

**AC 2010-1185: EXPLORING THE STUDENTS' ATTITUDE, MOTIVATION AND SELF-EFFICACY IN PHYSICS LEARNING: A STUDY IN THE UNIVERSITIES OF TECHNOLOGY IN TAIWAN**

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# Exploring the Students' Attitude, Motivation and Self-efficacy in Physics Learning: A study in the Universities of Technology in Taiwan

## Abstract

The purpose of this study was to investigate the reality of physics curriculum/learning in the universities of technology in Taiwan. It should be noticed, university of technology (UT) in Taiwan is categorized to vocational education system. Therefore, in physics learning, the performance of UT students should be something different from general university (GU) students. This study involved a survey, comprised of four sets of questionnaires concerning attitude toward physics, learning motivation, self-efficacy and learning states were investigated. Four instruments (Motivation toward learning test, Attitude toward physics test, Self-efficacy about learning test, Learning states test) were adopted in this study. The participants in this study were 3031 freshmen, and were sampled randomly from 12 UT in Taiwan. Participants were categorized as three groups by their majors—electricity and machines group (EMG), information engineering group (IEG), and other engineering group (OEG). Furthermore, in order to explore the differences between GU students and UT students in physics learning, another 249 engineering college students from a mid-level general university were selected randomly as the contrast group (CG). After data analysis, some interesting research findings were discussed and will be suggested to the practice of physics curriculum design in university of technology.

## Background and Purpose

The last three decades, contemporary educational reforms around the world have gradually emphasized the development of student's abilities about scientific understanding, critical thinking, creativity and problem-solving. Student should be equipped with properly proficiency for a productive adult life in the rapidly changing world. For example, knowledge and skills from science, technology, engineering, and mathematics—the so-called STEM fields—are crucial to everyone, and all students should be educated to be “STEM-capable”<sup>1</sup>. However, there are many factors affecting students' learning performance in school, such as students' attitude, motivation, and self-efficacy.

Motivation is a crucial factor affecting students' learning in school. It can be defined as any process that initiates and maintains learning behavior. Motivation is important for learning because students can not learn unless they are motivated<sup>2</sup>. Therefore, motivation could be viewed as an essential pre-requisite and co-requisite for learning.

Attitude can be considered as a learning outcome. It is also a important factor that affects learning<sup>3</sup>. Consequently, more positive student attitudes can be a factor in increasing enrolment in science course and amplifying learning science achievement<sup>4</sup>. So, it is important to understand the reality of student's attitude toward physics in order to enhance their science learning achievement.

Self-efficacy beliefs provide the foundation for human's motivation, well-being and personal accomplishment<sup>5</sup>. People have little incentive to act or to persevere in the face of difficulties unless they believe that their actions can produce the outcomes they desire. Generally, physics is

one of the subjects that students feel it is difficult to learn. If students have higher self-efficacy, they should be more confident to overcome the difficulties in physics learning.

However, to date, there has been relatively little research conducted on exploring the performance of UT students in physics learning in Taiwan. Especially, physics is one of obligatory subjects for all engineering majors of UT students in Taiwan. Up to this point, there were few empirical studies in investigating the students' perceptions of physics learning. In order to promote physics teaching/learning for UT—a vocational education system in Taiwan, the foci of this study were to explore the reality of students' physics learning.

In sum, the purpose of this study was to investigate the reality of physics curriculum/learning in the universities of technology in Taiwan. Furthermore, the students' attitude toward physics, motivation and self-efficacy were analyzed too.

### **Research Rationale**

The President of America Obama had argued that “every American will need to get more than a high school diploma for their own futures”. However, the higher education environment in Taiwan is quite different from USA. Recently, most of senior high school graduated students go to college or university in Taiwan. Generally, physics is one of the subjects that students feel it is difficult to learn for every grade level student in Taiwan. Besides, it should be noticed that UT in Taiwan is categorized to vocational education system. Therefore, in physics learning, the performance of UT students should be something different from GU students. Since students' attitude, motivation and self-efficacy are important factors affecting science learning. In order to enhance the science learning achievement of UT students in Taiwan, it is crucial to understand the reality of students' attitude, motivation and self-efficacy toward physics learning.

### **Method and Design**

In this study, the UT students' attitude, motivation and self-efficacy toward physics learning in Taiwan were investigated. Four instruments (Attitude toward physics test, Motivation toward learning test, Self-efficacy about learning test, Learning states test) were adopted in this study. In the present study, the  $\alpha$  value of the four instruments were higher than 0.7, implying that a good internal consistency existed among the instruments. Besides, the validity of the four instruments was confirmed by panel meeting.

The total participants were 3031 freshmen that were sampled randomly from 40 departments in 12 Universities of technology in Taiwan. According to their major subject, all participants were categorized to three groups—electricity and machines group (EMG), information engineering group (IEG), and other engineering group (OEG). Furthermore, in order to explore the differences between GU students and UT students in physics learning, another 249 engineering college students from a mid-level general university were selected randomly as the contrast group (CG).

In order to collect the stable state of UT students in physics learning, the research instruments were sent to the sampled schools two months later in the new semester. To analysis the data in this study, dependent sample t-test and ANOVA were conducted.

## Result

### *Learning states of UT student in physics learning*

The instrument of learning states in this study was designed as Likert’s five-point rating scale. The main purpose of this instrument was to investigate the students’ perception and expectation about learning, assessment and instruction in physics course. Figure 1 presented the results of students’ general perception toward physics course in UT in Taiwan. As shown in Fig 1, the mean score of item 6, 7, 10 were higher than three points. The results revealed that the UT students in Taiwan expect that the physics course should be integrated with life world and practical affairs. They also expected that they could get more opportunities to engage in doing experiment in physics course. Besides, the mean score of item 1 in EMG was higher than IEG and OEG, it revealed that the students in EMG considered physics is more important compared to the students in the other groups.

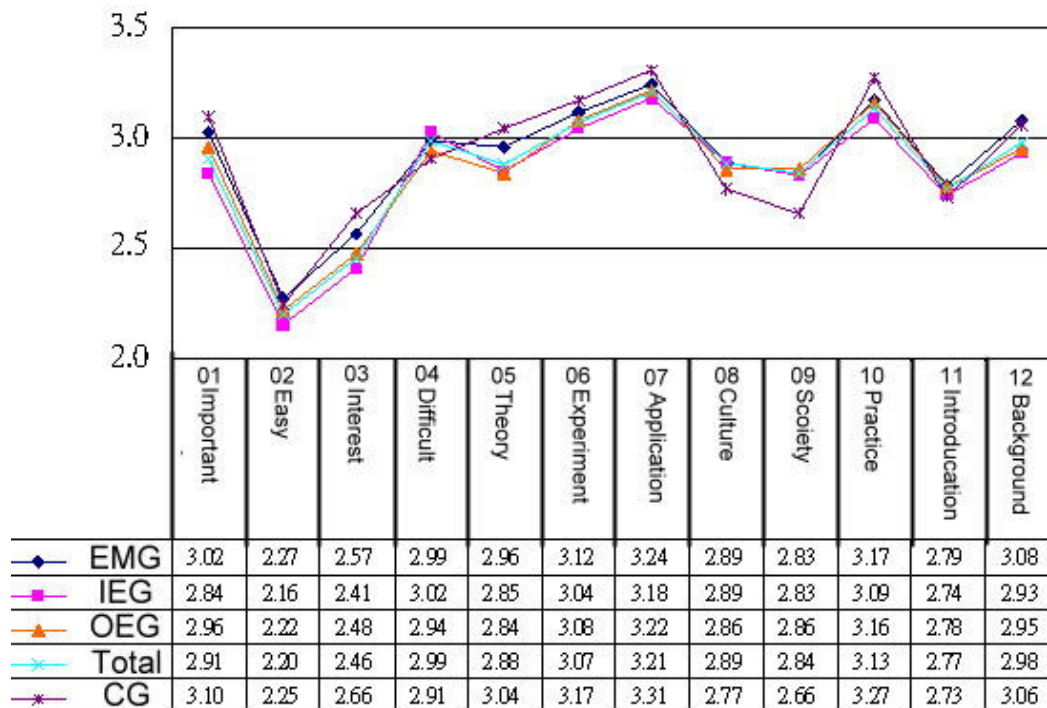


Fig1: Students’ general perception toward physics course

It is interesting that the mean score of item 10 in CG was lower than the other groups, and the mean score of item 1 in CG was higher than the other groups. It revealed that the GU students considered physics is more important compared to the UT students. Relatively, UT students considered physics should be integrated with social issue compared to the GU students.

Figure 2 presented the results of students' perception about learning and assessment in physics course. The percentage score of item 1 and 2 in CG were higher than the other groups. It revealed that the GU students considered principle explanation and application are more important in physics course compared to the UT students.

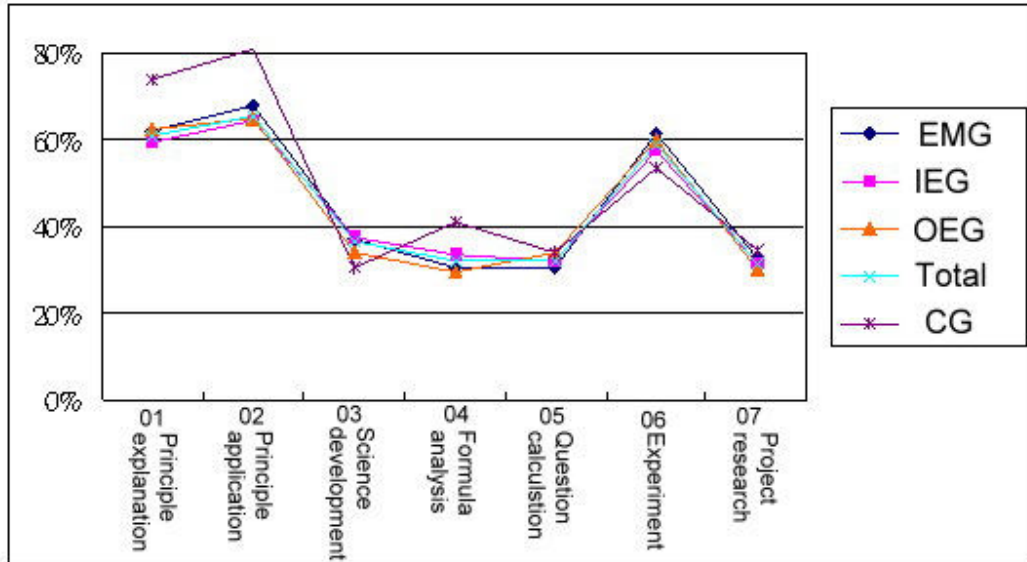


Fig2: Students' perception about learning and assessment in physics course

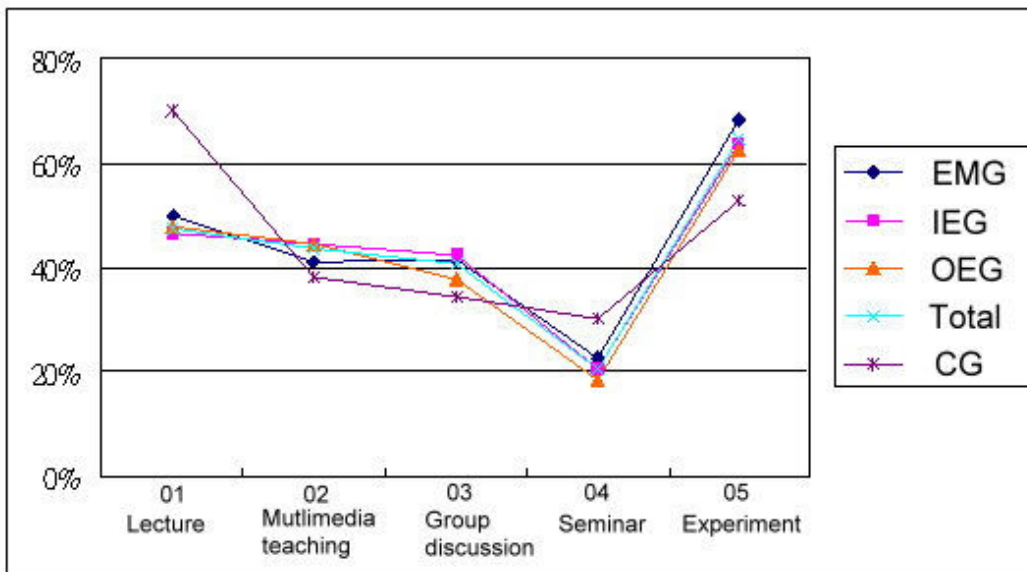


Fig3: Students' perception about instruction style in physics course

Figure 3 presented the results of students' perception about instruction style in physics course. The percentage score of item 1 and 4 in CG were higher than the other groups. It revealed that the GU students considered lecture and seminar were the regular instruction style in physics course compared to the UT students.

The percentage score of item 2, 3 and 5 in CG were lower than the other groups. It revealed that the UT students considered multimedia, group discussion and doing experiment were the regular instruction style in physics course compared to the GU students.

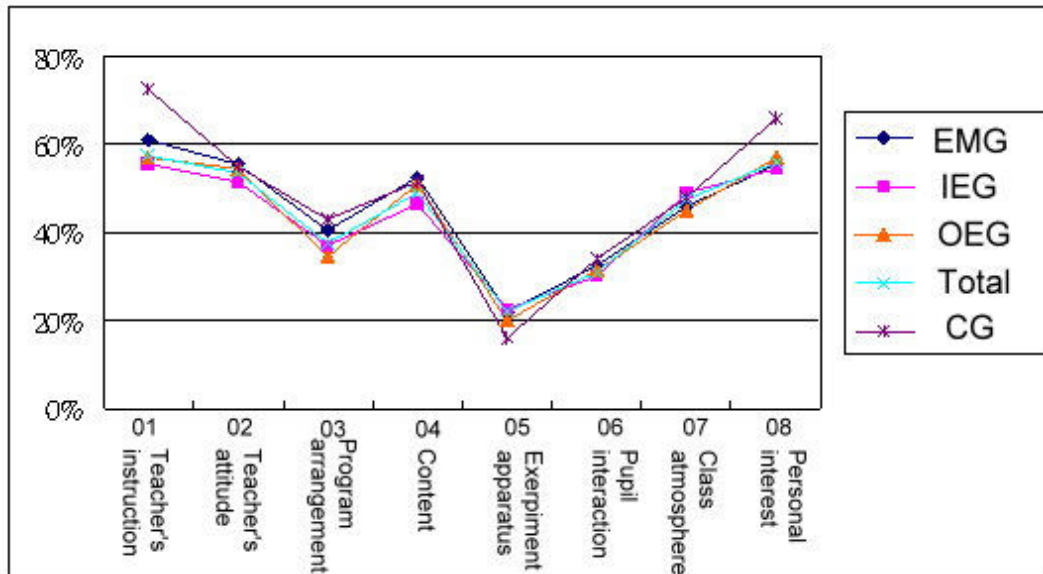


Fig4: Students' perception of factors affecting physics achievement

Figure 4 presented the results of students' perception of factors affecting physics achievement. All the groups showed the similar pattern that agreed with teacher's instruction and personal interest were the most important factors affecting physics achievement.

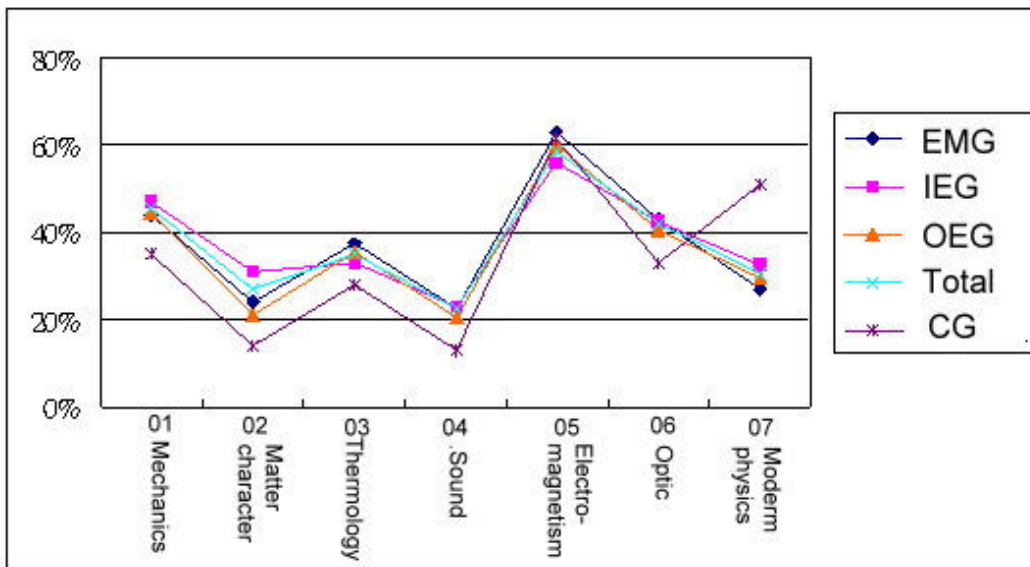


Fig5: Students' perception of difficult topics in physics learning

Figure 5 presented the results of students' perception of difficult topics in physics learning. All the groups showed the similar pattern that agreed with the topic of electromagnetism was the

most difficult topic in physics learning. It is interesting that the topic of modern physics was ranked as second difficult topic by the GU students, however the UT students did not hold the same idea. It is probably that most of physics course in UT did not cover the topic of modern physics.

*Attitude toward physics of UT students in physics learning*

The instrument of students' attitude toward physics learning was also designed as Likert's five-point rating scale. Table 1 presented the results of students' attitude toward physics. Generally, the mean of all subjects was 2.62, it revealed that all UT students hold the positive attitude toward physics learning. Furthermore, the mean of EMG was higher than the other group. And there were significant differences between EMG and IEG. However, the mean of CG was 2.72, it revealed that the GU students hold more positive attitude toward physics learning than the UT students.

Table1: the performance of students' attitude toward physics learning

group	Mean	SD	F	p-value	Scheffe
EMG	2.65	.321	14.966	.00**	(EMG, IEG)
IEG	2.60	.341			
OEG	2.63	.338			
total	2.62	.336			

*Motivation toward physics of UT students in physics learning*

The instrument of student's motivation toward physics learning was designed as Likert's five-point rating scale too. Table 2 presented the results of students' motivation toward physics learning. Generally, the mean of all subjects was 2.65, it revealed that all the UT students hold the positive motivation toward physics learning. Furthermore, the mean of EMG was higher than the other group. And there were significant differences between EMG, IEG and OEG. However, the mean of CG was 2.74, it revealed that the GU students hold more positive motivation toward physics learning than the UT students.

Table2: the performance of students' motivation toward physics learning

group	Mean	SD	F	p-value	Scheffe
EMG	2.68	.288	12.414	.00**	(EMG, IEG) (IEG, OEG)
IEG	2.63	.315			
OEG	2.67	.297			
total	2.65	.305			

*Self-efficacy of UT students in physics learning*

The instrument of students' self-efficacy toward physics learning was also designed as Likert's five-point rating scale. Table 3 presented the results of students' self-efficacy toward physics learning. Generally, the mean of all subjects was 2.57, it revealed that all the UT students hold

the positive self-efficacy toward physics learning. Furthermore, the mean of EMG was higher than the other group. And there were significant differences between EMG and IEG. However, the mean of CG was 2.62, it revealed that the GU students hold more positive self-efficacy toward physics learning than the UT students.

Table3: the performance of students' self-efficacy toward physics learning

group	Mean	SD	F	p-value	Scheffe
EMG	2.60	.334	3.742	.01**	(EMG, IEG)
IEG	2.56	.349			
OEG	2.58	.354			
total	2.57	.346			

### Conclusion and Suggestion

In this study, we presented the reality of physics curriculum/learning in the universities of technology in Taiwan. Based on our finding, four of these finding and one potential research issue are depicted bellow:

#### *Physics course should be integrated with life world and practical affairs*

The students in universities of technology expected that the physics course should be integrated with life world and practical affairs. They also expected that they could get more opportunities to engage in doing experiment in physics course. It is interesting that the students in general university considered physics is more important compared to the students in universities of technology. Relatively, students in universities of technology considered physics should be integrated with social issue compared to the student in general university. Besides, in the analysis of students' perception about learning and assessment in physics course, it is found that the students in general university considered principle explanation and application are more important in physics course compared to the students in universities of technology.

#### *The regular instruction style in physics course: multimedia, group discussion and doing experiment*

In the analysis of students' perception about instruction style in physics course, it is found that students in general university considered lecture and seminar are the regular instruction style in physics course, however the students in universities of technology considered multimedia, group discussion and doing experiment are the regular instruction style in physics course.

#### *The most important factors affecting physics achievement: teacher's instruction and personal interest*

In the analysis of students' perception of factors affecting physics achievement, it is found that all students agreed with teacher's instruction and personal interest were the most important factors affecting physics achievement. Besides, in the analysis of students' perception of more



difficult topics in physics learning, it is found that all students agreed with the topic of electromagnetism was the most difficult topic in physics learning.

*The UT students hold positive attitude, motivation and self-efficacy toward physics learning*

In the analysis of students' attitude toward physics, motivation toward physics learning, self-efficacy toward physics learning, it is found that all students in universities of technology hold the positive attitude, motivation and self-efficacy toward physics learning. However, the students in general university hold more positive attitude toward physics than the students in universities of technology.

*Future research issue: to develop more effective teaching strategy in the topics of electromagnetism.*

Based on the findings of the present study, the students in universities of technology expected that the physics course should be integrated with life world and practical affairs. Therefore, the physics teacher should provide students more opportunities to engage in doing experiment in physics course. Furthermore, more research is need on developing more effective teaching strategy to enhance students' physics learning, especially in the topics of electromagnetism.

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