

# Application of Needham's Five Phase Constructivism Model in (Civil, Electrical and Mechanical) Engineering Subject at Technical Secondary School

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## Abstract

The aim of this study is to find out the application of Constructivism Model based on the Needham's Five Phase Constructivism Model in (Civil, Electrical and Mechanical) Engineering Studies at Technical Secondary School. The focus of this study is to describe the 5 (five) phases in this model which are orientation phase, generation of ideas, restructuring ideas, application of ideas and reflection phase. Qualitative research methodology is used in this study. A total of 40 teachers who teach Engineering Studies subject at Technical School in Selangor and Malacca were involved as a sample to this study. Questionnaires were used as the research instrument. The data was analyzed using *Statistical Package for Social Science* (SPSS) version 17.0 and presented in the form of frequency, percentage and mean. This study show that teacher applied the Needham's Five Phase Constructivism Model in Engineering Studies (mean = 3.63). In the other hand, the most often phase which applied in the teaching and learning process is the restructuring of idea phase (mean = 3.78) and the orientation phase (mean = 3.46) is a phase of less applied by teacher. Although the Needham's Five Phase Constructivism Model is implemented by the teacher but there is still have some problems in implement the model (mean = 2.85). From the findings, it is suggested to the teachers to be exposed in a variety of teaching models that can improve the quality of teaching and learning process in the classroom.

**Keyword:** needham's five phase constructivism model, technical school, engineering studies

## 1. Introduction

Tenth Malaysia Plan (2011-2015), Ministry of Education conducts an assessment and review the comprehensive education system with particular attention to enhance the educational programs. In general, many changes in education to this country have been introduced by the Ministry of Education to transform the education field which the core curriculum to these changes. In addition, the country has a high hopes for the teachers in Malaysia. According to Ahmad Ramli (2002), teaching and learning process based on constructivism is to promote understanding and provide space for students to practice and develop their thinking skills. Constructivism approach is effective because it involves teachers in guiding students by build their own understanding. Curriculum Development Centre (2001) published a module entitled "Constructivist learning" is to help teachers to understand and practice this approach. It shows that the Ministry of Education has a high emphasis on the implementation of constructivism theory, especially for science-oriented, mathematic and technology subject.

According to Nik Pa (1999), constructivism is part of the stage's commitment to view of the humans in constructing their own knowledge. Thus, constructivism needs more emphasis in giving knowledge to students from teachers. According to Fosnot (2005), the constructivist perspective means that students cannot be passive in accepting the knowledge that is supply by teacher. Teachers should not be a presenter or distributor of knowledge and manage the class. Students are actively constructing their own knowledge and not just accept passively through teaching and learning process. Students used prior knowledge to interpret new knowledge in a meaningful way for themselves. Studies in Civil, Electrical and Mechanical Engineering was introduced to allow students in applying engineering skills and knowledge that a need to the country.

Learning in Civil, Electrical and Mechanical Engineering enable pupils to apply skills and knowledge of the

engineering that is growing nowadays. Constructivism method is also closely linked with existing knowledge of students. Therefore, teachers enhance interaction between students to make learning becomes more enjoyable and meaningful. Constructivism approach also places the student as the main focus in teaching and learning process (Hashim and Man, 2006). Therefore, Constructivism learning environment can improve the quality of teaching and learning in the classroom engineering through the concept of self-understanding and knowledge through a conducive learning environment.

### *1.1 Theoretical Framework*

According to the Tenth Malaysia Plan (2011), to accelerate the performance of students effectively, continuous and comprehensive, the Government will not only focus on physical development, but will be more focused on aspects of a large impact on student performance, such as teacher's quality and school leadership. In the plan, the government will take a systematic approach to improve the quality of new teachers and improve the professionalism of existing teacher's quality. According to a research by Sclafani (2009), on how the school systems with the best performance show that teacher quality is the primary determinant of student performance. Based on the best school systems in the world, improve on methods of teaching and learning in the classroom is the best way to boost the student achievement. This shows that the quality of the education system unable to cope with the quality of teachers in providing effectiveness instruction to students. Findings from the National Review (2009), showed that 69 percent of respondents suggested that the increase in teacher quality need to be a priority by the government and 30 per cent proposed increase in student outcomes at the primary level should be a priority by the government. Therefore, the solution is demanding on changing strategies among teachers for more effective learning.

According to Abdul Kadir (2002), teaching on traditional strategies or and teacher-centered learning does not meet the recommended strategy under the Integrated Curriculum for Secondary Schools (KBSM) that emphasizes student-centered strategies. Student-centered strategies encourage students to engage actively in learning activities and not simply receive information. However, problems arise when the constructivism approach used is only a few students and teachers involved and the students were taking granted of the efforts of others (Gordon, 2009). Traditional approach is an approach in which teachers act as giving information and students as recipients of information. In this approach, students play a passive role. Students only receive the information delivered by the teacher and is known as "spoon feeding" (Nordin and Osman, 2008). When students ask questions, teachers will provide answers to students without the students need to think what the answer to that question. According to Halim (2002), studies show that teacher-centered learning does not promote learning. Students are also less have the initiative to find answers for all the answers to all questions will be provided by the teacher.

According to Omar (2001), a teacher must aware of engaging students and be a stimulating agent that can boost learning. Constructivism teaching approach can provide opportunities for problem solving in a realistic and meaningful, providing group learning, and to guide and develop the knowledge construction process in the context of collaborative problem solving. If the approach adopted is 80 to 90 percent are still monopolized by teachers, this means that teachers are not ready to implement teaching and learning with constructivism approach (Utusan Malaysia, 2005). Does the teacher training still not sufficient, whether the equipment is provided for less appropriate, whether the teachers are not ready and even the teachers themselves feel that they are not able to teach with a different perspective from the usual teaching (Ghazali, 2005). Meanwhile, according to Taslim (2000) is, despite the effectiveness of constructivism approach in teaching and learning process often highlighted, but the application and practice of constructivism approach among teachers in Malaysia in general is still low. Teachers should be aware of teaching strategies and need to think about to improve the teaching process in the classroom.

### *1.2 Problem Statement*

The quality of education received by students in schools depends on the quality of teachers themselves. Teacher-centered learning makes the students rely on teachers and receive knowledge passively. This is contrary to the constructivism approach which teachers serve as mentors and facilitators to the students to solve any problem. Teachers must be prepared to enhance teaching method and awareness to student's interest in teaching and learning process. The aim of this study is to find answers about constructivism approach using the Needham's Five Phase Constructivism Model among teachers during the teaching and learning process of Engineering Studies (Civil, Electrical and Mechanical) from the point of application of constructivism approach, the often phases used and the problems faced by teachers in implementing this approach.

### 1.3 Research Question

The study was conducted to obtain answers to some questions as follows:

- i. Is Needham's Five Phase Constructivism Model applied among technical teachers of Engineering Studies subject (Civil, Electrical and Mechanical)?
- ii. What is the most frequent phase used by teachers in the teaching and learning process of Engineering Studies subject (Civil, Electrical and Mechanical)?
- iii. What is the problem faced by teacher in applying the Needham's Five Phase Constructivism Model in Engineering Studies subject (Civil, Electrical and Mechanical)?

### 1.4 Research Limitation

Research is focused only to the teachers who teach Engineering Studies subject (Civil, Electrical and Mechanical) at the Technical School. Researcher only uses a questionnaire as an instrument to carry out the study. The result is dependent on the understanding, integrity and honesty when answering the teacher items in the questionnaire form and the return number of submitted questionnaires. In addition, only 6 of the Technical Secondary School in Selangor and Malacca taken as a location of the study because of the long distance respondents and less time in conducting the study.

### 1.5 Scope

This study focus to the overall application of the Needham's Five Phase Constructivism Model in Engineering Studies (Civil, Electrical and Mechanical) and the frequency application of the phases in Needham's Five Phase Constructivism Model in these subjects. The populations are 45 teachers who teach Engineering Studies in six Technical School in Selangor and Malacca. The samples are comprised of 40 teachers at Technical School in Selangor and Malacca.

### 1.6 Importance of Research

Students always expect something interesting, effective and not burden in learning. By knowing the aspects that play an important role in influencing the effectiveness of learning process in Engineering Studies (Civil, Electrical and Mechanical), the students will become more aware and to act more positively to plan their educational goals. They will be more confident with their self when solving a problem. Research on the constructivist approach in teaching and learning process in Engineering Studies subject (Civil, Electrical and Mechanical) will not only give benefit to the teachers and even a positive impact on the improvement of learning achievement among students who take this subject. In addition, this study hopefully can assist the Ministry of Education in order to formulate the syllabus of Engineering Studies (Civil, Electrical and Mechanical), with emphasis on implementation aspects of constructivism in teaching and learning in the classroom later.

## 2. Literature Review

Teaching and learning theory plays an important role in determining the effectiveness of teaching and learning process in education. One of the effective theories in the teaching and learning is the constructivist theory. Generally, these theories are prepared to explain how knowledge in the human mind is organized.

### 2.1 Constructivism Theory

According to Ismail *et al.* (2005), state that constructivism is a knowledge that cannot passively receive but built by individuals. Students construct their own knowledge in an active way and not just passively get through the process of teaching and learning such as listening or only one-way delivery of instruction. According to Nik Pa (1999), constructivism is not more than a commitment to the view how people construct their own knowledge. In learning and teaching process, students will accept the knowledge to adjust existing knowledge for developing new knowledge. The implication of this theory is the teaching and learning process based on student-centered. The consolidation of new teaching materials with existing knowledge in the cognitive structure of students in the most meaningful thing as teaching means. According to Royer (2005), learning means the student has a set of thought and meaningful learning can be associated with the new material they have learned by way of substantive cognitive structures, and then learn what it has the potential to be meaningful to him. Thus, constructivism refers to a process of students building their knowledge by testing ideas and approaches based on existing knowledge and experience, applying it to the new situation and integrate the new knowledge gained with pre-existing intellectual construction.

### 2.2 Needham's Five Phase Constructivism Model

According to Ramli (2010), these models of teaching and learning was proposed by Richard Needham in the

United Kingdom in 1987 in the "Children's Learning in Science Project" to enhance students' understanding in science concept and encourage students to involve themselves in the classroom actively. Needham's Five Phase Constructivism Model used in this study consists of the following five phases:

- i. Orientation Phase aims to get attention and interest of students and motivate students for their continued interest in the teaching process. Some examples of activities that can be are to make a demonstration or showing a video.
- ii. Phase of generating ideas are teachers identify student's alternative thinking and encourage them to think why they are not consistent with the idea of scientific ideas. Question method that encourages thinking can be carried out by teachers.
- iii. Phase of restructuring ideas is information and activities according to their intelligence will be used to help establish student's new concept. Students will be able to make the definitions, explaining concepts, questioning the justification and request further explanation.
- iv. Phase of application idea is used to identify newly renovated or constructed in a restructuring phase to apply the idea of the new situation. The concept is built on associate and developed in other fields or in the real world.
- v. Reflection Phase assess and evaluate student understanding of the previous ideas have changed. Examples of activities are made by reflective questioning to the students as they question what they think, what evidence you have or what you know about things that matter. The effect on student is to assess whether their students understand and apply what they learned.

### *2.3 Advantages of Constructivists Learning*

According to the Curriculum Development Centre (2001), constructivism learning has its own advantages when applied in the teaching and learning in the classroom. In the process of developing new knowledge, students will think creatively and critically.

In addition, it also encourages students to think in solving a problem, generate ideas and make good decisions in the face of the range of possibilities and challenges in learning. This process can be achieved by students through research and investigation as to identify problems, gather information, process data, making interpretations and conclusions made on learning. Constructivism learning has the opportunity to found his own building understanding about anything (Nik Pa, 1999). Students gained an understanding to make them more self confident and courageous in the face in solving problems in new situations. Students construct their own knowledge, concepts and new ideas actively able to help students improve the understanding of a subject in the face of possibilities and challenges during the teaching and learning process.

Consequently, students can understand the concepts and ideas when they are directly involved in the construction of new knowledge. Students understand and apply new knowledge and new situations in life. As a result of understanding a concept, students can build a concept through active involvement in linking new knowledge with existing knowledge received to build new knowledge. The study was done by Saraamu (2009), the use of Five-Phase Model Needham Constructivism in Malay subjects, found that students' understanding increased in experimental group than the control group. The levels of student applications in Bloom's Taxonomy levels also increased and have a positive impact on students than traditional learning. Needham's Five Phase constructivism approach is to improve the academic achievement of students. In addition, students have a positive view of constructivism approach they adopted during the study period.

### **3. Methodology**

In this study, researcher used a survey research. According to Chua (2006), the survey research representing all modes to collect data directly from a group of subjects. According Wiersme and Jurs (2005), there are six steps in implementing the survey are:

- i. Planning
- ii. Identifying the population
- iii. Sampling
- iv. Construction of instruments
- v. Implementing views
- vi. Data analysis

Type of measuring instrument which is questionnaire was commonly used in the survey research because of

self-administered by the respondents (Lim, 2007). In this study, researchers used a questionnaire instrument for data collection. Researcher need to design questionnaires that is appropriate for teacher's understanding about the Needham's Five Phase Constructivism Model in the Engineering Studies subject. The data will be analyzed by *Statistical Packages for Sosial Science* (SPSS) versi 17.0. Thus, each plan must be well organized so that this research will achieve the objectives.

### 3.1 Sample and Population

Population is the number of teachers who teach Engineering Studies in six Technical Secondary Schools in Malacca and Selangor which are Sepang Technical School, Gombak Technical School, Kuala Lumpur Technical School, Technical School of Kuala Selangor, Malacca Technical School and Jasin Technical School. The populations are 45 teachers. Factors such as population size and covers a wide range of studies makes it difficult to use the population in the study researchers. In this study, the researchers chose to use simple random sampling method. Sample size used by the researcher based from the Krejcie and Morgan (1970) table represent 40 respondents out of 45 teachers.

### 3.2 Research Instrument

In this study, researcher used questionnaires as the instrument to collect data. According to Abdul Ghafar (2003), the use of questionnaires is to improve the accuracy and truth of the response given by the sample as not influenced by the researcher. For this purpose, the researcher distributed questionnaires and give some explanation about constructivist learning model which is Needham's Five Phase Constructivism Model to give an understanding to the respondents before answer the question. A set of questionnaires that contained three parts is used as an instrument of this study. The part is divided as items for assessing the implementation of Needham's Five Phase Constructivism Model.

- i. Part A consists 2 items about gender and teaching subject. This is for respondent background.
- ii. Part B which consists 27 items to test the application of Needham's Five Phase Constructivism Model in the process of teaching and learning of Engineering Studies (Civil, Electrical and Mechanical Engineering).
- iii. Part C is containing the items about problem faced by teacher in applying the Needham's Five Phase Constructivism Model in Engineering Studies subject.

### 3.3 Pilot Study

The pilot study is conduct to ensure that every item list in the questionnaire achieve the quality and needs. A pilot study is a preliminary survey before the real survey is conduct (Chua, 2006). After the assessment instrument approved by the experts, the next step is to carry out a pilot study. A pilot study was conducted by distributing 10 questionnaires to final year students of the Faculty of Technical and Vocational Education who have learn Micro Teaching. The data was analyzed by using SPSS 17.0 and the overall value of Alpha-Cronbach is 0.892. According Tasir and Abu (2003), the Alpha-Cronbach value that is acceptable is in the range of 0.6 to 1.0.

## 4. Research Findings

All data obtained are illustrated in the form of tables involving percentages and the mean for each item in the questionnaire. Explanation of findings is based on the analysis made using the Statistical Package for Social Science (SPSS) version 17.0. Data analysis was divided into three main parts as referring to the research question.

### 4.1 Respondent Background

A total of 16 teachers representing men which is 40 percent and about 24 women representing 60 percent of teachers are involved as respondents in this study. A total of 13 respondents representing the percentage rate of 32.5 is the teacher who teaches Civil Engineering Studies. Respondents who teach Electrical Engineering is about 15 people and the percentage rate of 37.5. Mechanical Engineering subjects are represented by the 12 respondents with the percentage of 30. Table 1 has shown the Number of Respondents and Percentage.

Table 1. Number of respondents and percentage

| DEMOGRAPHY       | ASPECT                         | NUMBER | PERCENTAGE (%) |
|------------------|--------------------------------|--------|----------------|
| Gender           | Male                           | 16     | 40.0           |
|                  | Female                         | 24     | 60.0           |
|                  | Civil Engineering Studies      | 13     | 32.5           |
| Teaching Subject | Electric Engineering Studies   | 15     | 37.5           |
|                  | Mechanical Engineering Studies | 12     | 30.0           |

#### 4.2 Application Needham's Five Phase Constructivism Model among Teacher in Engineering Studies Subject

The questionnaire has 27 questions related to the application of the Five Phase Model Needham Constructivism in teaching and learning process. The items in this section was divided into five phases in the model is the orientation phase, generating idea phase, the phase of restructuring ideas, the ideas and the application phase of the reflection. Part B is the answer the first research question (1) the application of the Five Phase Model Needham Constructivism in Engineering Studies while the second question (2) is the phase most often applied by teachers in Engineering Studies. Table 2 have shown the mean score for each phase and the total mean score.

Table 2. Mean score for each phase and the total mean score

| PHASE                    | MEAN        |
|--------------------------|-------------|
| Orientation Phase        | 3.46        |
| Generating Idea Phase    | 3.73        |
| Restructuring idea Phase | 3.78        |
| Application Idea Phase   | 3.68        |
| Reflection Phase         | 3.51        |
| <b>Total Mean</b>        | <b>3.63</b> |

Overall mean for this section to answer the question aspects of the first study to obtain the mean score of 3.63 and remains at high levels. This indicates that the respondent consents to the application of the Five Phase Model Needham Constructivism Studies in Engineering (Civil, Electrical and Mechanical). Respondent also applied this model in the teaching and learning process where they help students develop their knowledge actively and not just receive passively from the environment. Next, research findings indicate that phase is often conducted by teachers with the restructuring idea the high mean score of 3.78. While the second phase is the phase most often carried out with the idea of triggering the mean score of 3.73. Application phase of the third phase the idea is most often implemented in the teaching and learning process to obtain the mean of 3.68. Reflection phase at moderate levels with a mean value less than 3.51 in which the respondent agreed in applying the assessment of the extent to which the original idea has changed to the new ideas in learning in teaching and learning process. The orientation phase is also less importance by the teachers than the other phases based on the lowest mean score of 3.46. This shows that respondents less agrees in generating student interest by teaching and learning process is started.

#### 4.3 Problems Faced by Teacher in Applying the Needham's Five Phase Constructivism Model in Engineering Studies Subject

The study showed there was some problems faced by teachers who Engineering Studies in implement Needham's Five Phase Constructivism Model. This is based on the mean value that is 2.85. Respondent faced a few problems to carry out this model during the teaching and learning process because of limited time provided to finish the syllabus and students are weak in learning ability caused the teachers difficult to implement Needham's Five Phase Constructivism Model in Engineering Studies subject.

Other than that, respondents think that the practice of constructivism in learning is not realistic and the readiness of existing school facilities not complete is a problem in the application of the Needham's Five Phase Constructivism Model.

## 5. Discussion

Discussion is based on the analysis results obtained and conclusions are made based on the findings of the study and the objectives set while recommendations are made based on the opinions of the authors analyze the data in this study.

### *5.1 Application Needham's Five Phase Constructivism Model among Teacher in Engineering Studies Subject (Civil, Electrical and Mechanical)*

From This Research, Teachers of Engineering Studies apply the Needham's Five Phase Constructivism Model in teaching and learning process where they help students develop their knowledge actively. These based on the mean value for the question is 3.63. According to Ramli (2010), teachers act as designers of teaching method that provide opportunities for students to build new knowledge. The teacher who is a facilitator need to encourage student-centered learning. Students will build their own knowledge actively rather than passively from their environment. In Needham's Five Phase Constructivism Model, teacher should always encourage the students to explain their own ideas and appreciate their views. Researcher think that teachers should give students the opportunity to express their ideas and appreciate them because it can create a deeper understanding of students on the topic that being taught. According to Tobias (2009), when students meet with an object, idea or relationship that is meaningful to them, they will interpret what is seen to commensurate with the knowledge that had been established or adapt their knowledge to be able to explain the new information better. In this model, teachers should always encourage the students to explain their own ideas and appreciate their views. Researchers think the teachers should give students the opportunity to express their ideas and appreciate them because it could create a deeper understanding of students on the topic being taught. Researchers found that teachers understand Engineering constructivism learning approach is a knowledge-based approach to learning is actively constructed by students based on existing knowledge or experience of students. According to the Curriculum Development Centre Ministry of Education Malaysia (2001), constructivism is the notion that students construct their own knowledge or based on the concept of active existing knowledge and experience. In this process, students will match the accepted knowledge of existing knowledge to construct new knowledge.

### *5.2 The Most Frequent Phase Used by Teachers in the Teaching and Learning Process in Engineering Studies*

The findings show that the most frequent phase implemented by teachers in Engineering Studies subject is the restructuring of idea with the mean value of 3.78 while the second phase most often carried out is phase of generating ideas with the mean value of 3.73. Followed by the application idea phase is the third phase of the most frequent performed by the teacher with a mean value of 3.68. Next is the phase of reflection and orientation phase is the phase of less implemented than other phases, respectively 3.51 and 3.46 to obtain the value. Researchers found that the phase of restructuring ideas, the teacher's role is to reinforce the concept or idea more precise. Respondent applied the restructuring idea phase through discussions with students and provide justification and explanation. Students have many opportunities and generate creative thinking and group discussion with teachers. According to Nair (2005), teachers provide structured activities or give assignments to enable students to challenge their original ideas or ideas from friends, and build their own knowledge structures in a more meaningful and effective. In the generate idea phase of the idea, the researchers found that teachers using the question method to identify existing knowledge of students in teaching and learning process. Students will be better because uses own thinking to develop knowledge, concepts and ideas actively. This will make students more understanding because students interact with peers and teachers in building knowledge. According to Ramli (2010), questions and answers can lead to thinking is carried out by teachers. Through the study findings, the respondent agreed to stimulate student teachers to use new ideas to solve everyday problems. Researchers found that the application phase help students understand a concept more clearly so as to evolve in the real world. According Feden (2003), a student who understand what they learn will be able to apply knowledge in new situations. However, the reflection phase is the phase that is less applied by teachers of Engineering Studies. Researchers feel that teachers should ask students to be reflective to assess whether previous ideas have changed or not. The orientation phase is the less phase applied in the Needham's Five Phase Constructivism Model. Researchers found that the respondent not agree in carrying out activities that may draw attention as a video and given questions to generate curiosity. Orientation phase is to attract and motivate students so that students are directly interested in teaching and learning process. According to Abdul Rahman (2010), teachers need to practice the provision of induction based on a set of elements of the motivation to build a school of thought and attract students to focus attention on the subject.

### *5.3 Problems Faced by Teacher in Applying the Needham's Five Phase Constructivism Model in Engineering Studies Subject*

The study showed there was some problems faced by teachers who Engineering Studies in implement Needham's Five Phase Constructivism Model. This is based on the mean value that is 2.85 and in the low rank. Difficulties in implementing constructivism approach is changing the way teachers are teaching to the constructivism approach requires the support of professionalism and strengthening the confidence of the school. Model Constructivism requires teachers to be experts in the development of students. Constructivism approach requires teachers to be experts in the development of the students. They also need to be an expert to observe and understand the answers when students make the connection between concepts (Gordon, 2009). In addition, the problems faced by teachers of Engineering Studies are having time constraints when conducting Needham's Five Phase Constructivism Model approach. This statement is supported by Ismail (2006), which states that there are some problems in implementing this approach to constructivism. This approach requires a longer period of time to spend on a given topic. This will make it difficult to finish the syllabus. This approach shows the role of student and teacher will assist when needed. Researchers felt it would be serious if the teachers are not prepared to assist students in understanding a concept. According to Mayer (2004), students are expected to work through problems with a little guidance from teachers. Students are not taught to new ideas and new concepts, but are allowed to explore the whole concept of self. Thus, teaching in constructivism approach has the potential to make a conclusion that is not clear or is not true if the teacher did not respond to the student. Problems faced by teachers of Engineering Studies in the constructivism approach are poor learning abilities that cause difficulty for teachers in constructivism approach. According to Slezak (2000), the instructions will be difficult during class activities for each student that has different levels of exposure to life experiences.

The facilities available in the school play an important role to encourage teachers to use constructivism approach in their teaching and learning process as well as to improve student performance. In this study, researchers found that there are few respondents had concerns about the condition of school facilities that are less restricting teachers to implement teaching and learning through constructivism approach. According to Ash'ari (1999), structure environment, neat, comfortable and clean to ensure the teaching process runs smoothly. Teachers need to improve the class control may be difficult to do (Hamidin, 2000). This is due to the control class will be reduced where the Needham's Five Phase Constructivism Model encourages discussions between teachers and students, questions and answers to generate student thinking, doing their own activities and encourage students to submit their opinions.

### **6. Recommendation and Suggestions**

Based on data analysis and discussion on the findings of the study, researchers would like to submit some suggestions. It is hoped that the recommendations of this study can be used as guidelines by the parties concerned to reassess the effectiveness of teaching and learning in Engineering Education.

- i. Observers have suggested that teachers should be exposed to a variety of teaching models constructivism approach. Exposure to the teaching model is to be given to ensure that the level of professionalism is always positive and highly motivated.
- ii. Exposure course of teaching and learning strategies are expected to run by the Curriculum Development Centre, Teacher Education Division and District Education Centre from time to time to ensure the quality of teachers teaching in the classroom.
- iii. The findings of this study found that the phase orientation practiced by teachers. Thus, school administrators shall give emphasis to the orientation phase during monitoring in schools. This is because the orientation phase to attract interest and motivate students before teaching and learning process is started.
- iv. Technical and Vocational Education Division is expected to update the syllabus will come to be suited to the development of education today and in the student's ability level.
- v. Ministry of Education recommended that programs be able to draw up an opportunity for teachers to make reforms to the nation in effective teaching approaches so as to produce a generation of excellence.

#### *6.1 Further Study Recommendation*

- i. In view of the researchers, the study should be done on a larger sample. Possible results of the study will give a positive value and this study will have a clearer picture of the practice of the use of the Five Phase Model Needham Constructivism in Secondary Technical Schools Ministry of Education Malaysia.

ii. Researchers hope will come to use other instruments to support the findings of studies such as interviews, direct observation and intensive interviews to obtain more detailed information to know the phases of the constructivism teaching model lessons in Needham's Five Phase.

iii. Researchers also suggest future researchers could explore the relationship between teaching approaches Needham's Five Phase Constructivism Model with conventional teaching approach implemented at the Technical Secondary School.

## 7. Conclusion

The aim of this study is to find out the application of the Needham's Five Phase Constructivism Model among teachers who teach Engineering Studies in the 6 Technical School of Selangor and Malacca. From this study, teachers apply the Needham's Five Phase Constructivism Model in Engineering Studies (Civil, Electrical and Mechanical). Needham's Five Phase Model Constructivism describes the phase or step in the process of implementing the teaching and learning process. This model is seen as a proposal to create a learning environment that is not only conducive, but has the potential to encourage student involvement. Teachers can make learning meaningful for students actively involved. Phase of the most frequently applied is the idea of restructuring phase while the orientation phase is the phase of the least and importance to the teacher in teaching and learning process. Restructuring phase most often implemented as a teacher member description along with activities appropriate to the intelligence of their students to help develop this new concept. Students will be able to make a definition, explain concepts, ask questions about the description and request further justification and clarification. The five phases have to be followed systematically by teachers to obtain high efficiency. In summary, the orientation phase was to stimulate interest and motivate students in teaching and learning process. Second phase is to generate ideas so that students are aware of previous ideas, encourage collaboration, investigation by experiment and used to ask. The third phase is to restructure the original ideas for the original idea may have been modified to be replaced by a more scientific ideas are developed. The fourth phase is the phase of the application ideas to strengthen the idea that has been built in the new situation. Figure 1 have shown a conclusion framework.

The final reflection phases where teacher need to be assess the extent to which the original ideas have changed and which new ideas are correct.

Phase of the most frequent applied is restructuring ideas, while the orientation phase is the phase of the less implementation by teacher in teaching and learning process. By following all of this phase, the resulting effect is more fun for students to build their own knowledge and social skills because of mutual interaction, improve self-confidence to be given the opportunity to build self-understanding, solve problems and be able to recall a concept for a longer time for active participation in teaching and learning process. The implementation of this model, there are some problems faced by teachers in implementing to teaching and learning process. These findings obtained from a study showed the mean value of the questions at a modest level. Problems faced by teachers in implementing the Needham's Five Phase Constructivism Model should be considered as a challenge in educating students to build an effective learning environment. In conclusion, the approach of the Needham's Five Phase Constructivism Model is a need to be applied to the teacher to provide opportunities and path for students to generate ideas and applied in their daily lives.

The aim of this study is to find out the application of Constructivism Model based on the Needham's Five Phase Constructivism Model in (Civil, Electrical and Mechanical) Engineering Studies at Technical Secondary School. The focus of this study is to describe the 5 (five) phases in this model which are orientation phase, generation of ideas, restructuring ideas, application of ideas and reflection phase. Qualitative research methodology is used in this study. A total of 40 teachers who teach Engineering Studies subject at Technical School in Selangor and Malacca were involved as a sample to this study. This study shows that teacher applied the Needham's Five Phase Constructivism Model in Engineering Studies. In the other hand, the most often phase which applied in the teaching and learning process is the restructuring of idea phase and the orientation phase is a phase of less applied by teacher. Although the Needham's Five Phase Constructivism Model is implemented by the teacher but there is still have some problems in implement the model. From the findings, it is suggested to the teachers to be exposed in a variety of teaching models that can improve the quality of teaching and learning process in the classroom.

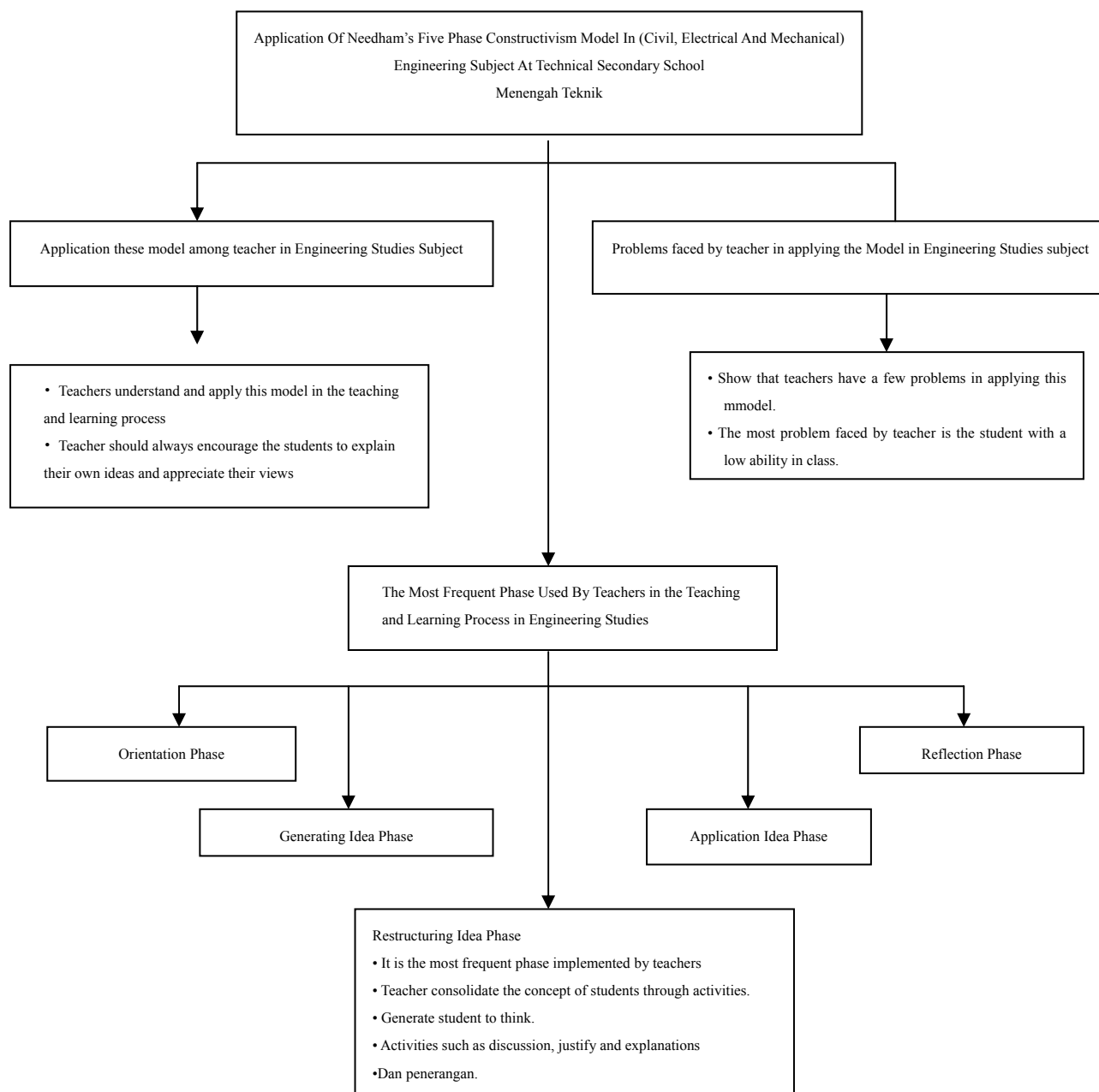


Figure 1. A conclusion framework

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