Ph.D. Candidate
DO THE HUNG

CDIO APPROACH IN TRAINING VOCATIONAL TEACHERS
AT UNDERGRADUATE LEVEL

Major: Theory and Education History
Code: 62.14.01.02

SUMMARY OF Ph.D. THESIS

Hanoi, 2015
This thesis is completed and hosted by

**Vietnam Institute of Education Science**

Academic instructors:  
1. Prof., Dr. Nguyen Loc  
2. Assoc. Prof., Dr. Vo Thi Xuan

Academic defender 1: Assoc. Prof., Dr. Mac Van Tien

Academic defender 2: Assoc. Prof., Dr. Tran Thi Tuyet Oanh

Academic defender 3: Assoc. Prof., Dr. Nguyen Tien Hung

This thesis will be defended by an academic board of Ph.D thesis evaluation-Vietnam Institute of Education Sciences, 101 Tran Hung Dao, Hanoi  
At................2015

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INTRODUCTION

1. Rationale

In reality, teacher training in the technical education system (Technical education) in our country recently has also revealed the limitations, such as: "Detailed curriculum, pedagogical departments to train technical teachers (TT) is not really innovative, heavy on theory, practice light, does not keep pace with the needs of social development practices, professional and international integration. Teaching methods are outdated, emphasized on the type of transmitting one-way, no effects wrought pedagogical students (PSs). “Study support activities, training, and ensuring conditions are inadequate. Quality training products take confidence for trainees after school" These limitations have shown, teaching models (TM) is currently not truly effective, that must seek new approaches to build teaching model more appropriate for the development trend of higher education study (HE) in the process of international integration. The effectiveness of the new teaching model must be expressed through quality "output" of the school, to help trainees get the vital competences by a technical teacher the in modern education

Teaching model -based competence is a widely-applied trend replacing traditional teaching in the modern education. However, no model approach has been applied so far to offer a detailed set of tools, namely, it is able to help for the design and implementation of technical training sector to achieve the expected output quality wait like CDIO approach (conceive - forming ideas; Design - Design, Implement - Implement, and operate - operate) - one of the effective approaches, which have been conducted and applied in more than 116 universities around the world. Vocational teacher training is a process including both technological expertise and pedagogical competence (PC). Therefore, applying the CDIO model will be rational and feasible to improve the quality of teacher training in technical education system

For those reasons, we have selected the research topic “CDIO approach in vocational teacher training qualified undergraduate level” as our Ph.D. thesis

2. Aims of the research

Suggest CDIO based teaching models and applications in training vocational teacher qualified undergraduate level. Also, improve quality of training to satisfy professional and social demands as well.

3. Scope of the research

Objectives: teaching activities in training teachers have been applied in technical education and CDIO approach in technical education innovation.

Participants: Relations between teaching model in training vocational teachers and characteristics by CDIO
4. Literature review

If teaching model in training vocational teachers is in accordance with CDIO approach to characterize: structural system components, integral, openness, power output oriented, action-oriented, this model will be beneficial for professional competence development skills, personal qualities, communication and cooperation to meet the graduate outcome (GO) of a curriculum. At the same time, it motivates trainees to study more actively and significantly improve study outcomes.

5. Content and scope of the research

5.1. Content of the research

- Building theoretical base of CDIO approach in training vocational teachers at undergraduate level;
- Evaluating current situations and teaching model applied in some educational institutions and departments of education;
- Suggesting theoretical teaching models based CDIO approach in training vocational teachers in the context of Vietnam and technical education system toward international integration;
- Applying a pilot teaching model in some specified lessons of a curriculum to improve quality of training and to evaluate this model;
- Conducting surveys to collect contributions from experts on results and on suggested teaching model to improve its approach.

5.2. Scope of the research

CDIO suggestions mentioned to 12 standards reflecting a comprehensive training process and quality management is attached with graduate outcome of engineers. The implementation of comprehensive and thorough standards will be short-comings in terms of limited resources from many universities in Vietnam. Therefore, we approached several fundamental points of CDIO in the suggested TE to ensure compliance with practical training and can be applied directly to the teaching activities to improve the quality of teaching towards meet pedagogical qualifications, as follows: 1) Design graduate detailed outcomes to train vocational teachers including detailed subject curriculum (level 4); 2) Design teaching contents matched with issued graduate outcomes; 3) Methods of active teaching, experience and assessments consistent with graduate outcomes.

On the other hand, teaching CDIO approach is essentially competence-based approach. Therefore, when designing teaching model to train vocational teachers, we will show different teaching points of view, thoughts of modern teaching theory, the modern teaching model and learning theories which is in accordance with orientation to develop skills and trainees’ competence.

Selecting participants and practical surveys were conducted in several higher education institutions: Hung Yen University of Technology and Education, University of Technical Education Ho Chi Minh City, Nam Dinh University of Technical Education and vocational colleges nearby.
application of suggested teaching models for subject credits of pedagogical knowledge of vocational teacher curriculum at undergraduate level.

6. Methods of the research

6.1. Methodology

- System-based approach: teaching model Research in training vocational teachers shows a point of view as a teaching system; its structure consists of essentially dialectical relationship and integrity. Teaching different subjects for vocational teachers’ curriculum is filled in a background relationship, unchangeable prerequisite to ensure satisfaction for graduate outcomes from one curriculum.

Teaching system with CDIO approach in training vocational teachers is a part of the higher education system and in the context of radical, comprehensive innovation for national education system towards standardization, modernization, socialization, democratization and international integration.

- Graduate output-based approach: development of output competence is an inevitable trend of higher education. CDIO approach in training vocational teachers clarifies the essential competence system for trainees, which is based on output standard as required by professional standards. On the other hand, it must demonstrate approaches or how to help trainees achieve output standards.

- Point of view on integrity: Integration is the trend of the development of education in decades. This view is also the thorough development of curriculum and organizational teaching CDIO approach. Thus, teaching model in training vocational teachers is essential to ensure requirement: integration of professional subjects in the same topic or project; integration of skills and personal qualities, profession, communication skills, cooperation in teaching to ensure that trainees have the ability to solve complex problems of practical education and teaching.

- Integration based approach: During the integration process, the development trend of teaching model, development trends of modern teaching theory and the theory of learning should be clarified to show the advantages of CDIO approach and apply appropriately with the conditions of teaching in different educational institutions where vocational teachers are trained in Vietnam.

- Practical approach: Teaching model with CDIO approach in training vocational teachers needs to focus on solving the problems of the practical training of vocational teachers in the technical education system. Grasping this point of the study, we will clarify the current situations and training teachers with teaching model to train vocational teachers, to compare with the basic thesis of CDIO to understand the problem solved, since the proposed model will be more suitable, and it is possible to increase the quality of training towards social requirement and profession.

6.2. Methodology

6.2.1. Theoretical methods

Analyze, compare, synthesize, systematized and generalized theoretical material domestic and international modern approaches in building teaching
models; Essential ideas and techniques underlying methodology with CDIO in technical education; trends in innovation of teaching model to train vocational teachers; and theoretical material, related to legal form the basis for the theory of the subject. At the same time, current model will be studied to build practical foundations for the future research.

6.2.2. Practical methods

6.2.2.1. Survey

Survey questionnaires and direct interviews with management staff, faculty, students of several schools in the system of technical education in order to understand the real situation of training vocational teachers and output standards from curriculum.

6.2.2.2. Collection of practical experiences

Synthesis of vocational teachers training experience in the technical education system is considered a practical condition to propose a suitable teaching model in accordance with the conditions of different educational institutions.

6.2.2.3. Ongoing product-based research

Summarizing and studying trainees’ outcomes from curriculum of vocational teachers clarify the current situation from research issues, and evaluate outcomes from new teaching models to suggest and to evaluate the effectiveness.

6.2.2.4. Expertise method

Applying expertise methods in two forms (organized seminars, questionnaires and/or direct interviews) to collect the opinions of scientists, university lecturers, and education managers with the content of the structural elements of the teaching model, to assess the explicit theory and feasibility of the teaching model with CDIO approach in training vocational teachers.

6.2.2.5. Pedagogical experiment

Conducting experiments regarding to teaching theory based on CDIO approach in a lesson of curriculum.

6.2.3. Tools

Collecting and processing of data by means of mathematical statistics, SPSS, MS. Excel to ensure that research results have accuracy with reliability.

7. Defending views

- Teaching with CDIO approach in training vocational teacher showed necessity to rely on a theoretical model reflecting the structure and function of a teaching system, including basic components: 1) teaching philosophy in training vocational teacher; 2) Establish learning goals; 3) Principles of teaching; 4) The content and organization, the structure of the educational content; 5) Methods, strategies and teaching techniques; 6) Learning, teaching facilities; 7) The views and technical evaluation of teaching.
Models have showed effectively orientations for designing and implementing a blended curriculum (macro level), and for designing, organize teaching subject, a lesson (micro level) in accordance with output standards in training vocational teacher.

- Applying teaching models with CDIO approach in training vocational teachers will increase the quality of teaching to satisfy pedagogical profession (vocational teachers’ competence).

8. **Thesis contributions**

- Systemize of the teaching model with multidimensional approach in theoretical teaching in modern universities.

- Clarify the application of CDIO approach in terms of theoretical teaching at undergraduate level.

- Clarifying the current conditions of teaching and quality of training vocational teachers at several universities and faculties of technical education.

- Building a system of output standards in training vocational teachers at undergraduate level based on CDIO approach to meet professional standards in the context of Vietnam.

- Proposal of teaching model under CDIO approach in training vocational teachers reflect modern teaching theory, the theoretical basis for practical application in the direction to satisfy vocational teachers’ competences output.

- Applying teaching model has proposed the blended curriculum (subjects Methods and skills taught in vocational education) in order to convey the output standards, design and experimental lesson in discipline integrated to confirm that the increase in academic performance and trainees’ competence will be created towards output demands.

9. **The thesis content**

Introduction, development and conclusion are in three chapters

Chapter 1: fundamentals of literature review and practical CDIO approach in training vocational teacher.

Chapter 2: Teaching model with CDIO approach in training vocational teachers

Chapter 3: Experimental science

**CHAPTER 1 – LITERATURE REVIEW AND PRACTICAL TEACHING WITH CDIO APPROACH IN TRAINING VOCATIONAL TEACHERS**

1.1. **Introduction**

1.1.1. **Released research on teaching model in the higher education**

Teaching model reflects the views, ideas, and approaches to build a system of teaching in schools serving the needs of society in every period of history. There has been changes from the world of higher education background
newly formed (HE East 3,000 years ago; Western higher education from late medieval period - XI century) now has a comprehensive transformation of education from elite to mass, education from traditional to modern education (replacement), according to the objectives of education (content) into education based on the output (competence).

**Traditional teaching model** oriental "reflect and propagate the ideology of Confucianism, Buddhism, Hinduism and cultural values of the society which mainly teach the system the philosophy, concepts, credit things, literature, some computational skills and are less rational, analytical ... ", with the first representative as Confucius (551-479 BC), Mencius (372-289 BC), sequential (313-238 BC).

Traditional Western teaching model characteristics depend on the classic works of authors such as Homer (750-650 BC), Sophocles (496-406 BC), Plato (427-347 BC), Josephus (100-37 BC), Dante (1265-1321), Shakespeare (1564-1616) and the integration of a Christian worldview in all subjects.

Traditional teaching model in Vietnam has survived to this day. However, many have voiced education criticize its shortcomings, and actively propose reforms in the model of modern higher education. The views, thoughts educational progress and the introduction of methods, modern teaching techniques have been studied and applied flourished since the 90s of the twentieth century back here.

**Modern teaching model** reflects the characteristics of an advanced education (education replaces traditional), associated with progressive ideological education, education reforms taking place in the strong East and West since the late nineteenth century to the present, is derived from far back, is reflected in the writings of John Locke and Jean-Jacques Rousseau. Both in turn called the forerunner of progressive education movement later. Teacher Advancement Movement began in the late nineteenth century, with representatives such as Johann Heinrich Pestalozzi typical (1859), Johann Friedrich Herbart (1883), John Dewey (1897, 1900, 1902, 1916, 1938).

The strong development of the achievements of physiology, cognitive psychology, developmental psychology in the twentieth century, with the advent of the theory of learning: Theory behavior (Pavlov - 1928 Thorndike - 1931 Watson - 1968, Skinner - 1976, 1978); Cognitive Theory (Bandura - 1976, 1979, Piaget - 1976); Tectonic theory (Piaget Jeans, Watzlawick, Hans Aebli, Maria Motessori, S. Lew Wygotzky); Theory of Multiple Intelligences by Howard Gardner ..., and the strong development of information technology and communication in the last decades of the twentieth century and early twenty-first century, was under the impact of modern teaching model in the diverse forms: Teaching is based on the competence (CBE); Teaching is based on the output standards (OBE); Teaching in a virtual learning environment (Virtual Learning Environment - VLE).

Modern teaching models were invented by Vietnamese educators with views that, firstly it represents the views of teaching learner-centered rather than take the teaching-centered tradition (Tran Ba Hung - 1994, 1995, 2003; Nguyen States - 1995.1996). Modern teaching and promoting action-oriented rather than passive reception of the study (Nguyen Ba Kim - 1998). In addition, modern
teaching was directed at the self-study training competency, innovative competency and the necessary social skills (communication, cooperation, teamwork) for SV (Nguyen Canh Toan - 1999, 2001; Dang Thanh Hung - 1999; Luan Phan Trong - 2002; Tran Thi Tuyet Oanh - 2006; ...).

Advocates of modern teaching are focused on competence-oriented competence and output-result oriented competence (Nguyen Minh Tang - 2005; Nguyen Duc Tri - 2005; Dang Ba Lam - 2006; ...), and that conform to the trend of higher education innovation in Vietnam, and it is gradually replacing the traditional model.

In general, the research on teaching model was very diversified but the specific application of each higher education institutions has not yet shaped clearly in Vietnam, or even inconsistent use, asynchronous elements of a teaching system.

1.1.2. Research on methods based on CDIO approach in the higher education.

In 2000, Massachusetts Institute of Technology (MIT) along with three other universities in Sweden has initiated initiatives CDIO, is a framework for international cooperation in engineering education reform. Initiative CDIO was originally a general convention of 4 universities, then Edward F. Crawley authors, Johan Malmqvist, Sören ostlund & Doris. Brodeur (2007) developed an approach in engineering education reform through the book "The rethinking Engineering Education CDIO Approach". Also since then, CDIO has become a prestigious association of the world with the rapid expansion, beyond the US and Europe. To date, the number of programs, collaborative participation of more than 116 universities around the world. The university researchers around the world have applied CDIO approach in fundamental reforms, comprehensive training of the major industries in the field of engineering.

In Vietnam, the application program of CDIO approach was started in summer 2008, with the initiation of two major universities: Vietnam National University, Hanoi and the National University of Ho Chi Minh City. Then, a series of cases were applying CDIO approach at different levels. Prevalence, the first step that many applied fields such as construction and development of curriculum under output standard with CDIO approach (University of Foreign Languages – IT, Ho Chi Minh City (2012) applied to 6 branches, among them, 5 branches has been added to the technical education, Thai Nguyen University (2012) applies to all sectors of education, University of Technical Education Ho Chi Minh City (2013) applies to all sectors of education; Academy of Postal Technology and Telecommunications (2013) applies to Multimedia Technology sector). Some other universities are in the process learn and start applying CDIO approach in training program (University of Information Technology (2013); University of Economics - Law (2013), University of Thu Dau 1 (2014); An Giang University (2014), University of Danang (2014) ...). Only 2 cases so far has become a member of the World Association of CDIO: Vietnam National University, Ho Chi Minh City and Duy Tan University.

Through research review shows that shaping teaching models in higher education is now essential; implementing CDIO approach in higher education in
the world and in Vietnam as well is increasingly expanding, and represent very diversified. However, according to identify teaching model with CDIO approach has not been specifically mentioned in the study of both theoretical and practical training of graduate training in general and vocational teacher in particular. It will be necessary to clarify the perspective of theoretical teaching to a higher education reform model which are currently widely applied nowadays.

1.2. Theoretical reviews on teaching with CDIO approach in training vocational teachers

1.2.1. Fundamental definitions

1.2.1.1. Vocational teacher

Vocational teachers are trained to ensure adequately professional qualifications and professional career to teaching technical subjects (can be theoretical and/or practical, experimental subjects in the theoretical basis, the technical reasons professional teaching theory or practice) in education institutions, college, or professional school (teaching technology).

1.2.1.2. Teaching model in training vocational teacher.

Teaching model in training vocational teacher including the theoretical model reflects the structure and function of a system of teaching in schools of Technical Education, which includes a set of components/elements necessary mainly of the system: Philosophy teaching point in training vocational teacher; Establish and expressive learning goals; Principles of teaching; The content and organization structure of the educational content; Methods, strategies and teaching techniques; Learning and teaching facilities; The views and technical evaluation of teaching. The structural elements of teaching model are organized and unified synchronously.

1.2.2. Teaching models

1.2.2.1. Theory-based teaching model

Teaching is a path of personal development for trainees with defined objectives. The process of learning occurs through the interaction of entities: Master - Games, organized on the basis of cognitive activities of pedagogical learning environment inside and outside the school. Theory and practice have shown that the basic elements of a teaching model including objectives, contents, methods, media, materials, results ... always advocacy, development of the teaching process. That depends on the development of learning platforms theory that humankind has created. Therefore, finding the difference of teaching model based on the theoretical approach to learning is right and necessary to establish appropriate model in school science teacher.

A theoretical research has suggested objectives, content, learning environment and especially aimed at clarifying the nature of the acquisition of knowledge, as well as models of teaching techniques to make changes according to the study-defined objectives. If the theory Behavior, Perception, Tectonics highlight the truth: the acquisition of knowledge takes place inside a human, the theory of learning Reconnect attention to the acquisition of knowledge takes place inside outside people (i.e. knowledge is stored and processed by technology). In
addition, it cannot be deflected if an insight into all learning theory so far, because each theory reflects its own philosophy and instruction to individual objects. However, in higher education, the theories aimed at forming behavior, perception, ability to create new knowledge, the autonomy, adaptation work, creative environment, promote and learning through experience introduction to the study will be useful to design appropriate adult-based teaching model, to facilitate personal development to meet the requirements of the profession and society.

Ideological views about teaching integrated, proactive, experience with the philosophy expressed in tectonic CDIO approach, which is fully consistent with the basis of learning theory presented above, and our approach is the establishment of teaching model in training vocational teachers applied in training.

1.2.2.2. Traditional teaching models

Traditional teaching is understood as the traditional way of teaching, it has become a habit and nature of transmitting knowledge from faculty’s teaching staff to students. It is a popular form of instruction in most college classes around the world. The job of the teacher is to teach and work of SV is received, understood, and receptive "teaching" - his words and his actions. We can see clearly the characteristics of traditional teaching model through the following elements:

**Teaching objectives:** Guide to convey all the knowledge specified in the program. Preparing for exams students achieve high results and completion of the course, the graduation.

**Teaching content:** Design mainly logical scientific content of the courses, usually expressed in the form of formulas, definitions, theorems, principles, rules, laws; focus on memorizing facts, objective information, true knowledge is paramount; little or no attention to social development.

**Teaching method:** Mostly presentation explaining, he said game record. GV lo thoroughly presented the lesson content, which enlisted transmitting knowledge and his experience. Students acquire passive, trying to understand and remember what went GV, GV answer questions about issues taught.

**Organization in teaching:** Organized by all classes. School students are arranged in layers in accordance with discipline, age and ability. All students in a class is taught the same material.

**Assessment:** the teacher is the exclusive assessment of student learning outcomes, attention to retention and reproduction of the information provided by the teacher.

1.2.2.3. Competence-based model (output standards)

Access to power is actually approaching to output standard in the world of education has been mentioned for nearly five decades. It is a global trend and inevitable in schools at all levels. In competence-based teaching model, teaching objectives of the program are described through the development of group ability: competence development; competence on method; social competence; and individual competence. Action-based competence is formed on the basis of the combination of these competences.
Content-based development perspective is not limited capacity of knowledge and expertise that includes the content group to develop the field of energy.

Teaching method of competence development does not only pays positive attention of students of intellectual activity, but also pay attention to train the capacity to solve the problem associated with situations of life and career, and associated activities intellectual activity with active practice, practice.

Assessment of study outcomes focused on the ability to creatively apply knowledge in different application scenarios.

1.2.2.4. Development trend of teaching model in training vocational teacher

Along with the rapid development of all aspects of society, higher education has shifted dramatically from elite education to mass education, to meet the increasing demands of cultural life and qualified human resources. Several trends are evident in the world and will grow significantly in the future are:

- Teaching philosophy aims to humanity, democracy, and sustainable development
- Change the target training requirements of social development
- Contents of teaching that emphasizes individual capacity development and flexible organization structure enables students to adapt easily
- Change the role of the teacher and students' learning. PPDH outlook is based on the school and its activities
- Increased use of information technology, electronic goods in the development of materials, design and organization of the teaching process is a strong trend
- Trends authentic assessment, based on competence standard will replace traditional assessment - based on the content.

1.2.3. Suggested teaching models based on CDIO approach in training vocational teacher.

1) Ensures that reflects the achievements of modern learning theory and in accordance with the requirements of practical vocational teacher training in Vietnam in the context of international integration
2) Ensures flexible application thoroughly understand the basic points of the CDIO approach based on inheriting and developing existing teaching model.
3) Ensures the generalized and specific teaching model
4) Ensures the effective and feasible in practical application

1.2.4. Basic views on CDIO approach to form teaching model in training vocational teachers

1.2.4.1. Nature and points of view on CDIO approach

CDIO approach (referred to as the CDIO approach) is defined as an approach to a theoretical model of training oriented output competences in technical universities. This theoretical model provides a scientific basis and the system 12 standards of quality assurance for higher education institutions, technical
training of engineers to meet the needs of the stakeholders in the context of business and society. Twelve standard targeting philosophy of the program (Standard 1), development programs (Standard 2, 3 and 4), the experience design - implementation and learning spaces (Standard 5 and 6), the teaching methods and learning new (Standard 7 and 8), faculty development (Standards 9 and 10), student assessment and evaluation of curriculum (Standards 11 and 12). In this standard, the standard 7 (*) are considered essential because they distinguish CDIO program with the proposed education reforms else. In other standard support CDIO program significantly and reflect best practices in technical education.

1.2.4.2. Output standard from a curriculum with CDIO approach

Output standard from a curriculum is shown that what student need to know, understand, be able to work after a course completed.

Teaching towards output standard is also objectification of learning based on competence-approached; it is an inevitable trend of modern teaching process. However, in many universities in Vietnam, the design of the output standard program has not been properly concerned with the superficial, built on the basis of the current program, not entirely derived from the needs of society; or are general, not specifically describe the capacity to be achieved by learners. CDIO approach has overcome the shortcomings pointed out that through a process of construction and development of output standard; it designs framework (called CDIO outlines) for the training sector with 4 levels of detail sufficient for the development of curriculum design, teaching and assessment.

Level 1 of four outlines the expectations, demonstrating that a mature individual intends to develop careers in technical fields should own a set of personal skills, communication skills and the elements nature, as the focus for practice. To develop the complex technical systems with benefit, students must master the foundation of knowledge and techniques necessary arguments. To work in a modern environment and in groups, the students need to develop the communication skills to work in groups and communicate with others. Finally, to build and operate the products, processes and systems, students must understand at a certain level of conceptualization, design, deploy and operate in the context of business and society.

Level 2 shows the detailed content of each component in level 1.

Level 3 and Level 4. This level of detail required for the transition from the high-level goals towards to output standards can be taught and assessed.

1.2.4.3. Designing integrated programs

- CDIO approach explained specific theoretical basis for an integrated curriculum, raises the important features of an integrated CDT, which is:

- Curriculum is organized around subjects, was restructured so that subjects can connect and support each other more, as opposed to the separate and independent of each other.

- The personal skills and communication skills create products, processes, and systems closely intertwined nature subjects to support each other, to relieve the potential conflict between the technical expertise and these skills.
Each course or learning experience and outcomes set out in detail the specialized knowledge, skills for personal and communication skills to create products, processes, and systems, to ensure sure students get the appropriate foundation for their future role of the engineer.

In the process of developing the current curriculum, one has to focus on the content and structure of the program, just interested in the training process innovation and innovation of teaching methods, while referring to media teaching and assessment procedures, confirm the study results. Integration of the program will be represented in the content, structure and its training methods. Specifically:

- Program integrated emphasizes on creating learning project in which the integration of knowledge, skills, interdisciplinary, multidisciplinary and personal skills.

- Integrated program, sources of knowledge will not framed in the context of the subject / subjects that tend beyond the textbook, this creates openness in cognitive study activities.

- Program enables integrated awareness - learning of students became more active and more flexible.

- Integration also facilitates the learner is engaged in flexible groups of students.

1.2.4.4. Teaching method, integrated learning and activeness to meet output requirements

CDIO model suggests teaching and learning to meet output standards of training programs through the integration of learning and teaching initiative (2 Standard 7 and 8 of the CDIO initiative), namely:

The integrated learning experience (integrated learning) is the pedagogy to promote learning specialized knowledge and learning individual skills, communication skills and create products and specifications the system in the context of professional engineering practice.

The approach emphasizes active learning attracting with the participation of students directly in the act of thinking and problem solving, participate in discovery, application, analysis, and evaluation of the idea. Active learning in courses may include methods: discussion with peers or in small groups, making demo, debate, and feedback from students about what they are learning. Active learning experiences is considered when students take on the role of simulation practice professional engineering, for example, the projects: design-implementation, simulations, and case studies.

1.2.5. Teaching model with CDIO approach in training vocational teacher

Teaching model with CDIO approach in vocational teacher training is a theoretical model describing the structure and function of a system of teaching, learning philosophical reflection is created, directed at top capacity the teacher's job to meet the requirements of the teaching profession in the field of vocational training. (Box diagram below)
Teaching model with CDIO approach in training vocational teachers has elements including: Philosophy and learning goals; The content and organization structure of the educational content; Principles, methods and techniques of teaching; Learning and teaching facilities; Assessment of learning.

1.3. Current situation of teaching quality and model in training vocational teacher in Vietnam

1.3.1. Introduction to vocational teacher training in Vietnam

At present, education institutions where train vocational teachers at undergraduate level (system of technical education) is rapidly growing in number. Among them, there are five universities of technical education, seven faculties of technical education of all universities. In 2013 alone, there were 1960 students enrolled in system of technical education, this has contributed timely to meet the needs of teachers in the field of professional education. However, there is no unity and systematic investment in professional training and complete vocational pedagogy.

1.3.1.2. Model and method of training vocational teacher

Education institutions where trains vocational teacher are in two main methods are parallel (simultaneously) and two-stage (serial)
1.3.2. Current situation on teaching quality and model in training vocational teacher.

1.3.2.1. Evaluation on the teaching model in training vocational teacher

Models present teaching traditional, according to access the content, lack of philosophical training vocational teachers, lack of standardized training professional capacity; The relationship between these elements: objectives, contents, methods, ... in teaching fragmentary, inconsistent; The reform model is not uniform; The methods and teaching techniques of slow innovation.

1.3.2.2. Objective and aims

The design and expression of learning goals in training vocational teachers predominantly described by the required knowledge, skills, attitudes needed to reach the SV (traditional), has not demonstrated the minimum power required to reach the end of the school curriculum of courses, courses, lessons (GPA average only poor: 2 to 2.03).

The content of the program is to teach teachers and students assess the relative fit of the body of knowledge, but a bit light on the theory of professional knowledge, pedagogical knowledge. Especially practical knowledge skills are very mild and mild even practical knowledge and pedagogical bias toward light, while the general theoretical knowledge in favor of heavy level.

1.3.2.3. Teaching method and assessment, evaluation, testing study outcome from curriculums

The method is mainly applied in teaching with "presentation" (GPA achieved at the highest level in the table). Meanwhile, the method associated with the integration of teaching, action-oriented than the less used. Especially the forging skills practice very little attention, namely: Practice at production facilities; Practice implementation capacity; Coaching, individual help; Use the online classroom; Visit reality (GPA of each method are evaluated at least in the table). Assessment of learning is mainly through essay exam, little attention was paid to the assessment process and the product under study.

Efficiency of teaching method mainly aimed at helping students to acquire new knowledge (highest GPA: 2.6), less attention to developing the capacity of individuals, society and the profession of school (lowest GPA).

1.3.2.4. Self- evaluation from lecturers and students on training products in curriculum of vocational teachers

Both students and teachers have noticed the development of moral superiority of the learned through training programs (highest GPA in the table and reached a fairly: 2.92), and the ability to see clearly the most restrictive they are "foreign language" (the lowest GPA in the table and only 2:10 point). In addition to language skills were rated the lowest, should also pay attention to the possibilities are evaluated at the average level or less. That is Skill practice / skills (2:45); Ability Informatics (2:36); Ability to manage and educate students (2:43); Creativity techniques (2:34); the ability to switch occupations (2:36).

CHAPTER CONCLUSION

1. CDIO is a model of higher education based on their competence to meet the requirements of the labor market in the new era. Access to CDIO to suggest teaching model in training vocational teacher is an appropriate way and necessary in the context of fundamental innovation, comprehensive education in our country.
towards modernization, democratization, and social cultural and international integration.

2. Through academic research shows teaching model be understood as a theoretical model reflects the structure and function of a system of teaching; reflect the views, ideas, approaches to build a system of teaching in schools serving the needs of society in every period of history. The model was developed that linked to the achievement of learning theory, theories of learning and the reform of education in the world. Teaching is based on the output capacity (including CDIO is one such model) is replacing the traditional model, is the inevitable trend of higher education today.

From the perspective of teaching theory, accessible through the basic thesis of CDIO to establish the structural elements of the teaching model in training vocational teachers appropriate theoretical and practical conditions of higher education in Vietnam , namely: 1) Design output standard of detailed program (level 4); 2) Design teaching content integration to deliver output standard issued; 3) teaching method with activeness, experience and academic assessment consistent with output standards.

3. Through the survey the status of teacher training in technical education system shows:

- Models present teaching traditional, according to access the content, lack of philosophical training vocational teacher, lack of standardized training professional capacity; The relationship between these elements: objectives, contents, methods, ... in teaching fragmentary, inconsistent; The reform model is not uniform; The methods and techniques of teaching slow innovation.

- The quality of teacher training at undergraduate level in technical ducation system currently not appreciated by the limitations also highlight: The content taught in curriculum was not reasonable (emphasis on the general theory of knowledge, light of practical knowledge and practical pedagogical skills); The efficiency of the selection, use the methods and means of teaching and assessment in curriculum is low, failing to meet the expectations of the participants on the need of it during training; Quality of training products do not really bring self-confidence to graduates after courses.

CHAPTER 2 – TEACHING MODEL WITH CDIO APPROACH AND ITS APPLICATIONS IN TRAINING VOCATIONAL TEACHER

2.1. Teaching model with CDIO in training vocational teacher

2.1.1. Teaching philosophy in training vocational teachers

Teaching philosophy in training vocational teacher towards excitement and passion from trainees about what teachers will teach as the role of "soul engineers" in the professional education institutions; this is aimed at developing pivotal competence for graduates: forming ideas - designing - implementation - completing the process of teaching and education in the context of oriented education reform in a way of normalization modernization, socialization, democratization and international integration.

2.1.2. Teaching aim setting and expressing

In this section, we will present the establishment and expression of learning goals as output standard, performing at grade level and subject program in a unified structure to ensure that graduates will meet its after each course and at the end of
program, level of output standards will be structured into four levels with outlined CDIO frame, and output standard will be specific subjects at level 4.

2.1.2.1. Output standard at curriculum level (in the field of vocational education)

**The content and structure of output standard Level 1:** Includes four themes of knowledge, skills and qualities required of vocational teacher that social expectations for graduate students in the university environment and society, as described in the following table:

<table>
<thead>
<tr>
<th>1. Knowledge and technical education argument</th>
<th>2. Skills and personal qualities in their professional activities</th>
<th>3. The ability to communicate and collaborate</th>
</tr>
</thead>
</table>

**The content and structure of output standard level 2:** Level 2 of Part 1. Knowledge and Technical Education industry argues that the themes associated with the specific requirements of training vocational teachers of professional competence in a particular field. It is the body of knowledge of basic science in the fields of mathematics, natural techniques, humane society, political theory; blocks technical knowledge base and enhance the core of the industry, and the methodology of intensive industries. This section is a priority objective in training with CDIO approach because it aims to bring students the skills needed to start a career.

Three rest towards the knowledge, skills and attitudes more generally that all graduates of the industry should have. We believe in training vocational teacher, part 3 - communication skills, will emphasize the peculiarities of communication pedagogy and interactive nature of teaching. The level of interaction and cooperation are essential skills in communication of vocational teacher because it is a factor in the success of teacher education in the school. Part 4 forming the basic competence of vocational teacher in their professional activities. That is, 1) **Forming the idea of building projects, strategies:** curriculum and education. This capacity reflects the thinking of the system level teachers, helping them to have a comprehensive view of the implementation of its mandate and confirmed their leading role in the process of teaching and education. 2) **Design:** As one of the capability to characterize the teaching profession, vocational teachers need to design a system specific learning goals and feasible; design curriculum, lessons, learning materials; design methods, teaching techniques; design of learning activities of students; design learning environments. 3) **Implementation:** vocational teacher is the direct implementation of the activities of teaching and educating students in the model was designed; implementation of monitoring, evaluating learning outcomes; and leadership, management trainees and learning to achieve the objective of teaching and education set. 4) **Complete the process of teaching and education:** After implementing the activities of teaching, education, the teacher must be based on performance and update feedback from learners to constantly
improve and perfect the process of teaching and education in different contexts of school and society.

Contents and structure of the output standard level 3: Includes topics included in output standard details to the subjects and skills in the curriculum. At this level, we will specify the areas of knowledge of the subject, the capacity of individual sectors, occupations and competencies that are specific CDIO skills into specific actions that learners should form when participating in curriculum. This level is the basis for the trainer to identify topics that output standard has been made in each subject or not. Through this system will be perfect output standard program at level 4 (implementation level for lessons and topics of study).

2.1.2.2. Subject’s output standards

Themes of skills and attitudes in the output standard level 3 will be integrated into courses in the curriculum or other (projects, theme, thesis ...). Therefore, to design the output standard-level courses, should perform the following steps:

1) Integration, and distribution process of teaching the subject of output standard at level 3
2) Identify the specific content and teaching process for each topic of output standard (the skills, attitudes)
3) Assign active verbs classified following to Bloom chart

Performing these steps, each teacher is in charge of discipline to build output standard for their courses and professional discussion group to complete it. Below is illustrated for the establishment output standard modules / subjects that we select in the experiment inside this thesis.

2.1.2.3. Illustration of output standard for a subject

This module is integrated on the basis of the subject: "Theory of teaching technical skills", "Professional teaching skill" and "teaching skills". In addition to the focus on integration between theory and practice are integrated attention to the content of the courses revolve around the theme of the output standard program, integrating the skills, personal qualities and communicate with is knowledge, skills and professional attitude.

On the basis of output standard in writing guidelines for approaching the subject under CDIO, we proposed output standard course "Methods and teaching skills in professional education" with 24 specific requirements of knowledge, skills and attitudes that students achieve at the end of this module (including the knowledge, skills, professional attitude, career, the pillars of CDIO skills, and abilities, personal attitudes, promote social needs of learners. Shown in Appendix 9 of the thesis).

2.1.3. Teaching principles

In addition to the classical principles, the model also proposes the main teaching principles, derived from tectonic theory and the foundations of modern learning theory, while ensuring the implementation of teaching philosophy and set goals, which are: 1) to promote the initiative, students actively in the process of building knowledge of each individual; 2) Calculate the problems of teaching and learning situations; 3) Ensure consistency between output standard with learning activities and assessment. This work directing the application of the unified model of teaching practices in order to achieve objectives
2.1.4. Content and organizational structures on a teaching content

Being designed towards integrating professional subjects of the course, the learning project to ensure a fully convey the theme output standard allows formation of professional knowledge, professional skills, abilities and factors personal qualities, communication skills, collaboration, problem solving, and develop themselves. The content was well arranged in a sequence relations platform, prerequisite, the dominant process of forming ability for trainees appropriately and in a dialectic way.

2.1.5. Method, strategies and teaching

As the road, how to reach the goals of the teaching process, the transfer of the output standard program to the school. Therefore, the methodology, teaching techniques are proposed to ensure the teaching principles stated above, promoting active learning and experience, and set up a specific plan, such as:

+ Teach students by organizing practical experience of professional activities in the practice of professional education.

+ Integrally teaching, directed at professional competence, develop personal competence, social and communication.

System of methods, teaching techniques in this model to move forward to the effective application of practices including scenario-based learning, project-based learning, discussion-based teaching, learning based on the issue ...

2.1.6. Teaching materials and tools

A system of output standard in training vocational teacher consists of many skills required to help learners achieve the goals, they must have access to a rich learning resources and systems to promote good media interactivity in teaching: teacher-student interaction; interaction with other students; and interaction between students with object perception, learning environment. Therefore, we propose to focus on the system using a suitable means of teaching and learning resources designed to reflect the rich diversity of the modern novel approach to help students practice the professional skills and personal skills to meet the output standard program. At present, questionnaires and study sheets are very effective tools to organize the active teaching methods on the basis of conventional techniques such as speech, information, events, discussions, study, investigations, training, etc. ... but have not been paid adequate attention. Therefore, we recommend that teachers should actively design and apply study sheet as a handout material in the group discussion method.

2.1.7. Views and evaluating techniques on teaching result

Testing and evaluation are in accordance teaching model with CDIO approach with an evaluation based on ability of each institution, this is aimed at encouraging active learning and experience, which developed the capacity pillar and personal skills, communication skills of learners to achieve output standard requested by profession and society. Forms, methods and techniques to assess diversity, with strict process and ensure the principle: for the progress from learners; evaluation satisfies competence of output standard –; Ensure the promotion of positive, proactive, creative learners; Ensure fairness and objectivity; Ensure the harmonious combination between traditional assessment with development of evaluation, assessment and evaluation practices creativity.
2.2. Application of teaching model with CDIO approach in training vocational teacher.

Suggested application of teaching model should be implemented in two levels: 1) the macro level (curriculum level), all structural elements of the model are specific instructions for the design of a curriculum based on Output capacity (in terms of theory). However, the application of teaching method at this level will take a long time (at least one training course: 4.5 years) and must be approved by the school authorities to put in place; 2) micro level (model applied in teaching design courses, lessons or learning themes) by the teacher directly implemented. Instructors teach courses can apply the thorough teaching model we propose to improve the quality of teaching in the direction to meet the standard output capacity of curriculum on training vocational teacher. For this, teachers need to implement the design through detailed course outline (curriculum of subjects), and lessons learned in designing the program.

At the level of use in courses and lessons, the thesis has designed course syllabi integration "method and teaching skills in vocational education" and set out the criteria for assessing the quality of CDIO syllabus with the approach. In addition, the thesis has designed a lesson in discipline that integrates. This is the realization of all the elements of teaching models that we propose to apply in practice. The requirement of designing lesson is:

- Integrated output standard course built in lessons
- Attention training skills and personal attitude, communication skills and cooperation of people through organizational learning lessons
- Design learning activities and assessment of learning consistent with output standard. In particular emphasis actively promote student learning and enhance the learning experience to develop ideas, the ability to design, implement and complete methods and teaching skills of the future vocational teacher. Focus the assessment of teachers and students' self-assessment to ensure a comprehensive assessment of the capacity of the school under the system of output standard.

The lessons are designed to comply with the following steps:

*Step 1: Schedule of achieving the objectives of the lesson as output standard lessons*

*Step 2: Determining structure for the lesson content*

*Step 3: Designing learning activities, methods, organizational forms of teaching and learning how to assess*

*Step 4: Selection of media, design of learning materials and learning environment*

*Step 5: Designing lesson plans*

On this basis, we conduct lessons in subjects designed for “teaching method and skills in vocational education" under the theme of chapter 2 – teaching method in vocational education.

**CHAPTER CONCLUSION**

CDIO approach is a teaching model in training vocational teacher based on competence, in an open direction, with integrity; it also focuses on the learners, market-driven. This has been shown through the description of its
structural elements include: 1) teaching philosophy (the concept of background in training vocational teacher); 2) The objective of teaching (output standard program); 3) Principles of teaching; 4) The content of education; 5) Methods, strategies and teaching techniques; 6) Learning and teaching facilities; 7) The views and technical evaluation of teaching.

With the specific description of its components, based on the teaching model, CDIO approach in training vocational teacher will work effectively to apply and implement with the requisite level both macro and micro scale, ensure consistency between theory and practice, teaching ensures consistent with output standard, facilitate the reform program, design and organization of teaching effectiveness in the process of improving the quality of training to meet the needs of society and profession.

CHAPTER 3 – EXPERIMENTAL INTERPRETATION

3.1. Introduction to experimental program

3.1.1. Identifying goals

- Evaluation is an increase in the quality of education (based on learning outcomes) compared to traditional education.
- Evaluate the quality standards and curriculum to meet the level of output standard (in terms of course) by accessing CDIO better than traditional teaching.
- Evaluation of positive feedback from students about teaching activities of teachers and learning environment.

Experiments show that improvements with CDIO approach have a positive impact on the quality of training vocational teacher to meet professional standards.

3.1.2. Content of experiments

We conducted experiments by applying suggested teaching models in teaching integrated subject: "teaching methods and skills in vocational education" of curriculum of vocational teacher at undergraduate level, through the design of subject syllabus, lesson design and organization of the teaching-oriented model.

3.1.3. Experimental conduction

i) Experiment No.1

*Duration*: 4 weeks of the first semester of the academic year 2013-2014. At that time, students are studying the subject “teaching method and skills in professional education” to the university's schedule in both experimental and activities-oriented classes.

ii) Experiment No.2

*Duration*: 4 weeks of second semester of the academic year 2013-2014. This time was implemented as planned schedule of teaching.

3.1.4. Criteria and evaluating tools

- K- Results of student learning in the form experiments by testing designed on the basis of output standard lessons.
- Perception of the level of student ability to achieve their own compared to the output standard program through stock answer questions designed based
on the theme of the output standard lesson and use scales corresponding level 5 with the level of cognitive ability and skill-based classification of Bloom.

- Perception of teaching students about the activities of teachers and teaching effectiveness of the program through experiment of questions expressed satisfaction from learners.

- The result with evaluation by experts of quality of detailed syllabus through evaluation forms.

- Data processing tools are by: MS. Excel software, SPSS.

3.2. Data analysis

3.2.1. Evaluation and orientation on students’ outcomes

*Flow-chart of frequency of convergence when testing*

Convergence Road frequency of experiment overlying layer, right versus frequency Convergence of FCA class. That said, the outcome in scores via tests, students have score higher than grades of experiment.

The graph achieve cumulative incidence of test scores with Experiment 1 skewed toward the upper right compared to Experiment 1 class, proven academic performance of students has increased between times (2nd times higher than 1). That can make adjustments and timely withdrawal of experience in teaching methods, and the application of teaching model with CDIO approach to improve the academic performance of students of technical education to satisfy output standard.

3.2.2. Self-evaluation by students on satisfaction of output standard in training vocational teachers through experimental programs.

The majority of students assessed themselves exceeded the output standard of lessons in subjects "teaching methods and skills in professional education". This means that students can perform good works in accordance
with the teaching techniques, and better use of knowledge to solve practical
tasks in professional activities.

3.2.3. **Feedback from students after teaching effectiveness with experimental model.**

Students respond positively to teaching activities of the faculty. Most of
them said that now reaches well taught and well, the criteria of lectures also
achieved from relatively older. In particular there are a number of criteria to be
evaluated very positively in class experiment, consisting of: 5) I was interested
in school; 7) teachers provide opportunities for students to apply knowledge
acquired; 10) Teachers encourage students to ask questions and express their
views of the issues of the lesson; 11) teachers often raise issues for students to
think, debate; 12) teachers interest organization for students engaged in group
discussions to resolve the learning task; 16) teachers introduced textbooks,
reference materials, lesson outlines appropriate, updated and accessible; 24) The
lesson helped me gain the necessary skills for the future.

Practical observations show that students in the experiment express and
changed markedly on the autonomy and self-discipline in the implementation of
the learning task. They are active, more active participation in discussions, more
confident in presenting the views, political opinions, his arguments on issues of
learning than traditional teaching. In addition, the enhancement of the learning
experience situations, play helps students integrate with dynamic learning
environment, not spontaneous, stress, create attraction, attract children to
participate . Thereby, has trained students with communication skills, teamwork,
critical thinking skills, problem solving, logical reasoning, applying theoretical
knowledge to practical teaching technical expertise .

3.2.4. **Opinion by experts on the quality of subject program in teaching model with CDIO approach.**

Survey results showed that 100% of experts are evaluating curriculum
quality, and without any criterion was rated unsatisfactory. This confirms that,
according to teaching model with CDIO approach in training vocational teacher
effects contribute to improving the quality of the curriculum. It is also hypothesized
that the thesis set out to build the model.

**CHAPTER CONCLUSION**

Through experiments applying teaching model with CDIO approach in
training vocational teacher shows:

- Teaching model with CDIO approach has been successfully applied in
technical education to reform the world’s education, it also proved to be
consistent with vocational teachers’ training to improve the quality of vocational
training to meet ongoing standards

- Teaching model follows CDIO approach was formed to help facilitate
orientation for curriculum development, curriculum development and lesson
design ensures output training vocational teacher achieve a university degree.
- The model has been applied in teaching student at undergraduate level for technical education has helped significantly improve the learning outcomes of students, while making students more interested in learning, enhance learning initiative, formed in the school system professional competence, professional development skills, personal qualities, communication and cooperation to meet output program.

- Results from experiments were initially confirmed that teaching model with CDIO approach in training vocational teacher at undergraduate level will brings soundness, feasibility and effectiveness, proven scientific hypothesis that the thesis suggested

CONCLUSION AND SUGGESTIONS

1. CONCLUSION

1.1. The search for a new theoretical teaching model, reflecting the trend of development of modern learning theory is one of the strategic orientation, creating the foundation for the effective application of theory to practice in training vocational teacher created is to enhance the quality of training to meet the requirements of society. Accessing to CDIO is to establish teaching model in training vocational teacher, this is one of targets included in this thesis.

To accomplish that goal, the thesis has been carried out to build a solid theoretical system formed the basis for practical research and proposed CDIO approach in training vocational teacher. It is a clear connotation of the term "teaching model in training vocational teacher"; Identification of structural elements makes teaching models; Essential teaching model satisfies different approaches; Essential ideas and basic techniques of CDIO approach; teaching model development trends in higher education and the requirements set out in the CDIO approach to propose teaching models in training vocational teacher in accordance with the context in Vietnam and Technical Education schools.

1.2. Through empirical research has shown: teaching model now traditional, according to access the content, lack of philosophy in training vocational teacher, lack of standardized training professional capacity; The relationship between these elements: objectives, contents, methods, ... in teaching fragmentary, inconsistent; The reform model is not uniform; The methods and techniques of teaching slow innovation. Graduates also revealed shortcomings: Ability of teaching, skills, teaching skill is limited. Computing skills and language is weak, thus limiting the updated information, material extraction to serve both academic, vocational training. Quality training products do not really confident learners after school.

1.3. Based on the theoretical basis and practical has concluded, we suggest teaching model under CDIO approach in training vocational teachers, including: training philosophy of vocational teacher; design and expression training objectives (a system of output standard to groups of knowledge in training
teaching methods for vocational teacher); the teaching principles in training vocational teacher; content and organizational structure of academic content (proposal for a system of subjects, project learning and teaching logic structures); teaching model and assessment of student outcomes; learning materials and teaching facilities.

Teaching model forms an effective solution to improve the quality of education in vocational teaching institutions. Otherwise, the proposed system of vocational education for output standard level 4 helps to implement specific contents in each lesson, topic, project learning, the model was given very specific instructions about teaching methods towards integrated learning, learning experience and active learning, friendly environment and test and evaluation authentic ... So, it is very useful in the application and deployment.

1.4. Teaching model with CDIO approach has been used to design the curriculum, "teaching method and skills in professional education" and applied experimental teaching with the subject "teaching method in the professional education" of vocational teaching curriculum at undergraduate level. The experimental results have initially proved the correctness, effectiveness and feasibility when applying that model into practice.

2. SUGGESTIONS AND RECOMMENDATIONS

To effectively implement this model in practical training at universities and faculties of technical education, the thesis recommends:

2.1. Managing ministries of universities of technical education should make policy to encourage the adoption of output-standard-oriented teaching models because it is the trend of higher education in the world. At the same time, there should be initiative and positive direction by leaders from universities of technical education when applying new teaching models to reform training vocational teachers.

2.2. Institutions, faculties of technical education should build innovative projects with curriculum of training vocational teacher based on teaching model with CDIO approach. In particular, the detailed description of the elements of the model should be applied thoroughly in building program.

2.3. All staff and faculties, which engaged in teaching with curriculum in training vocational teacher, should be imbued with the idea and how to master the elements of the model to apply in teaching subjects that they are in charge to translate contents of output standards for learners.

2.4. Students should be instructed to learn with new models and gradually formed a habit for them to learn self-discipline, active learning and actively participate in the experiences study based output standards.

2.5. The investment in infrastructure and friendly environment for designing and deploying, pedagogical practices, innovating teaching methods, and assessment to improve the effectiveness of the training program is a policy of priority for higher education institutions.
REFERENCES AND RELEASED PAPERS

In Vietnamese:


