

# **Application of Teaching Techniques in Engineering Education**

**Hung-Wen Chen<sup>1</sup>, Hsiao-Hui Yang<sup>2</sup>, Ken-Fu Cheng<sup>3</sup>**

## **Abstract**

Teachers and students have close relationship in teaching-learning process . Teachers are considered as “instructors” whereas students are learners . Only when both have positive interactions can instruction and learning be effective . Therefore, in order to facilitate teaching activities and attain successful engineering education, teachers not only have to possess professional knowledge, but also acquire teaching techniques . Among various kinds of teaching methods, there are efficient teaching techniques which will bring active participation and arouse learning interests . This study aims to discuss different kinds of teaching techniques, including lecture technique, questioning technique, discussion technique and presentation technique . The CIPP evaluation models (D . L Stufflebean et . ), context evaluation, input evaluation, process evaluation and product evaluation, will be used to explore reasons for successful engineering education .

Keywords : Teaching techniques, Engineering education, Teaching evaluation

<sup>1</sup> Associate Professor, Department of Civil Engineering, De Lin Institute of Technology

<sup>2</sup> Lecturer, General Education Center, De Lin Institute of Technology

<sup>3</sup> Lecturer, Department of Civil Engineering, De Lin Institute of Technology

## Teaching Plan

Teaching plan refers to teachers' written document which is designed in advance before teaching . The goal is to help teachers think carefully of a teaching goal, teaching process, teaching style, teaching material and evaluation . The design of teaching plan indeed has great influence on teaching material and on the application as well as teaching activities . A good teaching plan can make teaching activities lively . Both teachers and students will enjoy teaching and learning . According to time limit and teaching materials, a teaching plan can be divided into four categories :

- 1 . unit plan
- 2 . lesson plan or daily plan
- 3 . weekly plan
- 4 . long term or yearly plan

A complete teaching plan should, at least, contain the following items: teaching goal, teaching content, teaching method, teaching procedure, teaching material and evaluation on the learning results . The teaching plan in each unit is different based on students' levels while teachers' various teaching experiences will present it differently . As shown in Table 1 is an example of a teaching plan .

Table 1 Example of a teaching plan

Teacher:	Class:
I . Unit	
II . Teaching Goal	
III . Reason	
IV . Procedure	
V Teaching method	
1 . content	
2 . activity	
a . preparation activity	
b . developing activity	
c . integrated activity	
VI . Teaching Material	
VII . Evaluation	

## Teaching Material

The content of a teaching material is to help students learning . For example, textbooks, references books, slides, films or handouts are some sources of teaching materials .

Teachers have to pay attention to choosing appropriate teaching materials . A suitable

material will facilitate students to learn . The following needs are to be considered:

1. to develop students' thinking
2. to enhance students' ability in organizing knowledge
3. to develop students' skills
4. to cultivate students' moral and interests

Besides the needs mentioned above, the arrangement of teaching material also has to meet learners' physical and mental development . The material should move from easy to difficult, near to far, specific to abstract and special to general . After deciding which material to be used, teachers have to design the teaching plan and lesson plan . When the plan is set up, teachers should rehearse it first . Then they can modify the plan depending on time limit or other inappropriateness . On the other hand, they have to be familiar with the lesson plan before teaching in order to make the teaching process as smooth as possible . Otherwise, if teachers are not well prepared, it will impede the teaching process and detrimental for both teachers and students . A lesson plan includes:

1. unit: refers to the subjects
2. teaching goal
3. reason
4. process:
  - (1) list the outline of the teaching material
  - (2) list the designed activities, including preparation activity, developing activity and integrated activity
  - (3) point out the adopted teaching method
  - (4) required time for each subject or activity
5. teaching material: audio or video media, teaching tools, or outside reading material
6. evaluation: the evaluation style and standard used before teaching

## **Teaching Technique**

Besides different teaching methods, teachers need to apply various teaching techniques to make teaching activities lively and arouse students' learning interests . Generally speaking, there are many different ways in teaching techniques, such as lecturing, questioning, presentation, experiment and inspection and learning from others . The commonly used techniques are discussed as the following:

1. lecturing : Lecturing plays an important role in most teaching activities . This technique is required in teaching because a teacher can make boring teaching material lively or make students interested in the topic through their expressions . Thus, teachers have to be articulate with words, suitable phrases, natural voices and smooth tones . The content in a lecture needs to be fixed to meet students' needs . Teachers

- also ought to be warm and generous and care about students' learning attitudes .
2. questioning : The questioning technique is an important process in teaching activities . Questioning can motivate students to participate in learning activities actively . Teachers and students can also obtain important messages and learning interests by asking questions . Consequently, teachers have to think about question design to attain teaching effects . A good question is usually brief and to the point . It can inspire students to think over and be challenging . After asking a question, a teacher has to leave students some time to think over again and later either ask a particular student or leave it open for the class . It's not proper to respond with a "yes" or "no ." Teachers have to encourage and support those who are introvert and passive .
  3. discussion : Discussion refers to teachers' guidance on students when facing problems . Through communications, discussions, debates, opinion exchange, a solution is found out . Teachers' guidance is very important in the discussing technique . Before the discussion starts, teachers have to list the outline for discussing questions, divide students into groups to collect information based on the teaching contents, and present the materials for discussion regularly . The conclusion comes out by mutual communication . The discussing technique is only effective under teachers' inspection unless it will be a waste of time and won't get to the expected results . Teachers not only need to be well prepared before discussion but also be familiar with the technique and process .
  4. presentation : Presentation refers to performance from teachers' instructing students about theories and techniques . Each subject can depend on presentation to arouse students' learning interests . A presentation can help students concentrate on what they are learning and develop the ability in appreciation and judgment . It is usually believed effective to combine questioning, discussing and presentation techniques to make the subjects easily understood .

### **Learning Motivation**

There's always a teaching goal in each lesson or unit in the teaching activity . In order to achieve those goals, learning motivation has to be considered first to arouse students' concentration . Motivation is a kind of stimulus which teachers make use of different ways to increase students' attention as well as learning interests . How can teachers bring about motivation? Here are some principles:

1. take advantage of students' current motivation: The motivation includes students' interests, attitudes, ideas, impetus, curiosity and adventurous behaviors .
2. make students feel learning is valuable
3. help students set up proper goals
4. create pleasant atmosphere

5.cultivate positive attitudes and ideals

6.make use of any reinforcement

7.provide role models

Most experienced teachers will bring about students' learning motivation prior to class and the followings are items which will bring about learning motivation .

1 . set up preconditions :

Teachers can use special gestures or motions before classes to get students' short-term attention in order for them to get in the learning environment . These gestures basically are to encourage students to learn and to make them learn in such a short period of time .

2 . keep students with successful expectation :

Teachers have to constantly arouse students' learning motivation and make students believe that learning is going to be valuable and successful . All teaching materials have different kinds of value . Teachers are responsible for making students feel encouraged by teachers and warm classroom atmosphere . The reinforcement of encouragement can help students believe that learning is successful and hopeful in the end .

3 . provide extrinsic motivation :

Extrinsic motivation is also an important factor to arouse learning motivation . Teachers can provide rewards fro those with good learning results in class .

4 . intrinsic motivation :

Every student has different intrinsic motivation with high or low level . Therefore teachers have to understand the intensity of students' intrinsic motivation and whatever that influence learning motivation so as to make teaching achievements . Motivation is really complicated and often not easy to be inspired . Here are some methods to create intrinsic motivation:

(1) establish students respect

(2) make use of current motivation and intensify intrinsic motivation through reinforcement

(3) help students develop proper goals

(4) provide comfortable learning environment

(5) create positive classroom atmosphere

## **Teaching Goal**

Teaching goal refers to the desired goal or learning results teachers hope to achieve in teaching . Teachers can design teaching activities or assess students based on teaching goal .

The teaching goal thus has the following functions:

(1) provide basis on teaching material analysis and student activity design

(2) describe concrete behaviors for teachers to evaluate teaching effects

- (3) help students understand expecting learning results
- (4) help teachers do evaluation and modify teaching process and goal

Generally speaking, teaching goal is divided into cognitive, psychomotor and affective .

1. Cognitive : The cognitive area includes six levels: knowledge, comprehension, application, analysis, synthesis and evaluation .
2. Psychomotor : According to A . J . Harrow, the psychomotor area includes reflex movements, body fundamental movement, perceptual abilities, physical abilities, skilled movements and nondiscursive communication .
3. Affective : The affective teaching goal includes attitudes, appreciation, interests, ideals and adaptation learning goals . According to D . R . Krathwohl, the affective teaching goal is divided into five different levels: receiving, responding, valuing, organization and characterization .

## **Teaching Evaluation**

Teaching evaluation refers to evaluation on teaching goals, not evaluation toward students' learning results . After teaching, each goal has to be evaluated to test if teaching has successfully achieved the expected goal . If the condition is nice, that means teachers have taught successfully . On the contrary, if the effects are bad, both teaching methods and techniques need to be modified . The result of evaluation not only provides feedback circle but also inspect the design of teaching process . D . L . Stufflebean has provided four types of evaluation, the so-called CIPP evaluation model .

1. context evaluation :  
the design of teaching goal
2. input evaluation :  
the collection of teaching materials, preparation of teaching resources, application of teaching methods and arrangement of teaching activities
3. process evaluation :  
the evaluation aiming to explore the shortcomings in the process
4. product evaluation :  
the evaluation of teaching goal or overall evaluation

## **Conclusions**

Teachers are “instructors” and students are “learners” in the whole teaching process . Both sides have close relationship and interaction . Only when there are positive interactions between teachers and learners can teaching and learning be the most effective . Since teachers play important roles in teaching, they should be responsible for teaching,

counseling, and managing . To sum up, teachers have to acquire abundant professional knowledge, teaching techniques which catch up with the current trend, positive points of views toward life and enthusiastic living attitudes . Students are basically teaching objects and main roles in the teaching activity . They have different background but same demands in learning . Teachers must have full understanding about students' demands, take advantage of different teaching styles, induce students' learning interests in order to make achievements for both instructors and learners .

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## 教學技巧在工程教育之應用

陳泓文<sup>1</sup> 楊小慧<sup>2</sup> 鄭根福<sup>3</sup>

### <摘要>

教師與學生在教學這過程中扮演著非常緊密的關係，教師是「教導者」而學生是「學習者」，必須在教師與學生有良好的互動關係下才能有效地達到教學成果。因此，為能成功地完成工程教育，工程教師不僅需擁有工程專業知識，教學技巧亦不可或缺。在工程教育上，有效的教學技巧除可引起學生對多樣的工程技術的學習意願與興趣外，並可獲致良好的教學成果。本研究針對不同的教學技巧，包括：講課技巧、發問技巧、討論技巧以及表達技巧進行深入之討論與分析，並透過 CIPP 評量模式(D.L Stufflebean et.)，來探討有效的教學技巧在工程教育上之應用。

關鍵詞：教學技巧、工程教育、教學評量

<sup>1</sup> 德霖技術學院土木工程系副教授

<sup>2</sup> 德霖技術學院通識教育中心講師

<sup>3</sup> 德霖技術學院土木工程系講師