出國報告（出國類別：其他）

參加教育與新學習科技國際研討會
(International Conference on Education and New Learning Technologies)

服務機關：國立嘉義大學

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摘要

林菁與陳耀輝老師參加第九屆教育與新學習科技國際研討會 (International Conference on Education and New Learning Technologies, EduLearn17)，於 7/3~5 在西班牙巴塞隆納舉行。此次會議共有 850 位學者專家參加，他們來自八十個不同國家，所以整個會議提供了很好的國際交流的環境，讓大家更加了解不同國家如何在教育上應用資訊科技。我們報告的論文是「Gender differences in the inquiry-based information literacy instruction: A six-year study」 (不同性別在國小探究式課程之比較：六年長期研究)，發表於 7/4 的 Pedagogical Innovations 場次。整個會議同時有十個場次的論文研究報告，包括 MOOCs, Online assessment, Educational games, AR/3D, University-Industry cooperation, Distance learning, STEM, Professional development of teachers, Technology enhanced learning, ICT skills and digital literacy, Pedagogical innovations, Apps & mobile technologies, Flipped learning, 等等。

目次

一、目的

本次出國計畫之目的如下：

(一)目標

參加第九屆教育與新學習科技國際研討會 (International Conference on Education and New Learning Technologies, EduLearn17)，於 7/3~5 在西班牙巴塞隆納舉行。此次會議共有 850 位學者專家參加，他們來自八十個不同國家，所以整個會議提供了很好的國際交流的環境，讓大家更加了解不同國家如何在教育上應用資訊科技。

(二)主題

此研討會的主題旨在探究資訊科技在教育上的不同應用，keynote 講員有二位，一位是 Dr. Alec Couros (University of Regina, Canada)，講題為 Transitioning toward 21st century learning，討論新興科技和社群媒體對於學習的影響，也提供自身如何在高等教育中應用社群媒體輔助教學，獲得很好的反應。另一位講員是 Jennie Magiera (USA)，他是芝加哥地區的教育科技推動者，自身是國小數學老師，但勇於接受資訊科技，並思考可以如何幫助 inner city 的孩童。他提供許多自己如何應用科技幫助孩童學習的方法和結果，讓與會人士受益匪淺。此外，整個會議同時有十個場次的論文研究報告，包括 MOOCs, Online assessment, Educational games, AR/3D,

University-Industry cooperation, Distance learning, STEM, Professional development of teachers, Technology enhanced learning, ICT skills and digital literacy, Pedagogical innovations, Apps & mobile technologies, Flipped learning, 等等。

(三)預期效益或欲達成事項

　　參加此次國際會議的效益是與世界各國專研於教育科技的學者專家互相交流，了解彼此研究的方向、困難，及未來合作的可能性。

二、　過程

　　陳耀輝老師與我共同撰寫的論文是「Gender differences in the inquiry-based information literacy instruction: A six-year study」(不同性別在國小探究式課程之比較：六年長期研究)，發表於 7/4 的 Pedagogical Innovations 場次，同一會場還有五篇論文報告，均是探討如何使用新的教學法來改變學生的學習狀況。我們這篇文章的摘要如下：

The purpose of this study was to examine the gender differences in memory and comprehension learning of the six-year integrated information literacy instruction. The subjects were 75 students who have participated in this study since they entered an elementary school in Taiwan. This elementary school adopted the integrated information literacy instruction and integrated it into various subject matters via the Super3 and Big6 frameworks of inquiry-based

learning. A total of eleven inquiry learning projects has been implemented from grade one through grade six. Nine memory tests and eleven comprehension test were used as pretests and posttest. Paired sample t test were conducted to measure students' improvements in memory and comprehension between pretests and posttests. In addition, pair-wise comparisons (i.e., male vs. female group) were used to obtain the differences between gender.

The results showed that regardless of gender, students improved significantly in both memory and comprehension learning. There were no gender differences in memory learning. However, among eleven projects, there were significant differences in comprehension learning in four projects, where females performed better than males. In other words, gender is a moderating factor of students' comprehension through inquiry-based learning.

由於此篇論文是篇六年的長期研究，獲得在場的聽眾讚賞，報告後不斷詢問此研究期間遇到的困難與解決之道；也與來自美國 University of New Orlean 的 Dr. Rebekah Granger Ellis 等人交換進行長期研究的心得和未來的研究方向。
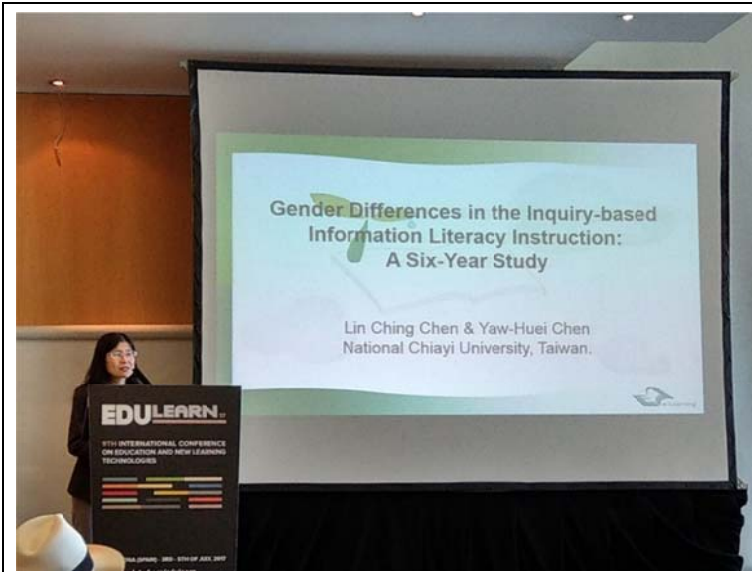
	林菁老師報告論文
	報告會場
	林菁老師暨陳耀輝老師於會場留影

三、心得及建議事項

　　參加這次 EduLearn17 的心得是資訊科技的發展真是無遠弗屆，大家所見略同，均在思考如何藉由科技，可增進學生的批判思考和問題解決能力。無論是國中小階段，以及高等教育階段，均是可以著力的地方。藉由專案導向、遊戲取向學習，與產業界合作，無論是行動載具、擴增實境或虛擬實境等新科技，均可融入學習現場中。

　　此會議的出席及報告的人員均是來自各國的學者專家，而非由研究生來報告，所以大家有很好的學術交流。主辦單位也很用心，有效率的安排各項事宜，包括報到、場地、設施、餐點、後續問卷等。可惜國內參加此會議的人員不多，只有淡江大學和景文科技大學的少數老師參加。之後應可鼓勵資訊科技和教育科技相關系所的師生報名參加此會議。

四、附錄

附上在此會議上報告的論文全文。

GENDER DIFFERENCES IN THE INQUIRY-BASED INFORMATION LITERACY INSTRUCTION: A SIX-YEAR STUDY

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Abstract

The purpose of this study was to examine the gender differences in memory and comprehension learning of the six-year integrated information literacy instruction. The subjects were 75 students who have participated in this study since they entered an elementary school in Taiwan. This elementary school adopted the integrated information literacy instruction and integrated it into various subject matters via the Super3 and Big6 frameworks of inquiry-based learning. A total of eleven inquiry learning projects has been implemented from grade one through grade six. Nine memory tests and eleven comprehension test were used as pretests and posttest. Paired sample *t* test were conducted to measure students' improvements in memory and comprehension between pretests and posttests. In addition, pair-wise comparisons (i.e., male vs. female group) were used to obtain the differences between gender.

The results showed that regardless of gender, students improved significantly in both memory and comprehension learning. There were no gender differences in memory learning. However, among eleven projects, there were significant differences in comprehension learning in four projects, where females performed better than males. In other words, gender is a moderating factor of students' comprehension through inquiry-based learning.

Keywords: gender, information literacy, inquiry-based learning, memory, comprehension

1 INTRODUCTION

Information literacy is the abilities to recognize, locate, evaluate, use and create effectively the need information [1], [4]. Many studies find that information literacy instruction should be integrated across the contexts of school curriculum, through inquiry-based learning [10], [19], [21], [25]. However, studies find that students with different genders may perform differently in integrated information literacy instruction [13], [16], [26].

2 PURPOSE OF STUDY

The purpose of this study is to investigate the gender differences in memory and comprehension learning of the six-year integrated information literacy instruction through inquiry-based learning. Specific problems related to the purpose are as follows:

- How do students with different genders memorize subject matters differently in the six-year integrated information literacy instruction?

- How does the memory learning trend differ among students with different genders in the six-year integrated information literacy instruction?

- How do students with different genders comprehend subject matters differently in the six-year integrated information literacy instruction?

- How does the comprehension learning trend differ among students with different genders in the six-year integrated information literacy instruction?

3 LITERATURE REVIEW

3.1 Information Literacy Instruction

Information literacy instruction is a valuable and essential part of school's program. It emphasizes both problem solving processes and multiple literacies of library, media, and computer [2], [10]. Information literacy instruction has been shown to be more effective when taught as an inquiry process combined with classroom subject contents [10], [13], [20], [21]. Eisenberg & Berkowitz [17] and Eisenberg & Robinson [18] developed the inquiry-based Big6 and Super3 models for integrating information literacy into subject matters.

3.2 Memory & Comprehension

According to Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths and Wittrock [3], memory process stresses recalling and recognizing of the learning content stored in long-term memory area, while comprehension emphasizes transferring conceptual understanding in a new context through cognitive processes of interpreting, exemplifying, inferring, and comparing. Wilson, Taylor, Kowalski and Carlson [27] randomly assign 58 students aged 14-16 years old to inquiry-based learning group or traditional learning group. The results show that students in the inquiry-based group outperform the traditional group in scientific knowledge, reasoning, and scientific explanations.

Chang and Mao [7] investigate the effects of an inquiry-based teaching in earth science and find that significant higher achievement scores only at the comprehensive test, not at the factual level. Chen, Chen and Ma [11] examine the effects of integrating information literacy into science instruction on 7th-grade students' science learning and problem solving. The results show that experimental group significantly outperforms their counterparts on comprehension learning and problem solving, while not on the factual information acquisition.

Thus, it is not completely clear whether inquiry-based integrated information literacy instruction can improve students' memory and comprehension of subject matters. More research should be conducted to explore this issue.

3.3 Students with Different Genders

Gender is another issue examined in the research on inquiry-based learning. Wolf and Fraser [28] investigated whether inquiry and non-inquiry methods of instruction were differential effective for males and females. The results showed that significant gender differences existed for student cohesiveness, teacher support, investigation, cooperation, and attitudes. Males benefited more from inquiry method, while females seemed to benefit more from non-inquiry approaches in terms of attitudes to science and classroom task orientation. Chen and Chang [9] investigated 138 third graders' performance in information literacy instruction. Gender had significant moderating effects on the information literacy learning; female students' performance of information literacy was superior to male students' performance.

On the other hand, females are under-represented in careers related to science, technology and engineering. Many studies indicated that gender differences in science-related occupational choices cannot be attributed to abilities; instead belief about their own competences may be the most important factor [6], [24].

Thus, as the above studies showed, the results are mixed. However, most studies supported that inquiry-based instruction can be an integral approach to promote motivation and understanding. Information about gender effects within inquiry learning for a longer period of time is limited.

4 METHODOLOGY

4.1 Research Design

A framework of collaborative action research was used for this study. Researchers collaborated with classroom teachers to develop the inquiry-based information literacy curriculum and have integrated it into various subject matters for six years.

4.2   Research Site and Participants

The study was conducted at an elementary school in Taiwan. The participants were 75 students (39 boys and 36 girls), who have enrolled in this study since they entered the elementary school in 2009.

4.3   Instructional Contents

The information literacy curriculum was integrated into subject matters via the Super3 and Big6 models. A total of eleven inquiry projects were carried out in each semester starting at the second semester of first grade.

4.4   Instruments

This is a longitudinal research which comprised eleven inquiry projects. Most projects employed both memory and comprehension tests to assess learning effectiveness, only two projects in fifth and sixth grades did not use memory tests. Thus, there were nine memory tests and eleven comprehension tests developed. Their reliability, difficulty and discrimination coefficients all were fine.

4.5   Data Collection & Analysis

Data were collected over six years from eleven inquiry projects and analyzed by SPSS 20. Paired sample t test were conducted to measure students' improvements in memory and comprehension between pretests and posttests. Owing to the item numbers were different among the instruments, test scores could not be compared directly. Therefore, the posttest scores of memory and comprehension tests all were transformed into standard T scores, and pair-wise comparisons (i.e. male group vs. female group) were used to obtain the differences between them. Then effect sizes (*Cohen's d*) were calculated in order to determine the relative magnitudes of experimental treatments and to judge the practical meaningfulness of the results derived. At last, the effect size values were plotted out in a run chart which displayed six-year trend among students with different genders.

5   RESULTS

5.1   Memory Differences in Students with Different Genders

Except the first grade, the obtained t values for memory learning in the nine inquiry-based projects were all significant improvement, which meant most students improved in memorizing subject contents. According to the effect size index developed by Cohen [15], there were 4 large and 3 medium among 9 *Cohen's d* effect sizes and the average of effect size was medium (*Cohen's d* = 0.774). It meant that there existed non-ignorable significant improvements of memory in practice.

For further understanding memory learning differences among students with different genders, paired t tests for pretests and posttest on nine inquiry projects were conducted. Among 18 t test results, 15 ones were significant improvement, while 1 were non-significant. Thus, except the "Investigation of Life on Campus" project in first grade, most students improved well in memory learning, regardless of genders.

Furthermore, the effect size values were rearranged based on Cohen's effect size index. Regardless of genders, the numbers of large effect size were more than the numbers of medium, small and none effect sizes (10, 4, 3, 1 respectively). The female students (averaged *Cohen's d* = 0.921) progressed better than male students (averaged *Cohen's d* = 0.869). However, both of them displayed a large level of progression. It implied that inquiry-based information literacy instruction help all students to memorize the integrated subject contents in practice, especially for female students.

5.2   Memory Learning Trend Analysis

We further examined the memory learning trend of effect sizes across the six years by comparing the posttest scores between male and female students (see Fig. 1).

Of the nine comparisons between two genders, seven were not significantly different, only two were. They were Grade 3/2 (t = 2.199, p = .032, *Cohen's d* = 0.503) and G5/2 (t = 2.082, p= .041, *Cohen's d*

= 0.479). However, the effect size of the latter was in small magnitude, which has no practical significance. In particular, students with different genders performed equally well in the two inquiry projects of grade 4, which both were related to science. Fig. 1 combined the six-year longitudinal trends of memory learning for the gender comparison. The M vs. F trend of effect sizes seemed swinging back and forth, but there existed ignorable differences for most inquiry projects, except G3/2. Thus, through integrating inquiry-based information literacy instruction into various disciplines, both genders grasped memory learning method and learned subject contents which related to facts. The results verify research results by Chu [13], which declare that there is no gender difference in memory learning for inquiry instruction.
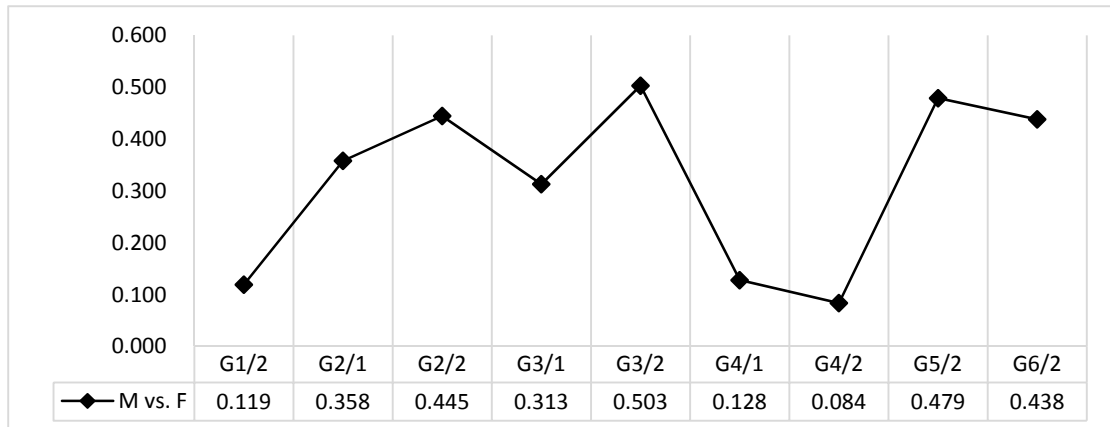
	G1/2	G2/1	G2/2	G3/1	G3/2	G4/1	G4/2	G5/2	G6/2
M vs. F	0.119	0.358	0.445	0.313	0.503	0.128	0.084	0.479	0.438

Figure 1. Trends of Effect Sizes between Genders for Memory Learning.

5.3 Comprehension Differences in Students with Different Genders

The obtained *t* values for comprehension learning in the eleven pretests and posttests in the inquiry-based projects were all significant which meant all students improved in comprehending subject contents. Furthermore, according to the effect size index developed by Cohen [15], there were 7 large and 4 medium values among 11 *Cohen's d* effect sizes. It meant that there existed non-ignorable significant improvements of comprehension in practice. Thus, in six years, the integrated information literacy instruction had had a positive effect on students' ability to comprehend subject-matter contents associated with relevant inquiry topics.

For further understanding comprehension learning differences among students with different genders, paired t tests for pretests and posttests on eleven inquiry projects were conducted respectively. Among 22 *t* test results, all were significant. In other words, all students performed well in comprehension learning in spite of their genders.

The effect size values were rearranged based on Cohen's effect size index. Regardless of genders, the numbers of large effect size were more than the numbers of medium and small effect sizes (17, 4, 1 respectively). The female students (averaged *Cohen's d* = 1.153) progressed better than male students (averaged *Cohen's d* = 1.083). However, both of them displayed a large level of progression. It implied that inquiry-based information literacy instruction help all students to comprehend the integrated subject contents in practice, especially for female students.

5.4 Comprehension Learning Trend Analysis

As noted above, we further examined the comprehension learning trends of effect sizes across the six years by comparing the posttest scores between males and females (see Fig. 2). Since the item numbers in the eleven posttests were different, the test scores were all converted to standard T scores, so that the comparisons could be performed using independent-sample *t* tests.

There were significant differences for Grade 2/1, 2/2, 3/1, and 5/1, and the values of effect size reached the medium magnitude (*Cohen's d* were 0.667, 0.559, 0.512, and 0.628 respectively), which had practical meaningfulness. In additional to the four comparisons between two genders, others were no or small effect sizes; in particular, the G1/2, G4/1, and G4/2 were the nearest points between males and females.

Thus, among eleven projects, there were significant differences in comprehension learning in four

projects, where females performed better than males. These four projects were across various areas of social studies, science, and language arts. In other words, gender is a moderating factor of students' comprehension through inquiry-based learning. These findings are similar to the results of research by Chen & Chang [9]. That is, female students' performance of information literacy is superior to male students' performance.
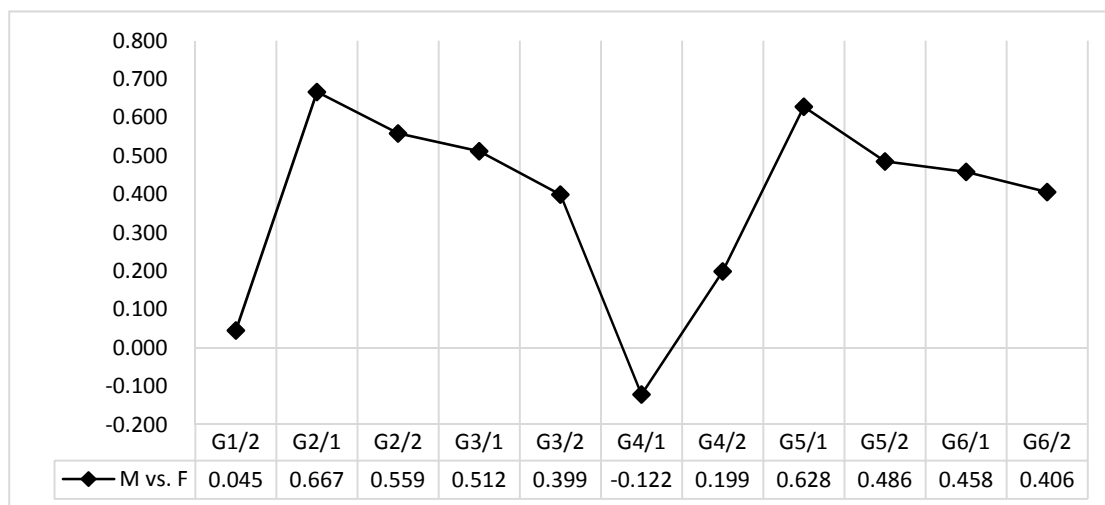

	G1/2	G2/1	G2/2	G3/1	G3/2	G4/1	G4/2	G5/1	G5/2	G6/1	G6/2
M vs. F	0.045	0.667	0.559	0.512	0.399	-0.122	0.199	0.628	0.486	0.458	0.406

Figure 2. Trends of Effect Sizes between Genders across Grades for Comprehension Learning.

6 DISCUSSION & CONCLUSIONS

In the six-year integrated information literacy instruction, students performed well in both memorizing and comprehending subject contents. Therefore, integrating information literacy into inquiry learning can help elementary students memorize facts, comprehend concepts in subjects and apply in new situations. These findings are similar to the results found by previous researchers [8], [22], [23].

With respect to gender factor, both male and female students improved significantly in both memory and comprehension learning. There were no gender differences in memory learning. However, among eleven projects, there were significant differences in comprehension learning in four projects, where females performed better than males. These four projects were across various areas of social studies, science, and language arts. In other words, gender is a moderating factor of students' comprehension through inquiry-based learning. The present work does not support earlier findings that females are good at social studies, while males are good at science [12]. On the other hand, these findings support that females can perform well in science and should not discourage them to choose careers in scientific and technical fields traditionally dominated by men [5].

Based on the findings of this study, the following implications and recommendations are made for the future research:

1) Inquiry-based information literacy instruction using Super3 and Big6 models could help elementary students both memorize fact as well as apply concepts of subject contents in a new situation.
2) Gender is a moderating factor of students' comprehension through inquiry-based learning. Thus when teachers deign inquiry-based learning, they need to consider this factor more carefully.

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