students to elicit their conceptual understanding					
5.The teacher makes lesson relevant by students' interest/prior knowledge					
6.The teacher encourage the students think about an examples from their own experience					
7.The students can apply Health Science to their real life					
8. The teacher gives an example which show that Health Science has changed over time					
9. The teacher gives an example which show that Health Science is influence by people's value/opinions					
10.The teacher gives an example which show that scientists have invented a new knowledge about AIDS					
11.The teacher gives a chance for the students to ask their questions					
12.The teacher gives a chance for the students to express their opinion					
13. The teacher gives a chance for the students to speak up for their right					
14. The teacher gives a chance for the students to set their learning goal					
15. The teacher gives a chance for the students to plan the contents which they want to learn					
16. The teacher gives a chance for the students to make decision about how much time they will spend on activities					
17. The teacher gives a chance for the students to assess their learning					
18.Each student gets the chance to talk with other students about the things that he/she have learned					
19. Each student gets the chance to express his/her ideas with other students					
20. Each student gets the chance to be involved in negotiations with his/her peers.					
21.The teacher encourages active participation of all students					
22.The teacher provides time for students to consider their points of view					
23.The teacher fosters a climate of respect for student ideas					
24.The teacher modifies lesson/learning activities based on student questioning					
25.The learning environment in this class is relaxed, flexible and encourages students to involved in learning activities.					

Appendix E

A Guideline question for focus group discussion

1. The guideline questions for focus group discussions in the first stage.

The main purpose of this stage was to generate feedback information, from reflection and discussion about the results of students' responses to the CLES. Examples of the question used are:

According to the results of the CLES, ...

What do you think about the gap between the actual and preferred means?

What does it mean? Are there some problems in this or not?

What do you think causes this gap?

In which of the scales are there large gaps?

2. The guideline questions for focus group discussions in the second stage.

The main purpose of this stage was to develop intervention strategies. Examples of the questions used are as follows:

How can we decrease the gap between the actual and preferred means?

What strategies do you think we could use to improve the learning environment and achievement?

3. The guideline questions for focus group discussions in the third stage.

The main purpose of this stage was to collect qualitative data to determine how effective the intervention had been. Data from re-assessment of the CLES, the ATAQ, and the SKAT were used as a basis for the focus group discussion. Examples of the questions used are as follows:

What did you think about the strategies that were used in the intervention process?

Did the intervention process help to improve your learning environment?

Are there some things in the intervention process (learning activities) that need to be changed? Why? How?

What have you learned?

How have you learned and how can you link your learning experience to your real life ?

Have you changed the way you learn after finishing the intervention process? How? Why?

Appendix F

A Guideline question for the student's journal

The following guideline questions were used to assist the students in the writing of their journals.

1. What have you received from the learning experience about the AIDS topic?
2. How did you learn about AIDS?
3. How are the learning activities helping you to gain understanding about AIDS?
4. How much knowledge or understanding have you gained about AIDS?
(assesses cognitive dimension)
5. What do you think or feel about AIDS? (assesses affective dimension)
6. How can you link your learning experiences in this topic to your real life?
7. According to your learning experiences in this topic,
 - 7.1 Does the instructor provide the chance for you to involved in planning your learning (plan about the time, content, activities), How?
 - 7.2 Does the instructor encourage you to practise, think, express your opinions? How?
 - 7.3 Does the instructor provide the chance for you to be involved in learning assessment? How?
 - 7.4 Did you learned from your peers? How?
8. Do you think this new way of learning was similar to or different from traditional learning? Why? How?
9. Do you think this new learning approach helped you to improve the learning environment in your class? Why? How?
10. What do you think or feel about this new learning approach? Why?

Appendix G

A worksheet for learning activity 1 : The history of AIDS

The history of AIDS

1. Divide a students into four groups of equal size by using the students' ID number as a method for deciding the membership of a group.
2. Hand out a worksheet to each group, then the teacher explains the learning objectives and learning activities to the students.
3. Each group select their preferred method for searching for information about the history of AIDS. Each group choose a difference method as follows:
 - Group 1 websites
 - Group 2 textbooks
 - Group 3 journals
 - Group 4 research studies or theses
4. The students working in a group in order to review the information that they have got from difference sources in order to combine a similar information and generate a consensus. They also negotiate and integrate the difference opinions of others into their views. Finally, the students draw conclusions that will help them to answer their questions on this topic on the worksheet.
5. A representative form each group present the information to the class.
6. Think about the knowledge and learning experiences that they have gain from this learning activity.

Appendix H

Assessment sheet for learning activity 1: Group work check list

The self assessment when working in a group

Item	Always	Usually	Sometime	Seldom	Never
1. I shared my opinions with others					
2. I could explain my ideas clearly to others					
3. I encouraged others to work together					
4. I accepted the ideas of others					
5. I accepted group decisions					
6. I was adaptable and flexible when working with others					
7. I felt responsibility to complete the work					
8. I was a good participant as a member of the group by offering assistance appropriately					
9. I could work with others well					
10. I felt happy working in the group					
11. I didn't have any conflicts working in the group					
12. I could learn by social interaction with others					
13. I received benefits from the group work					
14. I was satisfied with the output and the result of my group work					
15. Overall I was satisfied with my role					

The group assessment when working in a group

Item	Always	Usually	Sometime	Seldom	Never
1. Everyone attempt to exchanged their opinions with other					
2. Everyone have assigned the work responsibilities appropriate with their ability					
3. Everyone attempted to help others to learned in a group					
4. Everyone have a reasonable discussion, negotiation in order to made conclusion					
5. Everyone have learned from group process					
6. The group has a good communication					
7. Everyone understand the objective of group working					
8. Everyone get involved in decision making of a group					
9. Everyone attempted to encourage other					
10. Everyone listened actively to others speaking					
11. Everyone accepted a group decision					
12. Everyone flexible to work with other					
13. Everyone felt responsibility for completing his/her part of the work					
14. Everyone got involved in all of the group activities					
15. When problems arose in the group, everyone offered assistance appropriately and considered different ways of solving problems					
16. The group spent time efficiently when working together					
17. Everyone felt happy working in a group					
18. Everyone could learn by social interaction with others					
19. The atmosphere in group working was relax					
20. Everyone received benefits from the group work					
21. The group working was organized efficiently and effectively					
22. Everyone was satisfied with the output and the result of the group work					
23. Overall I was satisfied with my group					

Appendix I

A worksheet for learning activity 2 : The causes of AIDS

The causes of AIDS : the game “Who is the highest risk?”

The materials use in this game consists of a worksheet, cards, colour pens, sticky tape.

1. Divide a students into four groups of equal size by using the Simple random sampling as a method for deciding the membership of a group.
2. Hand out a worksheet to each group, then the teacher explain the learning objectives and the directions of the game in this learning activities to the students.
3. Two sets of word cards were provided to each group.
In the first set, each card had the name of one occupation (such as police, nurse, teacher).
The second set contained a health risk behaviour (such as having sex without a condom, drinking water from the same glass as an HIV-infected person).
4. The method to play this game as following.

The first round

1. The students were encouraged to think about the risk factors of getting HIV in different occupations.
2. They then arrange the cards from the highest risk to the lowest risk occupation.
3. The students discuss with their peers about the reasons of arranging the occupations in this order.
4. When they were satisfied with their arrangement of the cards, they stuck the cards on a sheet of paper.

Second round

The process was the same as in the first round, but the word card was changed from occupation to health risk behaviour.

5. A representative from each group present their results and explain the reasons why they thought this occupation or health risk behaviour had the highest risk factor for infection with AIDS.
6. Reflect and discuss about this actively in order to combine the information and write the conclusions on the subtopic of the causes of AIDS in the form of concept mapping on their worksheets.
7. Think about the knowledge and learning experiences that they have gain from this learning activity.

Remark

The point of the game is that a person's risk of getting an HIV infection is not dependent on their occupation, but on how they behaviour in relation to the risks to getting HIV. For example, a prostitute having sex using a condom has less risk of getting HIV than another person who has sex without a condom.

Appendix J

A worksheet for learning activity 3 : The transmission of AIDS and True False Checklist about AIDS Transmission

The transmission of AIDS : the game “Exchange water”

The materials use in this game consists of a worksheet, plastic glass, pure water, disposable syringe, Phenolphthaleine indicator solution, and 0.1% Sodium Hydroxide solution.

1. Before start the game, the teacher prepared 20 plastic glasses, then, put 50 ml. of the pure water into 19 plastic glasses and the solution of 0.1 % Sodium Hydroxide solution 50 ml into one plastic glass. (The students did not know which glass is different from the other)
2. The teacher explain the learning objectives and the directions of the game in this learning activities to the students.
3. Each student pick one glass for him or herself. Then, each student exchanged 5 ml of their liquid with other students by using the syringe. Five volunteer students exchange their liquid with other students one at a time. The rest students exchange their liquid with other students for five time, but they could not repeat with the same students
4. The teacher used two to three drops of Phenolphthaleine as an indicator for test the 0.1% Sodium Hydroxide solution in each glass.
5. The teacher encouraged the students to used the Predict- Observe- Explain method by predicting the results of the test, observing what happen in each glass, and explaining the results.
(The answer is that, if the glass of water had 0.1% Sodium Hydroxide solution, the solution will change the color to the red solution).

6. The students thinking about the results of this game by answer these following questions.
 1. In how many glasses has solution changed to a red colour?
 2. Did you think how many students had different solutions at the beginning of the game?
 3. How is the 0.1% Sodium Hydroxide solution spread?
 4. By way of analogy, imagine the student who pick the glass with 0.1% Sodium Hydroxide solution is an HIV-infected, do you think AIDS can be transmitted like that?
7. Reflect and discuss about this game actively in order to combine the information and write the conclusions on the subtopic of the transmission of AIDS in the form of concept mapping on their worksheets.
8. Think about the knowledge and learning experiences that they have gain from this learning activity.

True False Checklist about AIDS Transmission

Item	True	False
1.Sharing the bathroom /bathing with an HIV infected person		
2.Being bitten by a mosquito		
3.Having sex with an HIV infected person without a condom		
4.Wet kissing with an HIV infected person and having open sores in the mouth		
5.Touching the skin of an HIV infected person		
6. Washing sex organs after having sex with an HIV infected person		
7.Eating food prepared by an HIV infected person		
8. Sharing a toothbrush with an HIV infected person		
9.Swimming with an HIV infected person		
10.Sharing clothes with an HIV infected person		
11.Receiving blood		
12. Receiving organs from an HIV infected person		
13.Giving blood		
14.Treatment at dental clinic		
15.Passing from an infected mother to the newborn child by blood		
16. Passing from an infected mother to the baby by breast feeding		
17. Having sex with an HIV infected person with a condom		
18. Having an open wound and touching secretion of an HIV infected person		
19.Sharing needles for drug use		
20.Working in the same place as an HIV infected person		
21.The doctor operating an HIV infected person		
22.Cutting the skin with a needles for an injection of an HIV infected person		
23. Sharing nail clippers with an HIV infected person		
24.Eyes becoming contaminated by the secretion of an HIV infected person		
25.Having a hand with a wound contaminated by the blood of an HIV infected person		

Appendix K

<p>A worksheet for learning activity 4 : Signs, symptoms and treatment of AIDS</p>

Signs, symptoms and treatment of AIDS

1. The teacher and the students have a field trip to the Department of AIDS and Sexually Transmitted Disease, at the Udonthani Hospital in order to learn about signs and symptoms of AIDS and the treatment of AIDS.
2. A doctor brief about signs and symptoms of AIDS and the treatment of AIDS to the students.
3. The teacher and the students visited an HIV-infected person in a suburb of Udonthani Province.
4. The students asked for permission and interview the HIV-infected person.
5. The students come back to the university and worked in a small group in order to review this learning experience, combine similar information, reflection and discussion about an information on this subtopic.
6. The students compared the information from the doctor and the patient.
7. The students write the conclusions on the worksheet. They use the following open-ended question as a guide for conclusion.

What are the symptoms of AIDS?

How many stages of the symptoms of AIDS?

Can AIDS be treated?

What is the treatments of AIDS.?

8. Reflection on this learning activity by think about the knowledge and learning experiences that they have gain from this learning activity.

Appendix L

<p>A worksheet for learning activity 5 : How to live with an HIV-infected person</p>

How to take care and live with an HIV-infected person

The materials used in this learning activity consists of a video and a worksheet.

1. The teacher explain a learning objectives and learning activities to the students.
2. The students watch the simulated story about AIDS from video tape.
3. Divide a students into four groups of equal size.
4. Hand out a worksheet to each group.
5. The students were encouraged to think about the story and have a discussion about how to live with and take care of an HIV-infected person by answer these following questions.
 1. If you have to live with an HIV infected person,
how can protect yourselves from HIV infection ?
 2. How can you take care of an infected person?
6. The students drew conclusions in the form of an essay about living with and taking care of an HIV-infected person.
7. A representative from each group presented the results of group working by role playing.
8. Reflection on this learning activity by think about the knowledge and learning experiences that they have gain from this learning activity.

Appendix M

A worksheet for learning activity 6 : AIDS Prevention and Self-assessment checklist for using condom

AIDS Prevention

The materials used in this learning activity consists of a condom, cucumber, tissue paper, and a worksheet.

1. The teacher explain a learning objectives and learning activities to the students.
2. The teacher asking for a student volunteer to demonstrate the method of using a condom to the class.
3. The student volunteer stand in front of the class and provide a demonstration of the steps of using condoms to his friends, and described each step of the process.
4. The teacher give a condoms and a cucumber to each students and then summarize the steps of putting on a condom.
5. Each student practises putting on a condom.
6. Then, the students working in a small group in order to have a discussion and reflection on this learning activity. Then, they drew a conclusions of this learning activity on the worksheet
7. The students think about the knowledge and learning experiences that they have gain from this learning activity then

Self-assessment checklist for using condom

Item	Excellent	Good	Fair	Poor	Very Poor
1. I can use a condom correctly					
2. If I am in a situation that I have to use a condom, I believe I can use a condom correctly					
3. I believe that I can advise or demonstrate the method to use a condom correctly					

Appendix N

Assessment sheet for learning activity 7: The impact of AIDS and Peer assessment checklist for Presentation Skill
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The impact of AIDS.

The materials used in this learning activity consists of a worksheet and a list of sources of information, such as the textbook, journals, Internet and examples of case studies about AIDS.

1. Divide the students into four groups of equal size.
2. The teacher explain a learning objectives and learning activities to the students and hand out a worksheet to each group.
3. Each group select their preferred method for searching for data on the impact of AIDS. Each group choose a difference method as follows:
 - Group 1 website.
 - Group 2 textbook , journal.
 - Group 3 interviews an HIV infected person.
 - Group 4 learning from a case study.
4. The students working in a group in order to review the information that they have got from difference sources in order to combine a similar information and generate a consensus. They also negotiate and integrate the difference opinions of others into their views. Finally, the students draw conclusions about the impact of AIDS on the worksheet.
5. A representative form each group present the information to the class.
6. Think about the knowledge and learning experiences that they have gain from this learning activity.

Peer assessment checklist for Presentation Skill

Item	Very Satisfied	Satisfied	Acceptable	Dissatisfied	Very Dissatisfied
1.Contents -It covered the topic -It was well constructed -There were several sources of up-to-date data					
2. Used time efficiently					
3. Used a clear and understandable language					
4. Used appropriate material/media					
5. Presentation activities interesting and appropriate to contents					
6. Encouraged participants to get involved					
7. Answered the questions clearly and promoted discussion in class					
8. Good personality					
9. The group member have a chance to be involve in their presentation					