

# 行政院國家科學委員會專題研究計畫 期中進度報告

## 提昇不同學習風格與性別學生的科學概念學習 (2/3)

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執行單位：國立交通大學教育學程中心

計畫主持人：佘曉清

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中 華 民 國 92 年 5 月 29 日

# 行政院國家科學委員會專題研究計畫進度報告

提昇不同學習風格與性別學生的科學概念學習 (2/3)

Improving different learning style and gender of  
students' science concepts learning (2/3)

計畫類別：個別型計畫                      整合型計畫

計畫編號：NSC 90-2511-S-009-003

執行期間：90年8月1日至91年7月31日

計畫主持人：余曉清

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(必要時，本會得展延發表時限)

執行單位：國立交通大學教育學程中心

中華民國90年5月15日

## **ABSTRACT**

The purpose of this study is to promote heterogeneous students' (different learning styles, achievement level, gender) science concepts construction. The following research questions would serve as the guideline for three years study:

1. Explore heterogeneous students' (different learning styles, different achievement level of students, students' willingness toward science learning and gender) science concept learning in terms of buoyancy, air pressure, and water pressure.
2. Investigate the impact of different instructional approaches and teacher-student interaction patterns on heterogeneous students' science concepts learning, science attitude, and motivation in terms of buoyancy, air pressure, and water pressure.
3. Help science teachers conducting action research (specifically focus on improving their science concept instructional approaches and teacher-students interaction patterns) in order to promote heterogeneous students' science concept learning.
4. Examine the heterogeneous students' science learning (science concept learning, science achievement, science attitude, teacher-students interaction and motivation) before and after science teachers' action research
5. Conduct cross-cultural comparison study of above research questions

It is hoping to promote heterogeneous students' science concepts learning, science attitude, and motivation throughout these three years study. Moreover, to provide the evidence how would teacher's teaching approaches and teacher-students interaction can contribute to students' science concept learning. It is also expecting to get deeper understanding how would cultural influence their teacher's teaching approach and teacher-students interaction thus influence students' science concepts learning.

### **Significance**

Some studies have reported that students whose learning styles are matched with their teachers' approach to teaching result in greater ease of learning (Packer and Bain, 1978) and higher satisfaction (Renninger & Snyder, 1983) than those whose styles are mismatched. Riding and Ashmore (1980) compared two mode of presentation (the textual and the pictorial) in a study of 74 11-year old pupils. They found that verbalisers were superior with the verbal version and imagers when learning in the pictorial mode. Riding and Douglas (1993), using 59 15-16-year-old students, found that a computer presentation of material on motor car braking systems in a

text-plus-picture format facilitated the learning by imagers, compared to the same content in a text-plus-text version. Hilgersom (1987) also advocates that teachers must be familiar with the learning preferences of their students and with the teaching strategies and learning activities that are most effective in dealing with these preferences. With a greater knowledge of learning preferences, teachers can more successfully design instruction for an entire class, as well as work more effectively with individual students. Wilson (1988) believes that awareness of learning styles and skill in utilization of instructional methods that can address those styles will give teachers a wide array of techniques to use in promoting student learning.

She's studies indicated that teacher-students communication pattern positively correlated with students cognitive and affective outcomes (She & Fisher, 2002, 2000, She, 2000, 2001). She also found that the hierarchical level of the scientific concepts would determine how easy or difficult it is to bring out a conceptual change. Concepts of higher hierarchical levels subsume more essential underlying concepts, thus making it more difficult for conceptual changes to occur. Other characteristics of the science concepts, such as very important concepts, abstract concepts, dynamic concepts, etc (She, in press, 2003, 2002). It would be interested to explore what should teacher do while they are teaching heterogeneous students' these hierarchical level or abstract concepts, dynamic concepts?

## **Research Questions**

### **First year**

1. Explore heterogeneous students' (different learning styles, different achievement level of students, students' willingness toward science learning and gender) science concept learning in terms of buoyancy, air pressure, and water pressure.
2. Investigate the impact of different instructional approaches and teacher-student interaction patterns on heterogeneous students' science concepts learning, science attitude, and motivation in terms of buoyancy, air pressure, and water pressure.

### **Second Year**

1. Explore the impact of combining QC-oriented instruction approach with web-based e-learning on students' science learning?
2. Investigate the learning environment created during use of this online web-based, multimedia, flash science learning program in their science classes?
3. Investigates its impact on students' cognitive and affective learning outcomes among different learning styles and grade levels.

### **Third Year**

3. Help science teachers conducting action research (specifically focus on improving their science concept instructional approaches and teacher-students interaction

- patterns) in order to promote heterogeneous students' science concept learning.
4. Examine the heterogeneous students' science learning (science concept learning, science achievement, science attitude, teacher-students interaction and motivation) before and after science teachers' action research
  5. Conduct cross-cultural comparison study of above research questions

## Methods

There were 459 grade 7 to 9 students from 11 middle schools involved in this study. The sample consisted of 65 grade 7 students, 270 grade 8 students, and 124 grade 9 students. All of the students were given a learning preference questionnaire to differentiate them into four different learning styles: QA, QB, QC and QD. Learning environment questionnaires were given during the teachers' and students' use of this online flash science program to assess the learning environment. A satisfaction of web-based learning questionnaire was administered to 459 students after they the use of web-based online flash science program. All of the 459 students were also given a pre-test before getting into the web-based online flash science program and finished the post-test of water pressure immediately after the web-based online flash science program. The pre-test and post-test are the same test and are given as an online-test. All of the results were analyzed by the SPSS version 10

## Results

The work presented in this chapter provides a significant contribution to science learning involving the use of a web-based, multimedia, flash science learning program using an online e-learning environment. Results show that students perceived their learning environment created during the use of this online flash science program is their science class as having high levels of students' cohesiveness, task orientation, cooperation, equity, differentiation, and their teachers using more challenging questions. Students' cognitive outcomes also increased dramatically after learning science through the program, regardless their type of learning preference (Table 1) (She & Fisher, in press) or different grade levels. Students' attitudes toward using computers and web usage are very favorable. Students were satisfied with the program and their cognitive outcomes increased dramatically after learning science this way, regardless of any types of learning preference or grade levels. In particular, students' cognitive outcomes were also found to be higher when students perceived more student cohesiveness, investigation, equity, self-efficacy, and more teacher use of challenging questions. These results are very encouraging and shed some light on how to successfully promote students' science learning through the use of a web-based online physical science learning program.

*Table 1. Different Learning Styles' Students' and Cognitive Learning Outcomes*

	Pre-test		Post-test		Difference	T test
	Mean	SD	Mean	SD		
QA learning preference	7.96	3.46	10.38	2.68	2.42	9.93***
QB learning preference	7.75	3.34	10.38	2.74	2.62	10.74***
QC learning preference	7.94	3.44	10.51	2.66	2.56	11.53***
QD learning preference	8.62	3.22	10.84	2.39	2.22	9.75***

\*\*\*  $p < 0.0001$ , N=459

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