

行政院國家科學委員會專題研究計畫 成果報告

要科學也要性別平等--女大學生結合科學與性別意識之學習歷程與楷模研究(第2年) 研究成果報告(完整版)

計畫類別：個別型
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執行期間：99年08月01日至100年10月31日
執行單位：國立高雄師範大學性別教育研究所

計畫主持人：蔡麗玲

計畫參與人員：碩士級-專任助理人員：張皓筑
學士級-專任助理人員：莊泰富
學士級-專任助理人員：林佩瑩

報告附件：出席國際會議研究心得報告及發表論文

公開資訊：本計畫可公開查詢

中華民國 101 年 04 月 20 日

中文摘要：性別平等意識可以幫助女學生繼續留在科學生涯裡嗎？女性主義除了批判主流科學的性別偏差之外，是否也能增進女性學習科學的動力？在科學界的女性偏少，大學科學相關科系的女生仍是少數的情形下，提升科學學習者的性別平等意識，是否反而有助於提升女性就讀科學相關系所的比例？如果，在大學以及研究所的階段，女學生們就有機會接觸，甚至學習性別平等教育作為「先備知識」，那麼，當她們遭遇學習困難或生涯認同的挑戰時，女性主義是否可能協助她們持續留在科學界呢？學習了女性主義的女科學生，能否帶著批判科學的精神，卻選擇留在科學之中，尋求從內部改善科學呢？本研究第一年先對一位希望「要科學也要性別平等」的「楷模個案」進行個別深度研究，描繪並指認她達到此階段的學習歷程要件；同時在南部地區大學理工科系中，邀集其他在科學學習歷程中，正遭遇學習困難與學習挑戰的「培力個案」參加本研究，然後在第二年讓這些女學生接觸幾個培力步驟，檢視這些步驟是否能改善其科學學習的困難；接著則以個別訪談的方式，對培力個案的生涯抉擇進行瞭解，以評估前面階段的培力成效，並了解提升性別平等意識是否有助於女學生繼續留在科學生涯。

中文關鍵詞：性別與科學，女性主義，角色典範，女大學生，科學生涯

英文摘要：Feminist science educators have long ago pointed out many gender issues in science learning, and various strategies have been implemented in earlier learning stages. However, less attention is paid to college and graduate stages where women students continue to confront self-suspicious whether they are the right gender to study science. This research adopts an interventionist approach to ask whether teaching feminism can help to empower women students pursuing their rights in studying science therefore retaining in a science career. A 'model' student and nine others have participated in this study. In-depth interviews and program interventions are used as the main data collection methods during August, 2009 to May, 2010. The model student has shown a successful retention case as her choosing to stay in science major after learning feminism; while the other nine are experiencing similar stimulations and are now pondering on their career choices. Preliminary findings show that, even in the 21st century, women

who choose science majors still experience along their learning paths various discouragement stressing science is not for women and a lack of role-modeling with clear feminist messages is serious; yet after some intervention, feminism can help to retain women's interests and senses of rights in science.

英文關鍵詞： gender and science, feminism, role model, female college student, career choice of science

行政院國家科學委員會補助專題研究計畫

期中進度報告

期末報告

— 要科學也要性別平等 —

女大學生結合科學與性別意識之學習歷程與楷模研究

計畫類別：個別型計畫 整合型計畫

計畫編號：**NSC98-2629-S-017-002-MY2**

執行期間：98年8月1日至100年10月31日

執行機構及系所：高師大性別教育所

計畫主持人：蔡麗玲副教授

共同主持人：無

計畫參與人員：專任助理人員林佩瑩、張皓筑、莊泰富

本計畫除繳交成果報告外，另須繳交以下出國報告：

赴國外移地研究心得報告

赴大陸地區移地研究心得報告

出席國際學術會議心得報告及發表之論文

國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢

涉及專利或其他智慧財產權，一年二年後可公開查詢

中 華 民 國 101 年 1 月 31 日

一、 中文摘要

性別平等意識可以幫助女學生繼續留在科學生涯裡嗎？女性主義除了批判主流科學的性別偏差之外，是否也能增進女性學習科學的動力？在科學界的女性偏少，大學科學相關科系的女生仍是少數的情形下，提升科學學習者的性別平等意識，是否反而有助於提升女性就讀科學相關系所的比例？如果，在大學以及研究所的階段，女學生們就有機會接觸，甚至學習性別平等教育作為「先備知識」，那麼，當她們遭遇學習困難或生涯認同的挑戰時，女性主義是否可能協助她們持續留在科學界呢？學習了女性主義的女科學生，能否帶著批判科學的精神，卻選擇留在科學之中，尋求從內部改善科學呢？本研究第一年先對一位希望「要科學也要性別平等」的「楷模個案」進行個別深度研究，描繪並指認她達到此階段的學習歷程要件；同時在南部地區大學理工科系中，邀集其他在科學學習歷程中，正遭遇學習困難與學習挑戰的「培力個案」參加本研究，然後在第二年讓這些女學生接觸幾個培力步驟，檢視這些步驟是否能改善其科學學習的困難；接著則以個別訪談的方式，對培力個案的生涯抉擇進行瞭解，以評估前面階段的培力成效，並了解提升性別平等意識是否有助於女學生繼續留在科學生涯。

二、 英文摘要

Feminist science educators have long ago pointed out many gender issues in science learning, and various strategies have been implemented in earlier learning stages. However, less attention is paid to college and graduate stages where women students continue to confront self-suspensions whether they are the right gender to study science. This research adopts an interventionist approach to ask whether teaching feminism can help to empower women students pursuing their rights in studying science therefore retaining in a science career. A “model” student and nine others have participated in this study. In-depth interviews and program interventions are used as the main data collection methods during August, 2009 to May, 2010. The model student has shown a successful retention case as her choosing to stay in science major after learning feminism; while the other nine are experiencing similar stimulations and are now pondering on their career choices. Preliminary findings show that, even in the 21st century, women who choose science majors still experience along their learning paths various discouragement stressing science is not for women and a lack of roll-modeling with clear feminist messages is serious; yet after some intervention, feminism can help to retain women’s interests and senses of rights in science.

三、 研究背景及目的

性別平等意識可以幫助女學生繼續留在科學生涯裡嗎？女性主義除了批判主流科學的性別偏差之外，是否也能增進女性學習科學的動力？在科學界的女性偏少，大學科學相關科系的女生仍是少數的情形下，提升科學學習者的性別平等意識，是否反而有助於提升女性就讀科學相關系所的比例？

（一）結合「科學教育」與「性別意識」

國內外科學教育界在過去三十幾年來，不斷投注學術人力與心力，試圖建構各種課程來吸引女性選讀科學，或者設法指出可能造成不利於女學生學習科學的因素，或者希望提出解決之道，以留住已經選讀科學生涯相關科系的女生。科學教育界這樣的努力，常常結合女性主義提倡性別平等的訴求，因此有女性主義科學教育學者的產生，例如 Calabrese Barton (1998)、Nancy Brickhouse (1994, 1998, 2001)、Heidi Carlone (2004)、Alison Kelly (1976, 1985) 等等。然而，在種種改進課程與教學的措施當中，即使融入性別平等精神，亦鮮少在學生學習科學的同時，明確教導女性主義或性別平等意識。後者總是被某種程度「包裝」或「轉化」，而「融入」課程改革之中。

目前許多國際組織(IUPAP 國際純物理與應用物理聯盟、IUPAC 國際純化學與應用化學聯盟、AIP 美國物理研究院、EU 歐盟)，也逐漸注意到這些問題，有許多女科學家開始應用性別平等意識來試圖改善自己以及女性後進的處境，她們許多人，在成為女科學家的過程中，並不特別關注性別議題，也並不特別接觸性別平等論述；反而是在專業生涯的過程中，與其他女性串連之後，意識到女性主義以及性別平等意識的重要性。也就是說，在她們求學的過程裡，並沒有性別平等意識的培訓來為她們將來面對以男性為主的職場做準備，使得她們在專業階段，必須以補足這方面知能以及用串連的方式，才能協助面對科學職場的挑戰。

而性別研究界的學者（例如 feminist STS 研究學群），他們對科學知識生產以及科學參與等性別政治議題的討論，由於從根本上探討科學的本質以及價值（例如所謂「理性」；哪種「客觀性」），訴求「另類科學」或者「更好的科學」的產製，也因而質疑毫不批判地進行主流科學教育的必要性。從事這方面研究的學者，有許多都具有科學訓練的背景（例如學士或碩士學位都是理工科系畢業），因此常被誤會為「轉出」科學界，或「轉行」到非科學界，然而，她們卻常常以關懷科學走向作為出發點，而檢視科學的知識生產。若具有性別批判觀點之人，常常「離開」科學以「關懷」科學，那麼，如何說服科學界以及科學教育界引入性別平等意識呢？

綜觀上面三種學術領域結合科學與性別關懷的現況，我們可以問一個問題：如果，在邁入專業科學生涯之前，也就是大學以及研究所的階段，女學生們就有機會接觸，甚至學習性別平等教育，提升性別平等意識作為「先備知識」，那麼，這樣的培育過程，是否有助於預備她們將來科學生涯中，處理自身作為性別弱勢所可能遭遇的種種問題？大學階段的女性科學學習者，當她們遭遇學習困難或生涯認同的挑戰時，女性主義是否可能協助她們持續留在科學界呢？學習了女性主義的女科學生，能否帶著 feminist STS 批判科學的精神，卻選擇留在科學之中，尋求從內部改善科學呢？

（二）發現一位「學習楷模」

2007 年初，一位理工科系三年級的女學生來到我上通識性別教育的課堂，在幾次簡短談話後，她選擇信任我，告訴我她正面臨是否離開她正在就讀的電機光電相關科系。雖然她的功課仍名列前茅，但她似乎漸漸找不到學習的重心以及目的，對前途產生茫然感，甚至懷疑：「可能女生真的不適合念理工」。

她的學習歷程非常典型，不但是很多理工科系女學生的寫照，也喚起我自己過去在物理系

所求學的所思所想。即使當年我通過資優保送、大學四年名列中上，甚至順利考上物理研究所，仍然常常在學習挫折時有類似的疑問。後來轉向性別研究後充實了許多理論觀點，讓我重新檢視自己作為女學生的科學學習歷程，也因此能很快地，在具有理論思辯的基礎下，提供這位女同學兩種可能性：第一，離開科學生涯，以她感興趣的性別觀點，從事性別與科學的分析研究；第二，留在科學生涯中，運用自己培養的性別觀點，讓自己從事的科學生涯對女性更友善。之後她進入審慎的思考與體會期，也不斷主動向我要求推薦閱讀性別研究相關書籍，或參加國內科學界為女性參與科學舉辦的研討會。

半年多後，這位學生主動告訴我，她決定了，她要繼續留在原來的理工生涯中，甚至她要準備出國深造，繼續就讀電機光電領域，同時繼續進修性別研究課程，她要做一個「科學裡的女性主義者」！她說這些話的時候，眼神充滿堅定。她告訴我，她對自己的目標越來越篤定，也能找到電機領域中自己願意投入的部分，她還說，希望在學習科學時遭遇困擾或挑戰的其他女孩，都能跟她一樣，有機會接觸女性主義，獲得協助。

（三）「學習楷模」如何可以影響女性學習科學

這位女孩可以稱為「要科學也要性別平等」的「學習楷模」，並且，這位「學習楷模」還希望輸出自身的經驗，幫助其他女學生學習科學。這位學習楷模的出現，相當程度回應了前述科學教育界、科學界、性別研究界共同的關懷，成為她們理論問題的共同聚焦之處。她的出現，正是「跨領域性別與科學研究」最佳的研究時機。藉由她的學習經驗歷程的分析，提供研究「性別與科學參與」的另類切入角度；藉由她學習科學與女性主義的經驗分享，可以檢視她的經驗可否輸出？是否能讓其他女學生受用？需要何種條件？

因此，本研究設計運用三年的時間，先進行對這位「學習楷模」的「個案研究」，描繪並指認她達成「要科學也要性別平等」的歷程要件；另外，以立意取樣的方式，在南部地區的大學中找尋與她有類似學習困擾的其他個案，先進行個別訪談，以瞭解其「學習歷程」；然後，利用從「學習楷模」的個案研究中所分析整理出的研究問題與訪談大綱，運用「培力焦點團體」的方式，製造「學習楷模」與其他個案對談的機會與情境，以觀察是否能傳遞「性別平等意識」的重要性，並鼓勵其他個案多接觸性別平等論述以及女性主義書籍。在「培力焦點團體」進行後的半年到一年之間，再進行其「生涯抉擇」的後續訪談，以瞭解她們在接觸性別平等論述，以及親自與「學習楷模」互動後，如何重新思考她們的科學生涯。

詳細的研究設計將在後面「研究設計」中呈現。以下則簡要回顧科學教育與性別研究、科學與性別的重要文獻以及理論觀點。

四、文獻回顧與理論觀點

（一）科學學習中的性別議題

過去三十年來，關於科學教育與性別的關係的研究，在以歐美為主的西方學術界中一直蓬勃發展，例如在英國、美國、加拿大、澳大利亞等國。除了科學界本身投以關注以外，以性別為主要關懷議題的科學教育研究學者(Barton, 1998; Brickhouse, 1994, 1998, 2001; Gaskell, Hepburn, and Robeck, 1998; Hughes, 2001)，和以科學為主要關懷議題的性別研究學者(Bentley &

Watts, 1986; Harding, 1986, 1991, 1997; Haraway, 1991; Keller, 1977, 1983, 1985), 都是這方面議題的研究主力。他們的研究重點, 主要是性別因素如何影響科學參與, 以及科學內容裡是否有性別偏差。

性別因素如何影響科學參與? 美國科學教育界重要的學者 Jane Kahle 和 Marsha Lakes 早在七零年代末八零年代初就發現了科學學習中的性別不平衡現象(1983)。她們援用美國國家教育成就評量(NAEP 1976-1977)的統計資料作進一步的性別分析發現, 美國女孩在九歲時, 接觸科學活動的經驗就已經比同齡男孩少, 而在十四歲以及十七歲時, 女孩參與科學課堂或課外活動的機會也較同年齡的男孩低。早年接觸科學相關活動的機會的差異, 顯然造成日後對科學課程的嫻熟度的差異, 與對科學參與熱誠的差異。

科學參與裡的性別議題, 從七零年代開始, 就慢慢變成一個國際學術研究的領域, 也是爭取社會公平與教育機會公平人士關注的面向之一。英國在七零年代中期已經有一群科學教師發起所謂 GIST (Girls Into Science and Technology) 計畫, 探討學生在學階段, 教師的教法, 以及所用教材上是否呈現了性別不平等(Kelly, 1976; Kelly, Whyte, & Smail, 1987)。大約同時在美國, 也有一群科學社群裡的傑出女性科學家, 以生物背景的為多, 開始探討在她們的科學生涯裡, 傳統的性別刻板印象以及性別偏見, 如何形塑對女性不利的科學從業環境, 與製造不必要與不公平的科學參與障礙。澳洲在八零年代, 由於受到這股潮流的影響, 其政府也開始配合科學教育界, 發展出以性別平等為前提的新教材與教法, 以確保兩性科學學習與科學參與的權益 (McClintock Collective, 1988)。總體而言, 受到美國六零年代女性運動的影響, 一向以科學中立為前提的歐美科學界, 在七零年代以後, 開始省思科學客觀中立的價值以及其背後的性別議題。

英國學者兼女性科學教師凱莉 (Kelly, 1985) 在性別與科學教育的研究可說是這方面的先鋒。凱莉指出學校科學課程至少在三方面加重了科學的「陽剛」(masculine) 面目: 科學教室 (及實驗室) 裡不成比例的男老師 (及男科學家) 讓學生覺得科學是男性的事業, 讓女孩子不容易認同科學; 科學課程的包裝與所使用的語言與教學範例常常呈現陽剛意象或軍事偏差; 科學教室內兩性同儕互動的模式已經受到教室外社會性別期待的影響, 使得教室內的教學與學習行為成為強化「科學是男性的」迷思的幫兇。凱莉的分析幾乎替後來的研究者指出明確的後續研究方向。而經過筆者(即本計畫主持人)對其他研究的分析與整理, 科學教育裡的性別議題的研究主題, 大約可以分成四個方面: 師生互動、教室動態(包含同儕互動)、刻板性別與性意象、評量方法的性別偏差(蔡麗玲, 2004)。

(二) 科學界女性的管漏現象

在傳統「男理工、女人文」刻板印象的影響下, 理工相關科系一向有男性偏多的現象, 並且, 學科等級越高, 女性所佔比例就越少, 此稱為「管漏現象」(the “Leaky Pipeline”), 而此管漏現象卻是台灣與國際上許多國家皆然, 也在國際性的會議中受到討論(例如 2003 年於巴黎舉辦的國際理論與應用物理聯盟女性會議)。以台灣的物理相關系所為例, 1998 年女性在大學部、碩士班、博士班、教職的比例分別為 16%、18%、9%、8% (楊信男, 1999); 而 2005 年則為 13%、16%、11%、11% (蔡麗玲, 2006)。大體而言, 都有越來越少的趨勢。而美國的物理研究院(American Institute of Physics)的統計研究中心(Statistical Research Center)更是長期性、系統性地追蹤美國國內的管漏現象, 兩性參與科學的比例, 可以從高中時期互相接近的約 53% 男女

相對於 47%，一路差距增加，到正教授階層將近是男 95%、女 5%。可見，女性在「男理工女人文」的社會文化環境下可以選讀理工相關學科，並且有所表現，已經很不容易。可惜的是，在選讀後，卻又因為種種原因，在不同的階段離開科學，而使女性參與科學人數層級越高，比例越少。以教育資源與人力資源的運用來說，如果有能力也有興趣從事理工相關領域的工作，卻未能充分發揮其能力從事符合性向的工作，誠然是一種資源的誤用，而對有志從事卻被排除的少數族群而言，也是一種就業機會的不平等。

(三)「認同」決定了學生是否繼續留在科學領域

過去幾年以來，以美國為首且關注科學教育裡「性別平等」議題的學者，已經漸漸有了以下的共識：科學教育裡的性別議題，必須超越傳統的「為什麼科學裡女性這麼少？」(Why so few?) 的問法，而應該引進新的理論觀點——「認同」(identity)理論——來加深探討深度，並拓展出新的討論視野(Tsai, 2004a)。也就是說，科學學習者是否能想像其將來為科學人，或是想像自己的生涯或生活與科學有任何關係，此「認同」將影響其參與科學的程度，而在性別因素影響科學參與的例子中，尤其如此。並且，所謂的「性別」與「科學」不能只是被當作給定(given)的兩個概念來進行研究，只限定於傳統「科學本質或是科學就學與從業情境對女性如何不利」這一類的研究。雖然這類的研究仍有其重要性(尤其在當前台灣的學術研究脈絡)，但研究者應該更進一步結合性別研究與科學研究的理論，將「性別」與「科學」當作兩個「論述」(discourse)，來探討個人做為主體如何在論述場域(discursive field)裡所提供的主體位置(subject position)進行主體建構與認同，因而檢視所謂個人的生涯「選擇」與認同機會的不均，從而發現個人作為「行動者」創發新論述與新主體位置的可能。

科學教育研究社群對「認同」議題的關注，在學術社群分類範疇中，是承續過去數十年以來科學教育研究必須注重社會文化觀點(socio-cultural perspectives)的一支，其主要論點就是將科學視為一種社會文化建構，認為科學知識的生產與科學社群的溝通，都脫不了社會與文化背景的影響。而近年內對科學教育中社會文化觀點的關注，已經發展到更細緻的面向，尤其關於科學語言(論述)的使用以及科學認同形塑的議題，得到許多學術同儕的關注與討論。以 Science Education 期刊為例，過去幾年來，關於“identity”主題文章的發表已成為主要趨勢之一。這一波關於論述與認同的討論，主要是基於以下認知：特定社會情境與文化脈絡下，有關科學的論述影響了學習者對科學的認同，而此認同影響了學習者持續參與科學的意願與參與方式。以認同觀點進行一般教育相關研究早有呼聲(Gee, 2001)，而在科學教育方面，有以認同觀點進行科學素養研究者(Brown, 2004, Brown, Reveles, & Kelly, 2005; Reveles, Cordova, & Kelly, 2004)；有進行都市科學教育研究者(Barton, 1998, 2001; Proweller & Mitchener, 2004)；有進行師資培育研究者(Eric & Reed, 2002 ; Varelas, House, & Wenzel, 2005)；以及學習者適應研究(Kozoll & Osborne, 2004)等等。這其中，以「認同」觀點進行進行科學教育中的性別研究者也漸漸形成一個流派 (Barton, 1998; Brickhouse, 2001; Brickhouse, Lowery, & Schultz, 2000; Brickhouse & Potter, 2001; Carlone, 2004; Hughes, 2001; Tsai, 2004a,b)。

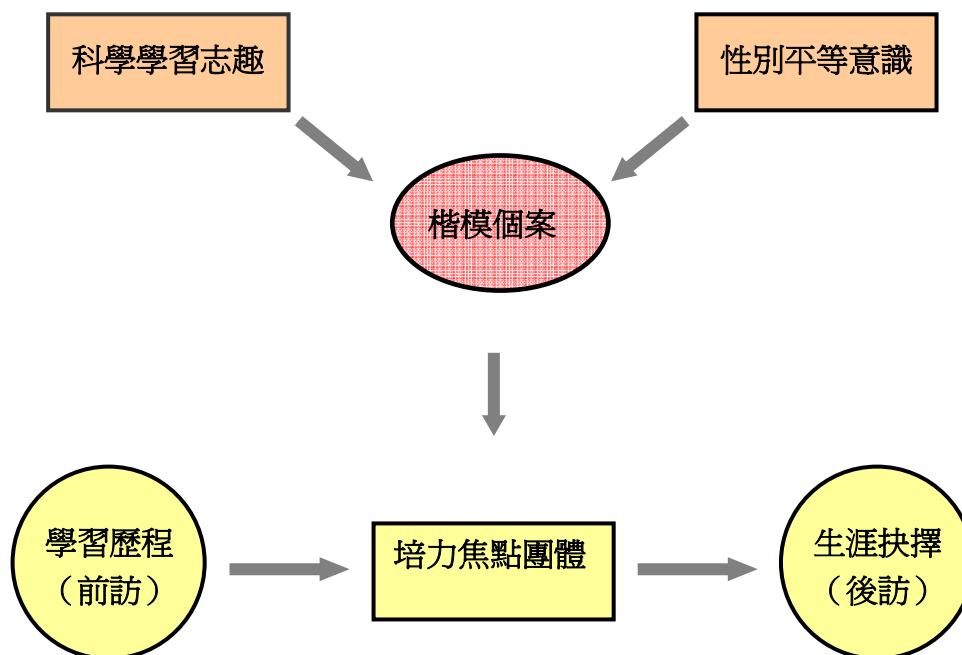
根據 Lave 以及 Wenger(1991)的理論，學習的目的即是為了認同形塑。由認同觀點出發，即可體認到學習不再只是獲得知識的過程，或者是個體心靈的認知現象。「學習」其實是一連串的「抉擇」過程，學習者抉擇著她們想知道與不想知道的內容，抉擇著她們如何想像自我與將

來，抉擇著她們即將從事何種生涯。而這些抉擇都受到社會文化因素的影響，例如性別，種族，階級，宗教等等。學習，幾乎可以說是學習者在複雜的世界中尋找得以據之生活的身份認同的過程。學習者常常在不同的身份認同所產生的不同意義中抉擇與平衡什麼是她們該知道的，什麼是她們可以忽略的。Nancy Brickhouse 在其重要的文章 “Bringing in the outsiders” (1994) 中曾經強力呼籲科學教育應該改變其內容與教法，以容納傳統「菁英」科學學習方法中被排擠的弱勢族群，矯正包括性別與族裔背景的偏差等，以建立學習者更廣泛的科學認同。

可見，學生在學習過程中，正不斷地在建構她們作為學習者的「認同」。她們會根據既有的種種「論述」，以及她們所考慮的種種人、事，可能是對她們有權威的，也可能是她們所關心的，而對自己的「身份／認同」做出調整。因此，學習者的身份認同，一直是複雜的、變動的，更是「情境」的(situated)。在複雜、甚至因為種種因素併陳而顯得混亂的情境中，學習者對她們身份的認同，正是標示了她們所在的群體中的優先價值，也標示了主流「性別價值」運作的所在。

五、 研究架構與進度

根據前面的文獻回顧與理論觀點，本研究設計研究架構圖如下：



根據以上的架構圖，本研究以「楷模個案」的學習歷程為第一階段的研究重心，在此階段中，分析「科學學習志趣」以及「性別平等意識」如何共存，以及互相配合，使得「楷模個案」得以發展堅定的科學學習志趣以及具有強烈的「性別平等意識」(以致於願意以「女性主義者」自稱)。

在本研究第二階段，關注其他學習個案（稱為「培力個案」）的「學習歷程」，也就是進行前導性訪談，瞭解其學習困擾，以及是否思考本身性別問題與其科學學習的關連。前導訪談結束後，以培力(empower)性別平等意識為目標，並且給予明確的「培力」步驟，包括讀書會或參加研討會等。大約經過一年或一學期後，利用在「楷模個案」的經驗分析中發展出來的訪談大綱，針對「培力個案」再次進行個別深度訪談，瞭解其受到性別平等論述影響的程度。

六、 研究歷程

（一）受訪者的選取

本研究原定經由立意取樣方式選擇一為楷模個案，化名為阿美。後來在「性別與科學」相關的研討會場合結識目前正在就讀高中的小如（化名），小如雖然為高中生，但其對性別與科學的態度與阿美的發展歷程類似，因此以方便取樣方式將其列為參考楷模個案以與阿美的經歷作比較。阿美的個別情形概述請見下面「楷模個案資料分析」。除了楷模個案阿美以及參考楷模個案小如之外，本研究亦邀請南部地區大學共十位理工科系女學生進行深度訪談，為了方便進行訪談考量，因此研究參與者的選擇以接近研究者的南部地區為主。受訪者目前皆選讀理工科系，三位四年級受訪者已考取理工研究所。十位女學生在參與訪談前表明其對於科學的學習適逢低潮、遭遇學習困難及挑戰，甚至有「轉行」的考慮。其中兩位來自北部地區大學之受訪者由網路上徵得。

以上十二位研究參與者的化名與背景概述整理如下面表 1-1。

表 1-1 研究參與者化名與背景概述

姓名	年級	學校
阿美	大學畢業	南部國立大學
小如	高二	北部菁英高中
阿儂	三年級	南部國立大學
出出	三年級	南部國立大學
阿明	三年級	南部國立大學
小陳	三年級	南部國立大學
可可	四年級	南部國立大學
小雨	四年級	南部國立大學
阿玉	二年級	南部國立大學
小華	二年級	北部私立大學
妮妮	二年級	南部私立大學
小比	四年級	北部私立大學

（二）個別深度訪談

本研究自九十七學年下學期開始，由計畫主持人與研究助理進行觀察紀錄與個別訪談，進行關於「就讀理工科系女大學生」的學習經驗訪談，訪談依據半結構式問題進行，不受限於訪

談大綱的順序，由研究者根據訪談情境提出問題作為討論基礎，學生針對問題自由回答或討論，以錄音筆記錄受訪者的發言。於訪談結束後，研究助理隨即進行資料的轉錄工作，此乃將所有錄音資料轉成逐字稿以作未來分析之用。謄稿、校對完成之後，則開始依研究架構的基本脈絡將受訪者所陳述的訪談內容作開放式編碼(opening coding)，編碼原則上以對照訪談大綱為主。

本研究由於研究問題重點的不同，因此分為二階段來執行及完成計畫。第一階段主要針對「認同性別平等價值且願意留在科學界的女學生」--「楷模個案」--進行深度訪談，以瞭解其意識發展歷程，以此發掘怎樣的接觸經驗或模式有助於使科學領域的女學生能同時發展女性主義性別平等意識以及對科學生涯的認同。

研究者與「楷模個案」與「培力個案」進行一對一的個別深度訪談，從中可以幫助研究者發掘女學生的科學與性別概念，以及平常教學、研究、學習中可能牽涉的困難與挑戰。「楷模個案」的訪談時間以半年到一年為主，不以次數為限，而已「資料飽和」為度，作為質性研究「單一個案」具有 intense case 的價值以及特殊性，具有「自傳」式研究以及「敘說研究」的精神。「培力個案」的個別訪談則由本研究計畫主持人或專任研究助理進行「前導」以及「追蹤」訪談，每次訪談至少二小時，由專任助理進行資料統整、歸納與初步分析。

本研究進度超前，由於有幸於第一年時即順利邀請到十位正對其科學生涯產生質疑的女大學生--「培力個案」，因此本研究將第二年初期的先導訪談亦於第一年之中完成。追蹤個別訪談則於於第二年計畫期間順利完成。其中，楷模個案阿美共接受兩次訪談，並有兩次自我敘說；培力個案全部十人皆有第一階段訪談，但於第二階段時，有些由於時間無法配合之緣故，僅七人成功接受訪談。

(三) 培力步驟

本研究選取「物理好丰采」影片以及「女科技人電子報」作為培力媒材，要求十位參與者觀賞並定期閱讀該電子報，並在第二年時個別進行第二階段訪談，以瞭解她們對這些培力媒材的看法，以及媒材對她們的影響。「物理好丰采」影片乃中華民國物理學會所拍攝，片中為十數位各年齡的在職物理學家現身說法介紹其工作與生活，以及對物理的熱情。此片目的乃作為年輕女性的「角色典範」，以期吸引更多女性從事物理相關領域。「女科技人電子報」則為國科會資助的研究計畫所發行的電子報，其中除了科技動態之外，亦有國內外性別新聞，更重要的是，每期皆有女性科技人的專題報導，類似「物理好丰采」的內容與功能，亦同樣提供年輕學子（特別是女性）作為建立其科技人認同的有利工具。

七、 研究結果

(一) 楷模個案分析

1. 個人背景與特色

阿美在家中排行老大，底下有一個弟弟兩個妹妹。爸爸是台商，媽媽是家庭主婦，家中經濟中等，從南部某國立大學電機相關科系畢業，畢業成績為第三名，是非常優秀的科學畢業生。阿美從高中起就非常積極，其主動報名參加過的活動包括「高中生人文社會科學營」，「台大經典閱讀課程」，「物理人的挑戰」，「國際女科學家會議」等等營隊或研討會。

2. 科學學習歷程

關於阿美的學習歷程，她自認國中文科較好，高中時數學老師給了她一個很好的典範，教學認真並活化數學。阿美本來對數學沒什麼自信，但是這位數學老師給了她很大鼓勵，於是阿美選擇理工科系就讀。另一方面，家裡的長輩也認為讀理工的出路較好，因此選擇其為志願。關於對性別與科學的看法，阿美覺得她不是理工能力很優秀的女生，而是對自己的期待較高，希望自己是一個獨立自主的人，例如她不把結婚(依賴另一個人)當成人生目標。接受科學的挑戰成為她表現自己的能力的方式之一。

3. 男性教師的「親善型性別歧視」

對阿美影響最大的性別化學習經歷，是上大學時，有一次考期中考，老師發考卷時強調「這次的題目出的比較活，女生大部份考得不好」。這句話讓阿美覺得不舒服，不禁質疑：能力差跟女生劃上等號嗎？阿美從不這麼認為，但當聽到老師這麼說時，她開始懷疑自己可能比較笨，所以要花比較多的時間去理解比較活用的東西。男老師這樣的評語，顯現了所謂的「親善型性別歧視」(Glick & Fiske, 1996)。

4. 接觸女性主義論述後的影響

由於對自己能力的懷疑，阿美從三年級開始就自行在校內找尋可能適合自己的「其他專業」，也就是開始有「轉行」的念頭，直到在學校通識教育課程中，發現有「性別」相關的課程，因此選讀，並在該課程中受到啟發。之後便積極參與國內「女性科學家」等相關研習營或研討會，並決定自己可以繼續留在原本的科學領域。

對阿美而言，接觸女性主義是正面影響。除了對事情的看法多元化之外，也對於未來可能會從事的工作有進一步的了解，並且加強她的信念，面對挑戰不會退縮，因而增強了留在理工界的動力。阿美認為，理工領域中也有女性典範在帶領著她，那種感覺很安心。

阿美覺得在科學裡的女生應該要團結起來，一起互相扶持解決性別不平等的問題。比如說，婚後的女生怎麼樣平衡家庭與研究，阿美並不認為美滿的家庭一定會和成功的事業相抗衡。她認為，追求性別平等是有必要的，就對於留住優秀人才的角度來說是很重要的。

除了本身被女性主義 empower 之外，阿美並發展出「倡議者」(activist)的精神與態度。她認為她可以影響的就是學弟妹們，至少她的故事能夠讓徬徨的大學女生有一個類似經驗且支持她們的人可以訴說。阿美自我期許，若其科學生涯很長的話，若她可以取得一些社會資源，在一些社會位置上為女性在科學的權益發聲，那就是很有意義的事了。

(二) 培力個案分析

本研究由於進度超前，因此順利尋訪到十位願意參與前導訪談的女大學生。前導訪談主要針對女學生在科學學習中所遭遇的困難及挑戰進行瞭解。例如，什麼樣的挑戰及困難會讓女學生感到沮喪、退縮甚至考慮轉行？鼓勵女性進入科學的同時，是否要檢視科學領域本身是否對女性友善？本研究針對其遇到的困難經驗中關注其存在的性別意涵。

1. 女性從事科學仍然受到不同的阻力

(a) 他人勸阻

國內外科學教育界在過去三十幾年來，不斷投注學術人力與心力，試圖建構各種課程來吸引女性選讀科學，或者設法指出可能造成不利於女學生學習科學的因素，或者希望提出解決之道，以留住已經選讀科學生涯相關科系的女生。然而，在受訪的女學生中，仍看到選讀理工科系的女生遭受師長言語勸阻、攻擊的情形，即使成績優秀也難在科學裡被「認同」。傳統刻板印象中認為男性較適合從事科學的信仰仍然存在，這些言語也影響著選讀科學的女學生，使其在遇到挫折時可能產生自我懷疑甚至自我否定。

受訪者小雨提到，她的男性教授讓她感受到無論如何男生在科學學習中是比女生優秀的；可在選擇專業領域時則產生自我懷疑，認為自己可能不夠聰明、能力不足，而這些想法來自於男教授及學長談到專業領域時，不斷強調其需要「聰明的腦袋」。(以下發言者中，「研」代表研究者)

雨：就即使在理工裡面很優秀，他們那些男生，就教授啦，還是會覺得男生最優秀。

研：教授是說了什麼嗎？

雨：我也忘記他確切說什麼了，但就是有這種意思，而且還不只一個！男教授，所以我就覺得很奇怪阿，即使我們班現在第一名是女生，反正他們還是覺得不管現在成績怎麼樣，到最後吼，以後出頭的還是男生最優秀。然後我就覺得也不是這樣子啊，然後我也不知道為什麼。(小雨一訪)

可：而且我重點是有沒有能力啦！因為做高能物理到底要多聰明，我真的不知道。

研：誰告訴妳那個要很聰明的人啊？

可：所有的大學長啊，連老師都很聰明。郭榮升就做高能的啊！他也好聰明，大家都好聰明。所以到最後一定要聰明啊！（可可一訪）

(b) 「男女腦袋不同」論述造成負面效果

成績中等、表現無法達到自我要求常常是多數女學生遭遇的困難之一，也是低潮的主因。選讀理工相關科系的女生如受訪者阿儂及可可，在高中時期是物理、化學、數學表現優異的學生，甚至就讀該地區第一志願資優班。自然而然選擇了理工科系後，卻出現「自我設限」的情形。阿儂認為自己的腦袋沒有男生好；可可懷疑自己到底夠不夠聰明？兩位受訪者因為自我懷疑的因素而造成其考慮離開原科學領域，讓原本有志從事科學，並且興趣在科學的女性流失。

阿儂在學習科學的歷程中有「腦袋構造不同、頭腦不如男生」的想法，如果她能有性別平等的「先備知識」，並且理解其中的脈絡因而看見女性從事科學的權力與價值，讓女性主義進入她學習科學的過程中，極可能有助於她導正「男女腦袋大不同」的說法，降低自我設限並發揮最大潛力。

儂：嗯。可是上大學就發現…靠杯！讀不過男生！差太多了！就腦筋構造好像真的不太一樣…我後來就是想說，既然真的唸不過男生的話，我就去當主管，主管階級，就是不

朝，就是研究…

研：不朝理工？

儂：就我腦袋也沒他們強，我真是去被打壓的啊！所以我不如朝管理方面的走，不過這樣又要跨組。(阿儂一訪)

可：高能是物理裡面就是比較難的一派，就是妳要真的很...我都聽人家講啊，要很聰明啊！要怎樣、要怎樣，我雖然喜歡高能，因為我做專題的時候跟高能有關，我還滿喜歡。可是它有兩個困難點，第一個就是我到底夠不夠聰明啊？因為我們去做專題有兩個女的一個男的，很明顯那個男的就真的很...那個男的很聰明，真的。(可可一訪)

(c) 刻板性別角色期待

即使現在已經 21 世紀，傳統的刻板印象仍然存在。「男理工女人文」、「男主外女主內」的角色期待在年輕女性身上依舊具有影響力。父母對於子女的性別角色期待尚未改變，如受訪者出出的父親不希望出出未來從事科學研究工作，認為她將來有自己的家庭需要照顧。顯示其對於「傳統女性的價值」仍然根深蒂固。

另一方面，受訪者妮妮提到「成功的女性大多沒有結婚，好像她們得犧牲掉一個東西才能成功」。女性若要在事業上有所成就，甚至是吃重的研究工作，家庭方面就得有所取捨；然而反觀男性經營事業、從事研究，卻不必將成家及家庭照顧納入考量。在在說明了社會對於女性的中心價值及角色期待仍然多半放在家庭照顧上。

出：可是他，他自己一方面也不希望我們就是像，其實像那種作那種研究那種，都很累，那他一方面不希望他自己的女兒然後這樣子。對啊，就是忙到晚然後，他想說，妳自己還有家庭要照顧什麼的。(出出一訪)

妮：可是女生就是其實，我覺得感情上女生可能這個會比較在意一點。就是，而且通常很多很多很成功的女人，都沒有結婚。就是好像她們是要犧牲掉一個東西，然後她們才能很成功。(妮妮一訪)

玉：就是那個水，一桶水，然後每次可能要搬個、搬個四、五瓶，然後就會叫那個男生搬，不然就是什麼搬東西去樓下幹麻的。(小玉二訪)

2. 性別化的對待與親善型性別歧視

針對十個培力個案，我們在訪談時，特別關注她們是否在成長或學習的過程中受到「性別化的對待」，特別是家長的期望或者教室與實驗室的氣氛等。而在師生的互動中，我們則關注是否出現如楷模個案經歷過的「親善型的性別歧視」，也就是貌似給女性的特別「優待」，但實質上卻反映了認為女性能力不足的一種歧視態度。

(a) 女性不用養家或繼承家業

在成長經驗方面，至少有兩位受訪者表示她們的父母對兒子女兒的差別化期待，也就是符合一般傳統性別角色的「男生養家」或「男生繼承」的期待。在這種期待下，女性比較沒有壓力，但同樣的也感受不到與兄弟對等的被父母看重的感覺。

明：（在期待孩子繼承家業方面）有啊，我弟弟吧。（阿明二訪）

華：就是我如果是男生我就要成家立業，因為我爸就會耳提面命，就會說「還好妳不是男生，要不然妳就要當兵，妳就要養家，對」。（小華二訪）

(b)不喜歡實驗室社交文化

在學習經驗方面，小玉明確地觀察到了以男性為多數的實驗室可以發展出怎樣特定的文化，而這樣的文化卻不見得對兩性都同樣具有親近性。例如為了型塑實驗室師生乃「一家人」的氣氛，實驗室常舉辦慶生活動，以表示對對成員的重視，以及提供社交機會。偏偏這些實驗室中女性比例太少，使得男性較為熟悉而女性較不歡迎的喝酒文化容易形成。

玉：「學姊就會辦一些什麼...有事沒事就要吃東西，然後幫老闆慶生」

玉：「然後就會喝酒，我就覺得很討厭」（小玉二訪）

我們曾問小玉，如果不喜歡，是否可以不去？但小玉表達了對實驗室上下階層權力關係的顧慮。她不需要擔心因為沒有共襄盛舉而得罪主辦人，也要擔心沒有出席可能被解讀為對老師不敬。因而，即使自己非常不喜歡實驗室的聚會與喝酒文化，但仍必須配合。

玉：「因為我怕就是不去，然後學姊會生氣，然後老師會默默記在心裡面，我就覺得很緊張」（小玉二訪）

(c)女生在系上有優勢（教師的親善型性別歧視）

與楷模個案阿美類似的經歷，在其他培力個案中也出現了。許多男性教師原本具有開明的態度與觀念，也不輕易淪為性別歧視的幫兇，甚至認為理工領域應該要有更多女性加入。但是，他們出於保護女性的善意，卻常常加強了「女性科學能力不足」的刻板印象。也因為他們的態度常常是友善的，因而這種「友善地看不起女性」的作為，就變成了「親善型性別歧視」。例如，阿儂與出出都明確表示她們的類似遭遇。

儂：有一個老師啦，可是我覺得、我不知道他是不是在開玩笑，他就會、他上、他上課的時候就是他打分數會對男生特別嚴格，那女生的話他還問說「這樣分數可以嗎」，就是打完分數就問她「可以嗎」。（阿儂二訪）

儂：他就會說「喔，男生一定要比較嚴格，因為男生出去要養家，女生出去嫁掉就可以了，妳程式爛也沒有關係」。（阿儂二訪）

出：就覺得女生好像不太會的樣子，就是相對標準會給低一點這樣。

出：女生會比較容易過關，就是男生可能要寫比較好一點這樣。

出：就只是女生比較容易放水啦。（出出二訪）

有些時候，連女性教師也可能犯了這樣的錯誤。也就是說，當女性成功地留在理工領域時，若她們自己對於性別議題沒有關注，則很容易完全接受甚至內化理工領域中對於女性不友善的偏見或態度。因此，不管是對於理工領域的男性或女性教師而言，首要之務，皆是培養自身的性別意識，以指認出這種「親善型性別歧視」的言行，並避免之。

3. 缺乏具有「女性主義」的科學典範(role-model)

科系的選讀與性別應該多元組合，某種程度上，這些選擇科學成為職涯的女學生跳脫「男理工女人文」框架，也試圖擺脫「科學是男性的」的性別偏見。然而，在她們科學的學習歷程中，卻缺乏一個可以追尋的典範。一來是因為科學教育層級愈高，女性比例愈低，讓女學生們沒辦法直接看見「女性的存在」；二來則是科學典範缺乏性別意識，傳統性別角色期待仍存在。

受訪者如楷模阿美、出出都曾表示無法和系上男老師討論其生涯規劃，甚至楷模阿美在受訪時提到系上教授仍以「婚姻」是女性一生中最重要的事為建議，不贊成其從事科學研究。

當選讀科學的女學生產生自我懷疑時，如果有一個具「女性主義」的典範現身說法，並且給予指引，則會產生決定性的影響。典範是重要的，是需要被看見的，也因此台灣的女科技人們聯合發起「女科技人電子報」、「女化學家聯誼會」、「女科學家會議」都是為了能讓選讀科學的女學生們看見 role model，幫助女學生繼續留在科學生涯。

可：因為我媽她是開店，可是等到我們大概國中的時候，她就決定就是要轉型，就是開始不走家庭美髮，要走那種連鎖的。可是...然後我媽媽就，我覺得我媽已經比較像那女強人那一種。就是...嗯～她遇到事情比較不會被打敗，就是她就想辦法趕快解決，然後我覺得這應該也是，我覺得我就這一點跟她比較像。而且我就會覺得不能被打倒耶！就是...事情，對啊～大概就是這樣。我覺得不能被打倒，就是一定有方法啦！（可可一訪）

如：後來結論是，後來我覺得跟一個學姊出現影響很大。

研：一個學姊？

如：然後後來在考試的時候她就一直鼓勵我，然後，她，那時候她都還沒有得獎，不過都不知道她那麼厲害，然後就是她會一直鼓勵我，讓我覺得能念XX女中是一件很棒的事。（小如一訪）

出：以前都不知道有這麼多傑出的人。最有印象就林清涼老師吧，74歲了！這麼老了還可以堅持自己，非常有意志力，但就會覺得，嗯？自己怎麼都沒有遇到這樣的老师！（出一訪）

(三) 培力媒材的影響與理工生涯意願

由於許多受訪者表達了她們缺乏「角色典範」，因此，本研究藉由訪談過程讓她們接觸楷模個案以及「物理好丰采」影片，對她們的啟發很大。十位培力個案中，有九位參與者觀賞了「物理好丰采」影片，她們的反應大約可以分成三種：有三位覺得影片中有成就的女科學家是「例外」(exceptionalizing)，雖然看完了但不覺得自己可以跟她們一樣；第二種反應是「有為者亦若是」(encouraged)，四位參與者自我期許可以跟影片中的科學女性一樣成功；第三種則有些「半抗拒」(semi-resisting)，二位的反應是認為她們很成功，但為何要強調「女性」？第一種反應就是所謂的「例外化」，將科技領域有成就的女性當成「例外的女性」，換言之，也就是「非正常的女性」，也就是「正常女性不會那麼成功」。這樣的看法顯示的仍然是科技領域適合男性的刻板看法。很不幸的是，三位女學生即使身為理工科女學生，仍然深化了這種看輕女性的觀念。而第三種反應的兩位女學生，則顯現了「假性別中立」的「性別盲」問題。由於理工科被認為是「男性的天下」，因而能在其中獲取一席之地的女性，反而不願意別人提及其作為「生理女性」的事實，彷彿提到「女性」就是一種貶抑似的。當人們相信「成功」沒有性別問題時，多數的情形是，在貌似中立的成功條件下，性別弱勢的遭遇不被看見，只能隱忍。

另外，本研究在第二階段的訪談時，也要求參與者先行接觸「女科技人電子報」，並閱讀其中女科技人現狀的訪談報導。另外，也有一些受訪者注意到國內外性別新聞，因而開啟了對於性別議題的關注與思考。本研究參與者普遍表示「女科技人電子報」對她們非常有幫助，例如「不再感覺孤單」、「感覺安全了」、「發現留下來的價值」等等反應，甚且有些參與者表示這樣的訊息應該在大一時就該閱讀了，她們並且表示願意將該訊息與同班女性同學分享。

有趣的是，本計畫快結束前，許多參與者已經面臨大學即將畢業或已經畢業的情形。例如，以參與第二階段（二訪）的七位女生為例，小比已經進入電機領域的研究所一年級就讀，四年級的阿儂、出出則已經遞出理工研究所的甄試申請，阿玉，妮妮雖然是三年級，但也都明確表示將來「不會轉行」，會留在理工領域。其中考慮轉行的，只有四年級的阿明（喜歡歷史），以及三年級的小華（喜歡人文類科）。她們的生涯意願整理如下表。

化名	二訪時是否考慮轉行
阿玉	會轉向生物化學或化學類科，仍留在理工領域
妮妮	不會轉行，想多方探索，將科學與人文結合
阿明	未來應會轉行，比較喜歡歷史
小華	未來應會轉行，比較喜歡人文類科
小比	不會轉行，考慮當專利工程師
阿儂	不會轉行，未來想自己開科技公司
出出	不確定是否轉行，想邊工作邊摸索興趣

這些受訪者，當初之所以進入本研究，乃是自認符合「學習有困難」以及懷疑自己「是否

念對科系」的理工科女生，但她們在研究結束後仍有多數表示不會轉行，仍會留在理工領域中發展。究其原因，或許未來工作機會以及收入的多寡，仍是她們的最主要考量。例如阿玉雖然有明確的性別意識，足以指認出其學習環境與歷程中的許多性別議題以及性別化的對待，但在受訪時，她仍不斷強調工作與收入才是她的第一考量。當然，這些受訪者已經念了三四年大學，即使在二三年級時曾自我懷疑是否念對了科系，但大學期間慢慢建立的學科「認同」，或許也相當可觀，不是這麼容易被動搖。我們不敢說，如果沒有這個計畫的介入，她們是否還是留在理工領域，但是，在本計畫的楷模個案、「物理好丰采」影片、以及「女科技人電子報」影響下，決定留在理工領域的她們，或許更知道如何因應將來工作環境中的性別議題，更可以做個不一樣的女科技人。

八、結語

從以上楷模個案的初步結果分析可以發現，女性主義確實可幫助女生保有從事科學的興趣，並學會重視女性在科學裡的權利。而尚未接觸女性主義的女學生，則普遍缺乏「性別意識」。訪談中培力個案女學生對自己設限，反覆地懷疑自己的能力，有些即使名列前茅仍然對於自己缺乏自信，或是認為頭腦不如男性、不如男性聰明，再次鞏固了「科學是男性的」的迷思。另一方面，從事科學教育的男教授們仍存在「男理工女人文」的思考，無法在女學生遭遇學習困境時提供鼓勵或肯定，讓年輕女性延續其對科學的興趣或選擇科學做為職涯規劃的目標。而所謂「男女大不同」的論述，於過去十年間以「科學」之姿在台灣社會不斷推廣，也在教育界造成極大的影響，然而其中卻有許多似是而非的說法，卻落入「生物決定論」的謬誤當中，使得接受此說法影響者，例如本研究中的一些女大學生，便輕易使用此論述來否定其在科學發展的潛力，並認為這是女性不可改變的先天弱勢條件。性別平等概念的倒退，莫此為甚。

所幸本研究也發現有效的培力步驟，的確可以幫助女學生強化自己是科學人的認同，因而選擇留在本系。而觀賞影片後的三種反應，也凸顯一般學生仍有「科學是性別中立」的迷思，這或許也反映了長期以來科學教育的目標與聲稱。

本研究也整理出幾個有用的「培力步驟」：選修性別課程、閱讀性別議題書籍、接觸女性主義者教師、參與科技與女性相關研討會、觀賞角色典範影片、訂閱性別與科技相關電子報、以及瞭解科學中的女性權益以及女性價值。可以提供將來的研究者參考。

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41st Annual ASERA Conference

Australasian Science Education Research Association (ASERA)

Shoal Bay Resort and Spa, Port Stephens, New South Wales, Australia
30 June-3 July, 2010

&

Women's Worlds 2011

11th International Interdisciplinary Congress of Women (WW)

Ottawa-Gatineau, Canada
3-7 July 2011

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本計畫為兩年計畫，其研究成果總共在兩個國際研討會中發表，但僅於第二年使用出國經費。第一年於澳洲科學教育研究協會 ASEAR 2010 的發表機會，乃是借用本人前一國科會計畫成果於同一研討會發表的機會，順道發表初步研究成果，因此並未動用出國經費。因此，本計畫所核定 16 萬之國外差旅費，一併於第二年至加拿大渥太華 Womne's Worlds 2011 發表全部研究成果時使用。所剩餘 5 萬 8 千餘元，已經在計畫後期因研究需要奉核轉移至業務費。

以下出國報告乃依據上述兩個研討會順序分為兩部分，皆以英文呈現。每一部份皆涵蓋該研討會歷史簡介，該次會議主軸，會中值得記錄的場次重點，以及本計畫發表的投影片內容。澳洲 ASERA 部分因與前一計畫成果於同一研討會發表，因此部分內容相同。本報告內容僅供參考，若有引用需求，務請事先聯繫本計畫主持人。是所至盼。

41st Annual ASERA Conference

1. Australian/Australasian ASERA

Starting July 1st, 2010, there were about 180-200 papers presented in the 41st Australian Science Education Research Association (ASERA) annual conference (ASERA history is attached at the end of this report). While the original goal for the conference is for Australian academics, the participants in this ASEAR 41, according to words of mouth and on-site observations, however, included 1/3-1/2 Asian presenters. These components finally justified the name change to "Australasian" in 1990, because of ASERA's first inclusion of New Zealand. This year, Taiwanese and Korean scholars formed two major groups. This phenomenon can be seen in the conference book. According to my rough estimation, there were 1/6-1/5 presenters were from Taiwan, including many PhD students following their professors. This was my first time to ASERA. It seems to me that ASERA is a major field of presentation for Taiwanese science educator training.

2. Highlights of Interesting Presentations:

Identity Projects and Practice in a Science Classroom:

This paper was presented by Jenny Arnold from the University of Melbourne. The subtitle is a case study of students' reflexive positioning. I was mostly interested in this paper because of its theoretical approach of identity as well as the focuses on agency and discourse study. The outline of its abstract is as follows: "This paper explores themes emerging in classroom videotapes of a middle year science classroom from a case study of student identity and agency using discursive psychology. The research was conducted in response to the widespread problem of student disengagement with science in the middle years of schooling

and related calls for research into the way in which students develop identities in and through school science. The purpose of the paper is two fold: firstly, drawing on Harre's model of Identity Projects, to present findings from the study showing one student's reflexive positioning in dialectic relation to local practice; and secondly to discuss the implications of the findings for research and practice in science education." This paper concludes by similar questioning as other scholars on how student expression of interest and desire is neither published nor conventionalized in science classroom practice.

Gender and Science, individuals and essentialism: avoiding dichotomies:

This paper was presented by Dr. Dorothy V. Smith from the La Trobe University in Australia. Unlike the first interesting paper focused clearly on identity studies, this second interesting paper used more general topic as 'gender and science.' Although the field of 'gender and science' includes quite a variety of research topics, this paper attempts to addresses to the recently rampant 'sex difference research' based on unreasonable focus of brain function. I have expressed similar concerns by publishing several articles in Taiwan. That was the main reason why, though attracted, the contents and opinions of the author's presentation were already familiar to me. This session attracted bigger audience than mine. I believe that the topic choice of general term of 'gender and science' may have been friendlier to the general audience. The highlights of the abstract are as follows: "The past several years have seen a renewal of interest in the possibility of intrinsic cognitive sex differences between girls and boys. New methods of investigating brain function purport to show significant differences in the brains of men and women. Although much of the reasoning that goes into such reports is deeply flawed, the reported differences have been taken up the media and by proponents of single-sex education for girls and boys, who link possible differences in brains to inevitable differences in cognition and learning styles. In this presentation I examine some of the recent claims that have been made about what science can tell us about the differences between girls and boys as learners. I argue that these claims largely frame each learner as an individual and leave unexamined the place of community in supporting learning. As a result, essentialist explanations for commonality become easier to accept; such explanations also leave the idea of science as a social institution largely unexamined."

A Teacher Professional Development Program to remediate misconceptions in Physics:

The third interesting paper was presented by Dr. Subramaniam from the Nanyang Technology University in Singapore. I was attracted to this session because I have taught Physics for 8 years. Although there were no gender perspectives in the paper, it presented a solid research method and very interesting teacher responses. It also shows many possible misconceptions by the teachers and the students and shows how to remediate them. I enjoyed this presentation. In the end, I approached to as for more information and was told that further data can be found on a website (listed in the end of this paragraph). The abstract of this paper is as follows: "In promoting learning outcomes in Physics, the need to address the

misconceptions of students is especially imperative. Strongly entrenched misconceptions, if not remediate, can affect the promotion of conceptual understanding in a topic. This study reports on a unique professional development program conducted by the National Institute of Education in Singapore for teachers and shows how over 40 misconceptions in Mechanics can be remedied using a mix of demonstrations, textual scaffolds and guided explanations. Feedback from the program over the past five years indicate positive support for the approach used to address misconceptions. Details of the program, examples of how a number of misconceptions are remedied and feedback from the teachers (in the form of a psychometrically robust evaluation instrument) who attended this program are discussed. Some implications for teaching and learning are also discussed.”

Korean Daegu University Team:

During the conference, I had the opportunities to attend some Korean scholars’ presentations. Two of the sessions I attended were presented by the similar team led by the same professor. Although not confirmed, I believed that Dr. Sung-Min Im was the leading professor of 5 students on topics of “Students' Belief about Learning Physics As a Resource of Teaching Physics” and “An analysis of the visually impaired students’ observation ability in physics experiments using substitute sense for vision.” This kind of professor-students grouping can also be seen in Taiwanese teams, which is a typical way of training PhD students for international academic presentations. Although we could not find all merits in their presentations, their thrust and solidarity impressed me.

3. My presentation: 8:30—9:10, Friday, 2nd July, 2010

Topic:

Can learning feminism help to retain women students to stay in science careers?

Abstract:

Feminist science educators have long ago pointed out many gender issues in science learning, and various strategies have been implemented in earlier learning stages. However, less attention is paid to college and graduate stages where women students continue to confront self-suspensions whether they are the right gender to study science. This research adopts an interventionist approach to ask whether teaching feminism can help to empower women students pursuing their rights in studying science therefore retaining in a science career. A “model” student and nine others have participated in this study. In-depth interviews and program interventions are used as the main data collection methods during August, 2009 to May, 2010. The model student has shown a successful retention case as her choosing to stay in science major after learning feminism; while the other nine are experiencing similar stimulations and are now pondering on their career choices. Preliminary findings show that,

even in the 21st century, women who choose science majors still experience along their learning paths various discouragement stressing science is not for women and a lack of roll-modeling with clear feminist messages is serious; yet after some intervention, feminism can help to retain women's interests and senses of rights in science. Keywords: gender, intervention, roll-model, retention, career-choice

Power Point Slides:

The Slides I presented in the conference are as follows. They are 10 major slides, including the front page.

Slide 1: Title Slide

Can learning feminism help to retain women students in science?

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Slide 2: Research Background

- Identity formation is key to learners' career decisions
- From 'why so few' to 'why 'they don't stay'
- Those who stay are not necessarily reflective of gender issues in science
- Science needs not only women but feminists

Slide 3: Research Questions

- Can learning gender equity empower those women science students who are in doubt of their career choice?
- Can feminist interventions help to retain women science students?

Slide 4: Methods





- Phase I interviews: A model case May and a reference case Roo
- Phase II interviews: 10 other college women students in science-related departments
- Phase III: Feminist intervention
- August 2009—May 2010

Slide 5: The Model Case May

- She was good at both science and humanities in high school. She chose science for higher income considerations.
- A male professor said that girls could not do well in exams requiring more thinking.
- She got only 'cutting jobs' in the lab.
- Under serious self-suspicion, she took my gender study course, starting get in touch with feminist discourses, including books, conferences, workshops, newsletters.
- She feels empowered and decides to stay in science careers.

Slide 6: Discouraging Discourse I

- Those male professors, not only one, would think that only guys are the most excellent, even though the first-place person in our class is a girl. (Rain)
- I just know that you must be smart enough...that guy is just smarter than the two girls...every male seniors say that, you must be smart enough. (Coco)

<h3>Discouraging Discourse II</h3> <ul style="list-style-type: none"> • I went to college and found, shoot, our brains are just not as good as guys. I'd better off study management. (Nono) • My dad doesn't want me to be so hard working...he thinks that I'll have to take care of my own family. (Chu) • Many successful women are single, they must sacrifice something...(Nini) <p style="text-align: right;"> 7</p>	<h3>Gendered treatment</h3> <ul style="list-style-type: none"> • The male senior said that he would have kicked me off the lab if I were not a girl...this is the only good thing, I think, the male seniors would be more patient and not scolding girls all the time...wow, being a girl could be advantageous, finally. (Bee) <p style="text-align: right;"> 8</p>
<h3>Reactions to the film</h3> <ul style="list-style-type: none"> • Exceptionalizing: I cannot be them—Min*, Nono, Chen • Encouraged: Wish I can be like them—Chu, Bee*, Hua, Rain* • Semi-resisting: Yes, but why mention "women"—Nini, Coco* • (Jade* hasn't seen) • To be continued <p style="text-align: right;"> 11</p>	<h3>Conclusion</h3> <ul style="list-style-type: none"> • Roo: If anyone chooses about science because of their gender, either included with no interests or excluded with defected access, it's just unfair. • May: I feel empowered and safe. I want to stay to help out those who are still uncertain about their careers. • Feminism helps to retain women students in science. <p style="text-align: right;"> 12</p>

Appendix: the History of ASEAR

The brief history of ASERA is as follows. There are 40 previous ASERA conferences, venues crossing both Australia and New Zealand. The following information is available at the website of <http://www.asera.org.au/index.php/history>

In 1970 Peter Fensham (Monash University), the first Professor of Science Education in Australasia, initiated the first conference of what was then the Australian Science Education Research Association. The list of researchers, their institutional affiliations and research interests, who attended this conference can be located by clicking on this link (asera1970). That beginning for ASERA (now the Australasian Science Education Research Association) makes it the second oldest science education research body in the world, after the National Association for Research in Science Teaching in USA. This was also several months before the first conference of the then newly formed Australian Association for Research in Education (AARE). It is thus likely that ASERA was the first professional body in educational research in Australia.

The New Zealand dimension of ASERA began with the attendance of the late Roger Osborne at the 1977 conference, but was not formalized in the name change to "Australasian" until 1990, 7 years after ASERA first met in New Zealand.

The general belief at the first conference was that every second meeting would need to be organized by Monash, a reflection of the fact that in 1970 Monash was the only substantial centre for science education research in Australia. The notion that Monash would be responsible for every second ASERA was part of the ‘gentle coercing’ that had the Macquarie organizers agree to host the second conference, and is why the third conference was held at a very different form of venue - a secondary science curriculum project headquarters in Melbourne. Such was the very rapid growth of Australian science education research and a strong association that this perspective only lasted until ASERA 5.

ASERA 1 1970 Melbourne, Peter Fensham, Lindsay Mackay & Dick White (Monash University)

ASERA 2 1971 Sydney, David Cohen & Neil Baumgart (Macquarie University)

ASERA 3 1972 Melbourne, Probably Les Dale (ASEP) & Peter Fensham (Monash) (Australian Science Education Project headquarters, Toorak, Melb) It has not been possible to establish with certainty who organized the conference.

ASERA 3 1972 Melbourne, Probably Les Dale (ASEP) & Peter Fensham (Monash) (Australian Science Education Project headquarters, Toorak, Melb) It has not been possible to establish with certainty who organized the conference.

ASERA 4 1973 Brisbane, Colin Power & Dick Tisher (University of Queensland)

ASERA 5 1974 Melbourne, Russell Linke & Leo West (Monash University)

ASERA 6 1975 Adelaide, Arthur Lucas (Flinders University)

ASERA 7 1976 Newcastle, Max Maddock (University of Newcastle)

ASERA 8 1977 Wagga Wagga, Tony Blake (Riverina CAE) (now a campus of Charles Sturt University)

ASERA 9 1978 Brisbane, Cam McRobbie (Mt Gravatt CAE) (now a campus of Griffith University)

ASERA 10 1979 Perth, Dennis Goodrum (Churchlands CAE) (now a campus of Edith Cowan University)

ASERA 11 1980 Melbourne, David Symington (State College of Vic, Toorak) (now a campus of Deakin University)

ASERA 12 1981 Hobart, Paddy Lynch & Andrew Davies (University of Tasmania)

ASERA 13 1982 Sydney, Bill Butts (Macquarie University)

ASERA 14 1983 Hamilton (NZ), Roger Osborne (University of Waikato)

ASERA 15 1984 Melbourne, Dick Gunstone & Jeff Northfield (Monash University)

ASERA 16 1985 Rockhampton, Ken Appleton (Capricornia Institute of Advanced Ed) (now a campus of UCQ)

- ASERA 17 1986 Adelaide, Chris Dawson, Mike Sullivan and Effie Best (University of Adelaide)
- ASERA 18 1987 Wagga Wagga, Doug Hill (Riverina CAE) (now a campus of Charles Sturt University)
- ASERA 19 1988 Sydney, Colin Gauld & Barry Newman (University of New South Wales)
- ASERA 20 1989 Melbourne, Dick Trembath (Chisholm Inst Technology, Frankston campus) (now a campus of Monash University)
- ASERA 21 1990 Perth, David Treagust (Curtin University of Technology)
- ASERA 22 1991 Surfers Paradise, Cam McRobbie (Queensland University of Technology)
- ASERA 23 1992 Hamilton (NZ), Malcolm Carr (University of Waikato)
- ASERA 24 1993 Lismore, Keith Skamp (University New England, Northern Rivers campus) (now Southern Cross University)
- ASERA 25 1994 Hobart, Brian Jones & Max Walsh (University of Tas)
- ASERA 26 1995 Bendigo, Peter Searle & Brian Hand (LaTrobe University, Bendigo campus)
- ASERA 27 1996 Canberra, Tim Hardy & Marilyn Flear (University of Canberra)
- ASERA 28 1997 Adelaide, Yvonne Zeegars & Paul Strube (University of SA)
- ASERA 29 1998 Darwin, Bill Palmer (Northern Territory University) (now Charles Darwin University)
- ASERA 30 1999 Rotorua (NZ), Bev France & Mavis Haigh (Auckland College of Education, now Auckland University)
- ASERA 31 2000 Fremantle, Léonie Rennie (Curtin University of Technology)
- ASERA 32 2001 Sydney, Peter Aubusson (University of Western Sydney)
- ASERA 33 2002 Townsville, Steve Ritchie (James Cook University)
- ASERA 34 2003 Melbourne, Rod Fawns & Christine Redman (University of Melb)
- ASERA 35 2004 Armidale, Debra Panizzon (University of New England)
- ASERA 36 2005 Hamilton (NZ), Judy Moreland (University of Waikato)
- ASERA 37 2006 Canberra, Jim Woolnough & Leah Moore (University of Canberra)
- ASERA 38 2007 Fremantle, Grady Venville (University of Western Australia), Vaille Dawson & Rachel Sheffield (Edith Cowan University)
- ASERA 39 2008 Brisbane, Gillian Kidman, Donna King, Steve Ritchie (Queensland University of Technology)
- ASERA 40 2009 Geelong, Coral Campbell (Deakin University)

Women's Worlds 2011

1. Main theme of the Women's Worlds 2011

'Globalization' is the key base concept for the construction of the congress WW2011. The organizers have addressed in the congress book that "Globalization has contributed to the destabilization and marginalization of women and communities.' This beginning statement says a lot about how the organization team imagines the interactions of women participants from all parts of the world under the influences of globalization. Therefore it is understandable that the congress theme was forged as "Inclusions, Exclusions, Seclusions: Living in a Globalized World." Under this main theme, the congress is further divided into four overarching themes that govern the submitted proposals: Breaking Cycles, Breaking Ceilings, Breaking Barriers, and Breaking Ground, according to which the daily themes were organized. As my paper is entitled 'Breaking the gender culture of science by teaching feminism,' it was arranged in 'Day Two' as July 5th.

As the concepts of 'globalization' and the four overarching themes are useful ideas for organizing further conferences, the following statements are selected from the congress's official website for further references.

<http://www.womensworlds.ca/call-participation/introduction>

In the face of globalization and all that it means, how can we combine our collective strengths in order to ...

- mount effective challenges to the dominant attitudes that perpetuate inequality
- highlight and share our successes and strategies
- amplify women's voices and ideas within the discourse on globalization

Breaking Cycles

- As globalization becomes more and more entrenched as the new world order, women around the world continue to mount opposition to the systemic cycles that perpetuate inequality.
- In what ways are women challenging cycles such as colonialism, capitalism, imperialism, patriarchy?
- What action is being taken to dismantle cyclical 'isms', i.e. racism, sexism?
- How do geo-political and global financial structures perpetuate women's inequality?
- Are global cycles of war and conflict linked to violence against women, and how?
- In what ways do financial crises and wavering global economies contribute to

women's poverty?

Breaking Ceilings

- Women across the planet are working to dismantle the ceilings – glass and otherwise – that serve to maintain women's inequality.
- Does the western concept of the 'glass ceiling' (an invisible block to upward mobility) keep women from accessing power itself, and how? What happens if/after the ceiling is broken?
- How are women forging opportunities for educational and civic advancement?
- What limits must women overcome when striving for what men easily claim?
- How are women challenging 'the boys club' in communities, workplaces, and institutions around the world?
- What are women doing to shatter ceilings within our own social justice and equality-seeking movements that benefit a few and exclude others?

Breaking Barriers

- The so-called global village is full of 'fences' that particularly affect women.
- What does the modern era of transnationalism mean for women?
- How has globalization transformed the meaning of borders – geographic and otherwise?
- How are women redefining boundaries – political, geo-political, economic, academic – in a way that promotes women's equality, leadership, and security?
- In what ways are women dismantling barriers to social services like health, justice, and education?

Breaking Ground

- Across the planet – in urban and rural communities – women are changing rules, seizing opportunities, and forging new ground. From academia to the grassroots, what new ground is being broken by women, and how?
- What are the emergent ideas (from the academy and other idea labs) that propose fresh ways of analyzing, doing, and overcoming?
- What new politics and new ways of political organizing are being practiced?
- How can women's organizations maintain resilience and momentum in the face of those aspects of globalization which oppose women's equality?
- In what ways can intergenerational exchange inspire the laying of foundations of a new era of women's movements?
- How are other critical exchanges – between North and South, East and West, academic and grassroots, resourced and otherwise – leading to innovation strategies that work?
- Which contemporary political victories and agendas present the most urgency?

Questions that fit under all 'Breaking' themes

- What divides or injustices exist between us as women working for equality, and how

are they being challenged?

- Can there ever be such a thing as equal access to power?
- What bridges are women building between our generations, races, cultures, ethnicities, (dis)abilities, sexualities, geographies, and beyond?
- What can technology and new media offer women to affect change?
- What new tactics, tools, and political ideas are women and communities employing to break systemic cycles, ceilings, and barriers?
- In what ways do modern wars (on terror, on drugs, on fundamentalisms) jeopardize the struggle for women's equality and rights?
- How are women particularly restricted, excluded, or secluded from possible benefits of globalization? Or included?

2. Highlights of interesting presentations

Individual presentations are all arranged according to the aforementioned four overarching themes in 4 consecutive afternoons, as the morning session 9:00-11:30 are all dedicated to plenary sessions.

July 6th Plenary: Breaking Barriers

On July 6th, the plenary session focused on 'barriers, borders, boundaries' and featured four speakers from Canada (Mary Simon), USA (Judith Heumann), Australia (Raewyn Connell), and Belgium (Malika Hamidi). In the plenary, the four speakers have impressed the audience by their kin and passionate presentations. For me, Judith Heumann has demonstrated a great role model for all disabled people to pursue the importance of their lives; and the transsexual Australian feminist scholar Raewyn Connell has a brave example for practicing gender theories so deeply as to diminish 'his' masculinity therefore underwent an expansive and threatening surgery to change his/her body and sex. Raewyn Connell has been a well-respected and well-cited feminist scholar by Taiwan's gender study researchers.

149 Gendering Excellence in Academia

On July 5th, the session 'Gendering excellence in academia: gender studies, science and technology, critical reflections and critical actions' gathered presenters from 6 countries including Finland, Iceland, Sweden, United Kingdom, Norway, and Netherlands. I must attend this session because it was one of the few sessions focusing on science and technology issues. This panel included four papers and talked about the reflections and actions taken for breaking gender ceilings/barriers in science and technology fields. I was impressed by the great network and opportunities for scholars in EU. These networks, as addressed in the congress book and in their presentation, include genSET, an EU project on gender equality in science and technology institutions; GEXcel, a joint university centre of gender excellence in

Linköping and Örebro, Sweden; EDDA, in Icelandic centre of excellence, equality, and diversity; and finally, the Routledge Advances book series in feminist studies and intersectionality. These projects show how advanced the EU had made progress in concerning gender issues in science and technology, while in Taiwan, the government has just taken the initial step as the NSC set up the ‘gender and technology research grant.’ Hopefully, Taiwan can catch up sooner than later.

230 Teaching with gender: Asian and European Perspectives

On July 6th, 8 presenters from 6 countries gathered together to talk about teaching with gender in their fields. Three of the 8 presenters are from South Korea, two of which from the Ewha Women’s University. This session interested me especially for two reasons: first, it focused on Asian; second, it focused on teaching. One of the Korean presenters are also an editor of the AASW journal, which is so far the most well-organized gender studies journal in Asia. Comparing to Taiwan’s lack of such kind of journal, South Korea obviously has made far advanced progress in either gender studies or focus on gender in science and technology. The establishment of the Ministry of Gender Equality in 2000 by the South Korean government has made great impact on the leadership of Korean scholarship in these fields.

3. My presentation: 13:00—14:30, Tuesday, 5th July, 2011

Topic:

Breaking the gender culture of science by teaching feminism

Abstract & Brief Content:

Science in the 21st century is still functioning as the ‘boys club’ thus perpetuating a culture of masculine dominance. This research asks how teaching feminism can raise women students’ gender consciousness that would lead them to insist their rights in science and break the gender culture in which they participate.

Feminist science educators across the planet have acknowledged that the gender culture of science is one of the key factors preventing women’s participation. Albeit slow increases in percentages at various stages of learning, science in the 21st century is still functioning as the ‘boys club’ thus perpetuating a culture of masculine dominance. To dismantle this gender inequity, what science needs are no longer biological women who may resolve into substitute men but ideological feminists who can identify those inequitable assumptions in the culture of science and therefore challenge from within.

To foster feminist literacy at an earlier stage of learning, this research asks whether teaching

feminism to science students may change their ideas about science and how they may be empowered in viewing their own experiences in learning science. This research focuses on women students of college and graduate levels where many of them encounter learning difficulties and easily slip into self-suspensions whether they are the right gender to study science. Adopting an interventionist approach, this research teaches feminism to those women students in order to prepare them to become critical to their situations, to pursue their rights in studying science, therefore to remain in a science career.

This research takes place in Taiwan. In-depth interviews and program interventions are used as the main data collection methods during two research phases of August 2009 to May 2010 and June 2010 to June 2011. A “model” and nine “learning” women students have participated in this study. The model student showed a successful intervention case as she chose to study gender courses as well as stay in science major after learning feminism. The other nine ‘learning’ cases experienced similar but less stimulations and showed three major responses after the interventions of seeing women role models talking gender issues in science: exceptionalizing, encouraged, semi-resisting. Preliminary findings show that, even in the 21st century, women who choose science majors still experience along their learning paths various discouragement stressing that science is not for women and there is a serious lack of roll-modeling with clear feminist messages. However, after some intervention, teaching feminism at earlier stages does help to raise women students’ gender consciousness that would lead their way to insist their rights in science and reconsider the gender culture in which they participate.

This research will call attentions from scholars who concern of gender equity in science and science education, and those who care about bridging collaborations between feminist communities and scientist societies. Audience participate in this session may expect a fruitful discussion on the most recent research issues of gender and science studies.

This research addresses to the congress theme of ‘breaking the ceilings’ by discussing how women can learn to challenge the gender culture of science as ‘boys club’ by teaching feminism in earlier stages of learning. At this age of globalization in which science affect every step of life and choice, women must strengthen their participation and power in science and in turn change the quality and nature of it. Keywords: gender equity, science, education, feminist intervention, roll-model.

Power Point Slides:

The Slides I presented in the conference are as follows. They are 14 in total, including the front page and some from the previous year presented in ASERA 2010.

Breaking the gender culture of science by teaching feminism

Dr. Li-Ling Tsai & Ms. Pei-Ying Lin
 Graduate Institute of Gender Education
 National Kaohsiung Normal U., Taiwan
 for Women's World 2011
 July, Ottawa, Canada

 <http://gender.ncku.edu.tw>

1

Research Background

- Identity formation is key to learners' career decisions
- From 'why so few' to 'why 'they don't stay'
- Those who stay might not be reflective of gender issues in science
- Science needs not only women but feminists

2

Research Questions

- Can learning gender equity empower those women science students who are in doubt of their career choice?
- Can feminist interventions help to retain women science students?

1

Methods

- Phase I interviews: A model case May and a reference case Roo
- Phase II interviews: 10 other college women students in science-related departments
- Phase III: Feminist intervention
- August 2009—May 2011

4

Discouraging Discourse I

- Those male professors, not only one, would think that only guys are the most excellent, even though the first-place person in our class is a girl. (Rain)
- I just know that you must be smart enough...that guy is just smarter than the two girls...every male seniors say that, you must be smart enough. (Coco)

5

Discouraging Discourse II

- I went to college and found, shoot, our brains are just not as good as guys. I'd better off study management. (Nono)
- My dad doesn't want me to be so hard working...he thinks that I'll have to take care of my own family. (Chu)
- Many successful women are single, they must sacrifice something... (Nini)

6

Gendered treatment

- The male senior said that he would have kicked me off the lab if I were not a girl...this is the only good thing, I think, the male seniors would be more patient and not scolding girls all the time...wow, being a girl could be advantageous, finally. (Bee)

1

The Model Case May

- She was good at both science and humanities in high school. She chose science for higher income considerations.
- A male professor said that girls could not do well in exams requiring more thinking.
- She got only 'cutting jobs' in the lab.
- Under serious self-suspicion, she took my gender study course, starting get in touch with feminist discourses, including role models, books, conferences, workshops, newsletters.
- She feels empowered and decides to stay in science careers.

8

Benevolent Sexism

After May got 16% in Electronics 101:

- Male Professor A: "That's OK. This exam requires more thinking, so girls achieved lower marks."
- Male Professor B: "It's OK, don't be so sad. No one will remember this low mark when you get married."



How Role Models help

- Not feeling alone any more
- Feeling safe
- Finding values (science for living; science as social construction) for staying



Feminist Interventions

- Taking gender study courses
- Reading gender study books
- Meeting feminist professors
- Participating in gender and science conferences or workshops
- Watching role-model films
- Reading women & science Newsletters
- Teaching women's rights to and values in science



2002 female physicist and chemist joint symposium



The film on women in physics in Taiwan, released 2005



Reactions to the film

- Exceptionalizing: I cannot be them—Min*, Nono, Chen
- Encouraged: Wish I can be like them—Chu, Bee*, Hua, Rain*
- Semi-resisting: Yes, but why mention "women"—Nini, Coco*
- (Jade* hasn't seen)
- To be continued



Conclusion

- Roo: If anyone chooses about science because of their gender, either included with no interests or excluded with defected access, it's just unfair.
- May: I feel empowered and safe. I want to stay to help out those who are still uncertain about their careers.
- Feminism helps to retain women students in science.



Appendix: Short 'Her-Story' of Women's Worlds

This congress is held very 3 years in different continents. The WW2011 Congress is the 30th anniversary. Here is the short 'her-story' of the congress:

YEAR	COUNTRY	PLACE
1 st Congress 1981	Haifa, Israel	University of Haifa
2 nd Congress 1984	Groningen, Netherlands	University of Groningen
3 rd Congress 1987	Dublin, Ireland	Trinity College
4 th Congress 1990	New York City, U.S.A.	Hunter College
5 th Congress 1993	San José, Costa Rica	University of Costa Rica
6 th Congress 1996	Adelaide, Australia	University of Adelaide
7 th Congress 1999	Tromsø , Norway	University of Tromsø
8 th Congress 2002	Kampala, Uganda	University of Makerere
9 th Congress 2005	Seoul, South of Korea	Ewha Womans University
10 th Congress 2008	Madrid, Spain	Universidad Complutense de Madrid
11 th Congress 2011	Ottawa-Gatineau, Canada	University of Ottawa

無研發成果推廣資料

98 年度專題研究計畫研究成果彙整表

計畫主持人：蔡麗玲		計畫編號：98-2629-S-017-002-MY2				計畫名稱：要科學也要性別平等--女大學生結合科學與性別意識之學習歷程與楷模研究	
成果項目		量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）	
		實際已達成數（被接受或已發表）	預期總達成數（含實際已達成數）	本計畫實際貢獻百分比			
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 （本國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	2	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	0	100%		
		專書	0	0	100%		章/本
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 （外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

<p>其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)</p>	<p>本計畫之部分成果，亦曾於下列學術發表中被引用</p> <p>Tsai, L. (2010). Gendered Statistics in Science & Technology Education in Taiwan'. 東京お茶の水女子大学性別研究中心。民國 99 年 8 月 27 日。</p> <p>Tsai, L. (2010). Toughness, Caring, and Smoothness: Gender culture and scientist identities in three women-led laboratories in Taiwan. Paper presented at the 41st Annual ASERA Conference. University of Newcastle, Newcastle, Australia. June 30-July 3, 2010</p> <p>蔡麗玲(2009)。從女科學人到科學女性主義者。第二屆國際女性科學家會議(2009ICWS)。高雄：高雄醫學大學。民國 98 年 9 月 6 日。</p>
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	成果項目	量化	名稱或內容性質簡述
科 教 處 計 畫 加 填 項 目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	110	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表 未發表之文稿 撰寫中 無

專利： 已獲得 申請中 無

技轉： 已技轉 洽談中 無

其他：（以 100 字為限）

目前正在整理資料並撰寫論文中，預計投稿國內外科教相關期刊

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

本研究主題非常創新，國際上「性別與科學」研究領域尚未有類似主題之研究，因此非常具有發表潛力。然而也因為其為前瞻性研究，因此目前研究規模與成果仍屬於「探索」性質或「前導」階段，可根據此小規模（十二人）之結果為基礎，規劃較為大型之類似研究，如此更可以引起國際上的注意。本研究結果在台灣與國際上皆具有應用價值，亦開創「性別與科學」研究的嶄新主題，在國際研討會以及相關工作坊發表時，皆能引起與會者進一步的好奇與興趣。可見相關研究應該繼續，以累積並深耕對此類研究的研究觀點，並與國際對話與接軌。