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探討植基於符號互動論的流動學習設計概念

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【摘要】數位學習已蔚為全球化的趨勢，學習在資訊科技發展之下正引起一波新的革命，流動科技(Mobile Technologies)實現攜帶方便、可易地儲存及處理大量資料，提供數位學習更快速、便利的使用平台，真正達到不受時空限制的學習新境界。流動學習(Mobile Learning)已成為數位學習重要之一環。

傳統或客觀主義者認為，知識是由老師直接傳授給學生。然而，建構式學習理論假設知識是學習者憑藉著自己的經驗，是經由個人與社會互動而建構的(Jonassen, 1999)。建構主義者相信知識建構是從活動中以及定著(Anchored)於該活動情境中而來。當學習者面對問題而需要其反思及表達所學時，他們才會將其所學意義化(Peck, Jonassen, & Wilson, 1999)。有意義的互動，將是流動學習設計發展成功的關鍵因素。

然而，現行各派典的學習理論是否能夠完全滿足流動學習發展所需？殊值深省。傳統學校教室課堂教育未來是否會退場？更是大家注意的焦點，流動學習發展不是過去式，而是現在進行式與未來式，實不容許絲毫停頓和遲緩。因此，研究者認為，應以各種學習理論為基礎，找出足以支持與引導發展的方法與方向，同時要以創新的思維，嚐試促進新時代學習理論的萌芽。研究者建議，流動學習設計發展應回歸從人類最基本的心智模式著手，以符號互動理論為基礎，將各類流動科技呈現學習內容的技巧與方法，以最佳方式進行有意義的編序與設計，促進學習者與流動學習內容的互動，引發與維持高度的學習動機，使學習者能如遊戲般的學習，以及有義意的學習成效。

【關鍵字】 流動學習、流動學習設計發展

1. 前言

資訊社會時代，知識的價值商品化，呈現的形式數位化，網際網路不僅成為最主要的資訊源，更是知識之所在。網際網路已經由獲取資訊的工具演變成為資訊的本體。J. Eifert(1994)指出資訊科技的演進，產生教師與學生角色、教學方式、教育目標的變化。傳統老師講、學生聽的被動學習方式，正朝向以學生為主的主動學習方式發展。學生由學習記憶正確答案的知識收集者，轉變成為獨立學習的知識發現者，甚至成為知識的應用者。謝清俊等人(1997)認為資訊科技的提昇，以及網際網路及媒體多樣化的發展，師生的關係已經不受時空限制，成為一種新的學習伙伴關係。Gartner機構以(1)藍牙3及4版本、(2)流動網頁、(3)流動Widget、(4)兼容不同平台的應用開發工具、(5)應用程式商店、(6)增強位置感應、(7)流動寬頻、(8)輕觸式屏幕、(9)M2M、(10)裝置獨立的安全技術等十大重大演變流動技術，指出：「大家都十分期待它們的出現，有些技術更有助企業解決2010年、2011年將面對的流動技術挑戰。」由於流動技術的發展，不僅實現了易於攜帶又能夠在不同地點輕易地儲存及處理大量資料的資訊系統。流動電子裝置的例子包括流動電話、個人數碼助理(PDA)、PDA電話、手提電腦、移動式白板等，提供了數位化學習更加快速、便利的使用平台，真正達到不受時空限制的學習新境界，流動學習(Mobile Learning)自然成為了數位學習重要的發展項目之一。

彼得·杜拉克(Peter Drucker)曾預言，在2025年由網路所提供的課程(Course Providers With Delivery Systems)將取代傳統教室的功能，傳統的大學將成為過去式。全美大學校院董事協會(Association of Governing Boards of University and Colleges, AGB)也指出，再過十年約有1/3的美國獨立大學院校將會關閉，取而代之的是虛擬學校。而Glenn Russell和Bernard Holkner(2000)則提出「虛擬學校」年代已經來臨，諸如目前知名的Rocky View Virtual School及Academy Virtual School等，這一類型的新興教育機制與方法將會持續不斷的增長，對目前的學校教育勢必造成巨大的衝擊和影響。(施文玲，2007)

麻省理工學院 S. Papert(1997)認為「數位科技扮演著雙重角色：其一是作為活動的材料（或媒介），有助於進行更複雜的活動；其二是作為資訊與通信管道，讓兒童有主動追尋知識的管道，而不必聽由課程設計來安排他們應該要獲得什麼知識。這樣的轉變，足以讓因循守舊的課程瓦解，甚至將兒童分年級的想法都失去意義。更確切來說，它讓學校的既定形象失去意義。」

2. 數位學習之定義

隨著教育科技的發展及網際網路的普及，學習已經不再侷限於傳統的教室學習型態，出現多樣、創新的學習風貌，數位學習在此一資訊社會變革當中，挾其優勢條件應運而生，各式各樣的數位學習如雨後春筍般的發展，展現了以學生為中心的學習型態，為人類學習注入新的活力，但是，究竟什麼是數位學習呢？

吳美美(2004)在其研究歸納後指出，數位學習是使用者透過電腦、廣播、錄音帶、網路...等數位化電子資源媒體來進行學習的方式，並由其所提供之數位內容及教學方法來創造學習經驗，以達成學習目的。數位學習可以是正式學習，包含非同步學習(Asynchronous Learning)、線上學習(Online Learning)、網站學習(Web-Based Learning)、網絡學習(Networked Learning)、遠距學習(Distance Learning)等。非同步學習意指學習者在不同的時間進行學習。線上學習、網站學習及網絡學習則是利用網際網路進行傳播或利用網際網路上的資源進行學習。網絡學習指的則是同儕間運用合作學習方式來進行學習，遠距學習則是強調師生各在不同的學習地點，進行非面對面的學習活動。

施文玲(2007)則指出，數位化教學有七個不同於傳統教學的特色：(1)學習態度主動化。(2)學習環境個人化。(3)學習內容適性化。(4)學習資訊數位化。(5)教學傳遞網路化。(6)學習社群虛擬化。(7)學習評量多元化。實施數位化教學的網路系統環境則應具備：(1)虛擬教室功能(2)提供教材功能(3)教師指導功能(4)評量測驗功能(5)虛擬同儕功能(6)教學管理功能(7)行政管理功能(8)虛擬圖書館及課外參考書。

綜合以上學者所述可得知，數位學習應具備以下三種基本要件：

- 一、網路化的學習環境：網路化環境使得教學者與學習者能夠隨時進行即時（或是非同步）收發存取、傳達分享教學或學習資訊，不受時空限制的資訊共享與學習活動。
- 二、資訊化的科技應用：數位學習利用各類型資訊化軟、硬體技術，將學習課程以電子化形式提供學習者豐富的呈現型態與互動模式，進行學習活動。
- 三、個人化的學習活動：數位學習模式著重於以學習者為中心的個人主動學習活動，豐富個人的學習內容，歷程，以及依個人的選擇參與合作式學習活動，可培養獨立學習、探索的精神，亦可進行多項化的合作學習活動。

廖萬里(2009)指出，所謂流動學習，是一種不受時地限制的教學模式，它可以促進自學，亦可配合師生一起的教學模式，主要是利用流動儀器進行學習。流動學習的運用範圍包括課室、校園，甚至於戶外作全方位教學活動。甚至可以利用離線移動學習系統，提供教學者或學習者離線進行教學準備、離線教學或離線自學等，展現數位學習更為便利的效果。

流動學習已成為數位學習重要之一環，其成功與否的關鍵是學習者的動機與認知，無論在課程設計、學習內容呈現、學習歷程與策略，都朝向個人化需求為導向。因此，當我們在設計與規劃流動學習課程或內容時，核心問題就在於人類究竟如何學習？學習主要的具體展現能力是什麼？這就需要深入探討人類的心智模式與對外界如何互動，始得以掌握關鍵因素，提供真正符合個人化學習需求的流動學習內容。

3. 人類心智模式

學習是人類將外界的一切感知，經過認知過程而儲存於長期記憶中，做為日後對外界刺激的反應主要的參考對照，它仰賴於人類心智模式的運作。心智模式早期的研究是來自於自然科學中控制論，Veldhuyzen & Stassen (1977)認為心智模式是控制系統的背後知識，它讓系統行為得以順利完成的一套標準或是策略。之後的一些研究則轉向認為「心智模式」的功能在於讓個體得以預測和解釋系統的行為，並作為一種記錄關係和事件的記憶機制(Williams, Hollan, & Stevens, 1983)。Wickens(1984)提出心智模式是人類心智當中一種假設性的建構(Hypothetical Construct)，可以幫助個體審視環境、形成計畫、以及對行為產生分類。其他學者亦認為心智模式可以讓人們進行推論、產生預測、瞭解現象、決定採取

何種的行動、並產生替代性的經驗（Johnson-Laird, 1983）。Kieras & Bovair（1984）則進一步認為心智模式是內在結構以及歷程如何作用的一種機制。（鄔榮霖等人，2009）

Rouse & Morris（1986）認為心智模式是一種個體所擁有的組織性知識結構，透過它可以與環境產生互動，讓個體解釋或是預測行為，辨認人與環境的關係並建構出一套行動的準則或是策略。而這樣的概念也漸漸由個體延伸到團隊與組織，包含Weick（1979）、Senge（1994）、以及其後的人力資源與組織行為的實證與實驗研究。Senge（1994）認為心智模式是深植於個體心靈中，其中包含個體、別人、組織、世界的形象、假設和故事，決定個體對世界的看法。在此一觀點下，所謂的心智模式乃包含了個體與組織賴以行動的基本假設和信念系統（艾昌瑞、李玉蓮，2002）。

綜合上述所述，心智模式是人類對於現實世界的一組知識建構或信念，承載來自文化、社會、群體或是個體的價值信念系統，決定個體如何看待這個世界，從中獲得解釋、預測或是與環境互動（鄔榮霖等人，2009）。因此，在流動學習的發展上，應以此一觀點做為最核心之觀念，一切學習活動若失去了心智互動，則學習將失去其意義。

如果我們想要深入探究了解人類心智是如何發展成形的，首先必須找出是什麼讓人類心智有別於其他生物。根據研究指出，在人類譜系和黑猩猩分開後，一些微小的遺傳漂變（Genetic Shift）讓兩者的計算能力產生了巨大的差異。共有的遺傳組成在重排、刪除和複製之後，創造出具有下列四項特質的大腦，構成了「人類獨特性」：（Marc Hauser，涂可欣譯，2009）

3.1. 衍生計算的能力

衍生計算指的是創造出變化萬千的表達方式。舉凡字的排列、音符的序列、動作的組合或一串數學符號等等。衍生計算包含了兩種運算：遞迴和組合。遞迴是重複使用一個規則來創造出新的表現，就像我們會把一個詞重複地嵌放在另一個詞中，形成含意更深的較長語句來表達想法。舉例來說，美國作家史坦（Gertrude Stein）寫過一句簡單卻充滿詩意的話：「玫瑰是玫瑰還是玫瑰」（A rose is a rose is a rose）。組合運算則是混合不同的元素來產生新概念，像新名詞「隨身聽」（Walkman）或新的音樂類型。

3.2. 隨意組合概念的能力

隨意組合概念指的是串連不同領域的知識。人類會結合對藝術、空間、因果關係和友誼的認識，而產生新的律法、社會關係和科技。例如：我們可以判定社會不容許（道德）我們為了搭救（道德）五個人（數字）的生命而蓄意（大眾心理學）把另一個人推（動作）到火車（物體）前。成語或詩詞將一些文字隨意組合，雖然這些字與字之間並無因果或關連性，但是，將其組合之後，往往內隱一段故事，或者是擬人化意境，產生一種人類獨創的認知方式，例如：一石二鳥、人山人海、黃沙百戰穿金甲、沈魚落燕之美等等。

3.3. 使用心智符號的能力

使用心智符號指的是將所有真實或想像的感覺經驗，轉化為個人內在的符號，或經由語言、藝術、音樂或電腦編碼表達出來。先民洞穴中的壁畫，顯示他們已經了解圖象具有雙重的特質：既是物體，也表達出其他物體和事件。骨頭和象牙所製成的古代樂器，無法透露它演奏出來的樂音，究竟是以重複簡單的旋律或是遞迴方式，讓各種主旋律反覆出現，如果沒有樂譜或其他足以表徵音樂旋律的符號，記錄與解讀將是一大困擾。

3.4. 進行抽象思考的能力

進行抽象思考指的是超越環繞著感覺和認知經驗。人類有許多想法並非來自於真實的認知和經驗，只有人類想得出獨角獸和外星人、名詞和動詞、無窮和上帝。例如：宙斯、阿波羅、波塞冬等，熟悉希臘神話的人都知道他們是誰，代表的是什麼；又如中國的女媧、盤古、應龍等，雖未真實見過，但我們卻也能了解其代表意涵。再如悖論中的阿基里斯追龜說、飛矢不動說，也都是人類獨具的抽象思考能力。

這四種心智能力就是我們在各種學習活動上的主要關鍵，透過外界的各種學習活動，產生有義意的學習，方能使得我們增強與提昇運用這四種心智的能力，來面對外界的種種刺激，採取至當的認知與行為，並不斷的擴張增強，有系統的深植於長期記憶當中。流動科技發展，使非語言和語言形式的各類型象徵符號廣泛的用來呈現人類的所知，數位化的

結果，使它更易於存取、處理與傳播。因此，流動學習設計必須要有更宏觀的視野，包容與肯定各種的表現形式。所以，流動學習必須了解欲增強提昇的學習目標為何，方得以設計並運用流動科技呈現與達到學習的效果。呈現的形式，無論是文字、圖像、影片都應該植基於學習者能夠在各種象徵符號的互動歷程中，展開個人化有意義的學習。

4. 植基於符號互動論的數位學習設計概念

在流動科技發展快速的時代脈動洪流當中，流動學習對現今學校教育的學習環境、學習型態、教材呈現、教師角色已產生了重大影響。如何將學習理論運用於流動學習的設計，以提升學習成效，將是流動學習發展的成敗關鍵。施文鈴(2007)認為一般研究者在探討數位學習的學習理論，不外乎從行為理論、認知學習理論、社會學習理論、到建構式學習理論等進行探討分析，或是以數位學習策略發展的格式塔學習理論、建構主義、情境教學理論等切入，相關研究均已明確提出諸多數位教學的策略，如概念圖、合作學習、錨式情境學習、虛擬實境運用等，俾符合學習理論，發揮數位化教學的特性，轉化知識並達到學習的目標，這些都是在流動學習規劃設計上很好的參考依據。

研究者認為，任何客體與主體之間，一開始是無相關和意義的，當主體對客體產生了知覺，進而形成互動，透過各種形式的運作進入主體而產生認知以後，才會形成意義。例如，路旁的廣告看板如果你沒有去注意它，它依然存在，但是對你而言它不具有任何的意義。當你注意到它的存在以後，進入你的感官、知覺而產生了認知，才會形成你個人的詮釋與意義。這個意義是我們基於過去經驗與認知，與客體之間的比對所出現的互動現象。因此，人類的思考能力係由社會互動所塑造而成，在社會互動過程中，人們首先學會意義與象徵符號，並得以允許其運用獨特的思考能力，而這些符號的意義乃是由社會所賦予。無論是傳統教學，或者是流動學習，仍脫離不開此一現象。另外，人們在互動過程中亦能以其對情境的詮釋為基礎，改變或修正意義與象徵符號。(George Ritzer, 馬康莊、陳信木譯, 1995) 因此，流動學習感以符號互動為設計核心概念，運用資訊科技帶來傳統教學所無法展現的多媒體形式，妥予呈現學習內容，方能有效吸引與維持學習者動機，並進一步達成有義意的學習效果。

符號互動論早在 1950 年代由 H. Blumer 倡導成為重要的社會學理論，E. Goffman 的「戲劇論」與 E. Lemert 的「標籤理論」(Labelling Theory) 均為經常被引用與探討的論點。就教育社會學而言，1960 年代末期才大量應用符號互動論，例如 Hargreaves (1967)、Jackson (1968)、Lacey (1970)、Nash (1973)、Delamont (1976) 及 Woods (1983) 等人。符號互動論的核心概念分述如下：(林義男、王文科, 1998)

一、符號使用與溝通

人類的互動係透過象徵符號來進行，而這些符號的意義是由社會情境所加以界定。當我們接受外界符號的刺激時，通常會先就其意義進行解釋分析，然後再設法反應。所以，人們在互動過程中以象徵符號來表達意念、價值與思想，而符號的意義則隨個人與情境的變化而產生不同解釋。不管此種現象是否真確，日常活動往往會產生和此種解釋相符應的結果。(陳奎熹, 2006) 由此可知，符號的使用與溝通是相當複雜的，同時人們也運用彼此都能理解的符號進行互動，進而適應環境以求得生存，流動學習的內容呈現應注意此一關鍵問題。

二、互動與角色扮演

人類進行辨認和解釋象徵符號的方式進行互動與溝通。並不受到時空的限制，透過它可以想像過去人們的生活狀況，也可以推測未來的憧憬。此外，互動的雙方可以藉由理解對方的反應，預期可能結果，而這種把自己放在他人位置上的能力，可稱為「扮演他人角色」。(吳曲輝等人譯, 2002) 它是一種能夠分辨他人態度和行為意向的能力，符號互動論者強調，角色扮演是互動產生的基本途徑，但是這種過程與脈絡之間息息相關。所謂「互動脈絡」並是由人、事、時、地、物所構成，它是在互動過程中由互動者(如師生)透過協商所共同建構而成，而且是一種持續變動與調適的動態過程。因此，如何使流動學習具備此一功能，將考驗著設計者的思維與創意。

三、心靈與社會

G. H. Mead 指出心靈、自我與社會具有緊密相連的關係。因此，符號互動論者著重分析人性起源和互動模式的關係，強調人類共同的能力。他們認為心靈是一種思維能力，可以用符號來指示各種行為方式，然後選擇適合的解決方案。（吳曲輝等人譯，2002）人們具有閱讀、詮釋與賦予符號意義的能力，而此一互動並非主觀的投射，而是必須面對來自他人的各種回應，溝通與調合的過程。因此，社會的存在係倚靠人類的思維和解釋能力，以及自我反省與評價的能力。所以，流動學習必須深入剖析知識、資訊和權力三者之間的關係，並預測學習者可能產生的反應為要點，建構一個良好的心靈與社會脈絡情境與互動關係。

流動學習內容以多媒體型式來呈現，旨在達成學習者將其內化成為自己所擁有的知識為目的，在互動的過程當中，究竟運用何種心智模式，或是多種並列同步處理，不僅考驗著學習者，更考驗著流動學習多媒體設計發展者的能力與巧思。如何有效、多層次的促進學習者運用單一或多種層的心智模式來進行學習，又能夠避免不良潛在課程肇生，這是未來精緻化數位多媒體學習發展的一項課題。

5. 結語

流動科技所帶來的流動學習風潮，引領著教育的未來發展趨勢，它所帶來的衝擊與影響實難以評估。R. McClintock 指出，數位圖書館、多媒體以及流動技術，將使學生和知識的互動形態徹底改變；老師的角色將轉變成為指導或幫助學生，在數位化資源中尋找並獲取知識。教育政策也將從過去思考如何選擇要教給學生那一些有限的知識，並設法成功的將知識傳授給學生，轉變成為如何讓學生能夠有效的利用網路浩瀚資源當中，獲取他們所需要的知識。（McClintock, 1996）

最後，我們應以戒慎恐懼之心，來面對此一變革，過去的學習理論，教育政策，以及長久以來的思維與策略是否能夠滿足未來流動學習的變革呢？在新的理論尚未形成，我們是否應回頭檢視現有各種學習理論典派在流動學習設計上的適用性，亦再回頭去探究人類最基本的心智模式，從這些基本的能力著手，再依據我們與外界互動的機制，無論是何種型態的象徵符號，然後朝向預期學習目標去規劃設計轉換這些載體，成為流動學習的呈現模式，滿足個人化學習與需求。在經驗累積成長的過程當中，相信符合流動學習資訊科技所帶給人類學習變革發展中，一種嶄新的學習觀念與理論將會逐漸浮現，並促進人類學習模式的再進化。

參考文獻

- Gartner, "Ten Mobile Technologies to Watch in 2010 and 2011" Report, 25 March 2010.
<http://www.gartner.com/resId=1311324>
- R. McClintock, "Renewing the Progressive Contract with Posterity: On the Social Construction of Digital Learning Communities", May, 1996.
<http://www.ilt.columbia.edu/mcclintock/renew/index.htm>
- George Ritzer（馬康莊、陳信木譯），社會學理論（上、下冊）。台北：巨流，1995 年。
- J. Eifert(1994)., "Charting Changes in Engineering Education" ASEE PRISM.
- Jonathan H. Tuner（吳曲輝等譯），社會學理論的結構。台北：桂冠，2002 年。
- Marc Hauser(涂可欣譯)，科學人雜誌第 92 期，2009 年 10 月，頁 38-45。
- S. Papert. The Connected Family，中譯本 WWW 新家庭，大塊文化，1997 年。
- 艾昌瑞、李玉蓮，T 公司成員的心智模式分析，商管科技季刊 3(4)，2002 年，頁 303-318。
- 吳美美，數位學習現況與未來發展，圖書館學與資訊科學 30(2)，2004 年，頁 92-106。
- 林義男、王文科，教育社會學。台北：五南，1998 年。
- 施文玲，以學習理論為基礎的數位化教學策略，生活科技教育月刊第 40(2)，2007 年，頁 32-41。
- 陳奎熹，教育社會學研究。台北：師大書苑，2006 年。

鄔榮霖、王思峰、徐達光，山不轉路轉：創業家心智模式改變與企業的轉折歷程，創業管理研究 4(1)，2009 年 3 月，頁 1-31。

謝清俊、尹建中、李英明、張一蕃、瞿海源、羅曉南、謝瀛春，資訊科技對人文、社會的衝擊與影響，行政院經濟建設委員會委託研究計畫結案報告，統一編號：017064860233，1997 年 6 月 20 日。

廖萬里，移動學習的發展，移動科技及教育協會簡報，

<http://qcrc.qef.org.hk/upload/File/TPESM%202009/34AA/34AA-4.ppt>

RFID 技术与科学探究

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【摘 要】作为一种自动识别技术与短距离通信技术，RFID 技术具有识读速度快、非接触性、实时动态、防碰撞性等特点，并广泛地应用于日常生活中，这为学生科学探究能力的提升提供了可能。论文以“RFID 技术本身特性的探究”与“RFID 技术结合‘植物的分类’科学教学内容的探究”为例，论述了 RFID 技术在科学探究活动各阶段之应用，提出 RFID 技术可以促进学生探究能力的培养。

【关键词】RFID、科学探究、科技优化学习

Abstract: As a kind of high technology for auto identification and short-distance communication, RFID (Radio Frequency Identification) which possesses a number of special features and has been widely applied in our daily-life, is highly suitable for enhancing students' scientific investigation abilities. In this paper, we highlight certain features or physical characteristics of RFID which can be used to effectively support or enhance children's learning of science within and outside school environment. Then, we put forward two exemplars, namely "scientific investigation of RFID technology" (subject matter aspect) and "RFID for supporting 'Classification of plants' through inquiry approach" (pedagogy aspect) to nurture students' science process skills, rendering some innovative ways of applying RFID in science education. Finally, we briefly discuss about the educational implications of using RFID in the aforementioned exemplars and other general situations.

Keywords: RFID, scientific investigation, technology-enhanced learning

1 · 引言

“科学探究”或“探究教学”在当前国际基础科学教育界彰显了特有的关注与聚焦，“以科学探究为核心”成为国际科学教育的共识(Flick & Lederman, 2006)。科学探究已成为一项重要的目标，一种重要的学习方式，体现在各国的科学教育纲领性文件与教学实践中，表现为对复杂性科学探究在内容与方法等层面明确而具体的规定；显现为对科学探究能力的界定与明晰化；彰显为科学教学的研究也关注与聚焦于如何培养或提升学生的科学探究能力要素及科学探究真实情境的创设。RFID 技术作为一种自动识别技术与短距离通信技术，其储存容量大、识读性能强（快速、非接触式、实时动态、防碰撞、唯一的序列码识别等），为科学探究能力的提升提供了平台，有助于实践以现代最新科技促进科学教育改革（Scanlon, Morris, Di Paolo & Cooper, 2002; Holliman & Scanlon, 2004; Hennessy et al, 2007）。

2 · RFID 技术组成、特性及教育应用

RFID 技术是一个宽泛的概念，有不同的类型，但系统的组成基本上由阅读器（也称读写器）、电子标签与应用系统构成。电子标签一般包括天线、调制器、编码器与储存器等，它置于被识别的物体上，存储着该物体的相关信息。阅读器由天线、射频发射模块、控制处理模块组成，它与电子标签间的数据传送是通过空中接口实现——阅读器向标签发送命令，标签随之做出相应的反应。阅读器除了与标签间的数据通讯外，还要将采集到的标签数据通过应用程序接口 API (Application Program Interface)回送到后端的应用系统中，即实现了数据信息的读。对于可读写的 RFID 系统，还要求阅读器通过 API 可以接收应用系统

的命令，并向标签中写入相关数据信息。RFID 技术通过读写功能实现为学生学习活动提供相关信息及对应的反馈信息。

不管是通过负载调制实现数据传输的近距离 RFID 系统，还是通过反向散射得以数据传输的远距离 RFID 系统，都可通过被识别物品与识别装置间的接近，自动获取被识别物品的相关信息，并提供给后台的计算机处理系统来完成相关后续处理(游战清，刘克胜，吴翔，林汉宏，2007)。因而，RFID 技术的自动识别特性在教学中可用于自动记录与判断学生的活动。相对其它自动识别技术（条码技术、光识别技术、语音识别、生物识别、磁卡、接触 IC 卡），RFID 技术除了识别速度快、储存容量大、识别的唯一性、对环境的强适应性（如低频 RFID 在金属或液体中仍有较好的读取能力，从而拓宽了学生活动所能记录的范围）等，还具有防碰撞功能——同时识读多个标签，有助于实现对多个学生活动的同时记录。RFID 作为一种短距离通信技术，可实现实时动态通信——如以 0.02-0.01ms/每标签的速率与阅读器进行数据与信息通讯，且在可识读的范围内，可以对其位置进行动态追踪与监控，即使实时记录与反馈学生信息提供了可能。

正是基于 RFID 技术的特性，RFID 自 20 世纪 60 年代应用于商业中的防盗与销售记录以来，广泛地涉足于交通、生产、商业、物流、管理等不同领域与区域的应用。也将应用触角延伸至教育领域，不仅有效应用于学生安全管理、学校行政管理、资产管理，也体现在教育教学各方面（黄晓，杨友源，江绍祥，2009）。那么，可否以 RFID 技术促进科学探究活动的开展，以有效促进学生科学探究能力之养成？

3.RFID 与科学探究活动

基于学生对 RFID 技术最普遍的体验表现为公交、校园一卡通、银行、电信、收费站（香港的八达通）等，如何基于学生经验吸引学生参与科学探究是科学探究的起点。可从两方面设问引导参与：（1）RFID 标签是常接触并渗透于日常生活应用中，RFID 标签作为 IC 卡的一种，其自身特性如何？——为何 RFID 阅读器与标签采用的外壳材料是 ABS 塑料，而非金属？标签与阅读器内部都有晶片与天线，实现对外界的感应，这些内置天线各有什么特点，可感应的范围如何？会受何种因素或环境影响？等等。关于 RFID 自身特性的每一个问题都可以吸引学生参与探究活动过程。（2）基于对（1）中 RFID 特性的认识与应用技能的把握，RFID 如何结合具体的科学教学内容（此处我们选择小学科学教材中的植物的分类为例），促进科学教学探究活动的开展？

对于科学探究过程中的第二环节（即预备探究），RFID 同样也从两层面体现其功能：

3.1. RFID 自身性能的探究

选取所需的辅助器材，包括 RFID 阅读器（如图 1a），与标签感应过程数据传送的应用



系统（电脑），用于直观呈现感应信号的波形幅值与频率的示波器。将 RFID 标签外壳拆开（如图 1b），以便将其与示波器连接（如图 1c）。具体的探究活动，可结合五个不同维度的实验体现，其科学实验活动依据杨友源（杨友源，2008）提出的科技促进科学教育方案设计，旨在让学生参与这些活动过程中提升探究能力。（如表 1）。

表 1：RFID 特性探究		
探究维度	可探究的子问题	新问题
①不同材料对 RFID 感应性能的影响	a) 为何不用金属、玻璃等材料代替塑料外壳？这些材料（材质、面积等）对 RFID 感应性能的影响如何？	为什么方形贴片与条形铁栏对 RFID 感应的干扰差别显著（近 10 倍）？
	b) 比较不同材料对 RFID 感应性能影响的前提条件是什么？	
②RFID 感应距离（感应随高度的变化）	a) RFID 能感应到的距离确切为多少？（是否与理论值相当？）	
	b) 感应的高度值与感应强度是否存在数值关系（或图示化）	
③RFID 感应范围（平面运动对感应的影响）	a) 如何测定不同位置（中心位置或远离中心）的感应值？	
	b) 同一平面不同位置感应强度是否存在某一规律（如同心圆、方形）	
④RFID 感应效果（倾斜角度对感应的影响）	a) 如何测定不同角度变化（改变角度的工具、值）对感应的影响？	
	b) 不同倾斜角度与感应值的对应数值关系（或图像）？	
⑤RFID 对不同材料物体感应的进一步探究	a) RFID 对不同形态（固、液体）物体的感应如何测定？如何测定？	如何解释多张光盘相对一张光盘对 RFID 感应的影响效果？不同材料、形态对 RFID 感应影响探究有何应用？
	b) 测量仪器是否对 RFID 感应有影响？该如何避免？	

3.2 · “植物的分类”教学内容

选取探究活动中的设备与仪器——除了应用系统（电脑）外，采用的 RFID 阅读器为深圳峰华公司的工作频率为 13.56MHz 的 S8-A 阅读器，能读写 Mifare S50, S70 与 Utralight 芯片，标签采用 Mifare S50（最好采用不干胶形），以将其与各种植物对应，用植物名词标记（如图 4）。同时备一张卡状的 Mifare S50 标签用于记录学生的各种参与学习情况，存储为学生的学习档案袋。因而整个活动的教学原理图可呈现为如图 2：

探究活动的设计与开展是探究学习过程中的重点，体现了学生的设计、实验能力及解释与表达能力等。对于 RFID 特性的探究活动，可依据表 1 中的五个维度的问题，形成各部分的子问题得以具体开展。而针对 RFID 结合“植物的分类”这一科学内容问题的探究活动，可分成三步开展：（1）认识各种植物——各种植物在 RFID 阅读器的天线感应场内时，与阅读器连接的 Database 可以为学生提供植物的相关信息（植物的生长条件、植物形态、药用功能、性能及饮食文化等），同时记录学生的活动行为；（2）植物的各种分类——学生按自己的分类方法（如颜色、大小、形状、结构、味道等）对各种植物进行分类，RFID 能自动、实时地判断学生分类活动，并提供对应的反馈信息，如归类正确时进一步提问学生该种分类的原因与依据。（3）学生在前两次活动中认识到多种分类方法后，将各植物按植物的部位（根、茎、叶、果实、花）进行分类活动，同样在 RFID 阅读器感应范围内，系统会自动判断学生分类，并提供结果信息。

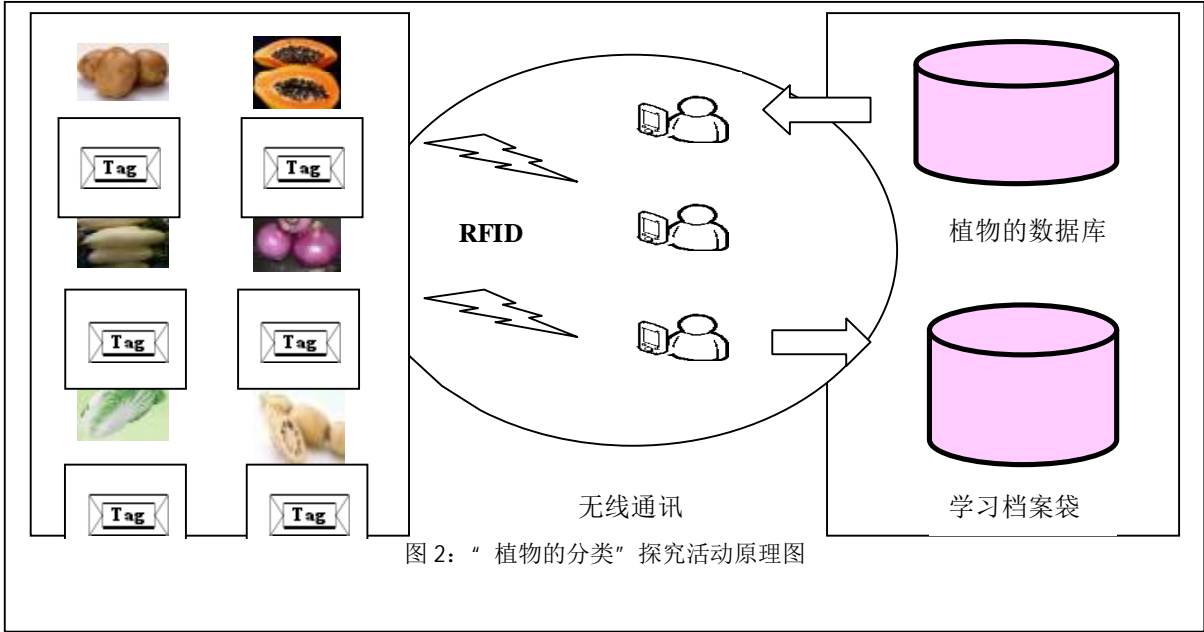


图 2：“植物的分类”探究活动原理图

4.讨论与反思

探究活动是学生探究问题的过程，也是与同伴交流解决问题的过程，其间离不开学生个体的主动探索、思考、表达与解释，也离不开与同伴的交流、争辩及帮助，以获得对结果的支持论据(Flick & Lederman, 2006)。对 RFID 特性的探究中，交流、表达、解释及报告源于不同学生个体对不同子问题的探究，源于不同的方案、手段探究结果的差异——如对于



图 3a：学生探究活动 2 中可能的不同反馈结果

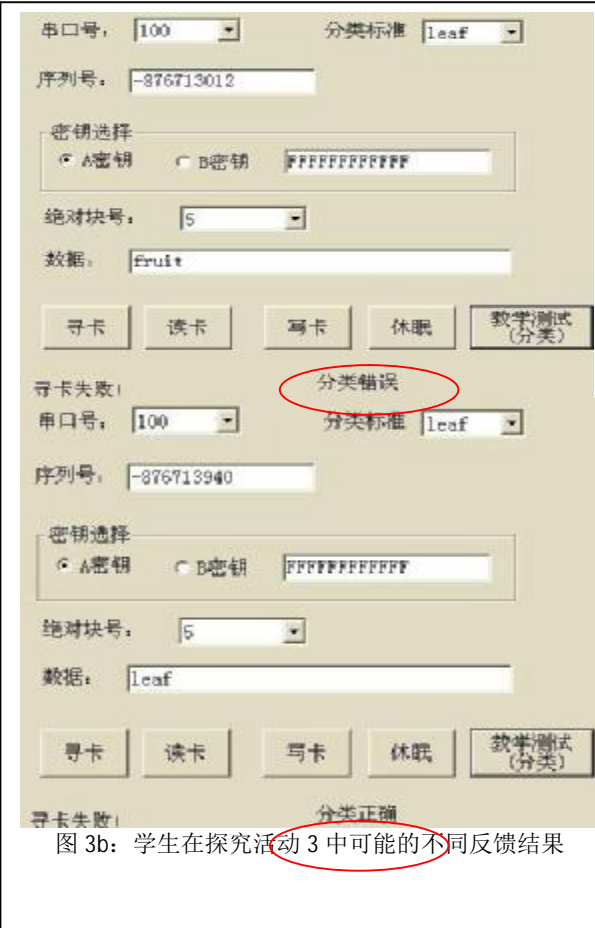


图 3b：学生在探究活动 3 中可能的不同反馈结果

探究维度①，有学习者选择金属作为探究的材料，有学习者选择书纸、布等作为探究的材料，因而得出的结论会有差异，特别是选择金属作为探究材质的学习者，可以结合探究维度②，通过实验获得证据，阐释表 1 中的理论陈述：金属材质使信号衰减，减少了识读距离。又如对于维度③与维度④的探究，不同学习者可能选择不同的表征方式（图像法、公式、文字表达）来表达同一平面不同位置及不同倾斜角与感应强度的数值关系。不管是观

察与探究结果的差异，还是方法与手段的不同，都可以促使学习者对其思维的表达、交流、解释、论证、反思与评价。因而表 2 中呈现的观察现象与可能的结果，也只是某种可能呈现的思维、探究与交流的结果。而基于探究结论汇报、交流与解释过程中又引发的新问题，成为又一次探究的起点。同样，对于结合“植物的分类”这一学科内容的探究活动，学生在经历“植物的多种分类活动（活动 2）”与“按植物部位进行分类（活动 3）”的探究中，会呈现不同的分类结果（如图 3a，图 3b），RFID 技术的实时反馈促使学生在探究学习过程的交流、解释、报告及合作中得以彰显，同时也引发进一步探究的新问题：为什么这样的分类不行？正确的分类只有一种吗？分类完整吗？等等。

5. 總結

本文提出以 RFID 技术内在特性的探究，以及对 RFID 技术融合于具体科学内容教学中的探究，来达成科学探究教学的实现。具体表现为个性化科学探究情境的彰显——RFID 的应用系统可实时提供学生真实的、与生活密切相关的科学、技术与社会问题情境，提供学生探究中理解科学的机会；RFID 系统实时的记录学习活动，依其个性化需求提供探究问题的信息与反馈。多元合作途径的实现——学生可基于不同兴趣主题的协商与合作，可以是基于探究的要求与学习风格的合作同伴的选择，体现了合作的不受时空性与丰富、多元性。科学探究过程中有效过程评价的达成——对学生科学探究活动中的观察与分析是有效评价不可或缺的，RFID 技术的实时记录与跟踪学习过程，确保了有效科学探究活动的可能。

参考文献：

- 杨友源（2008）。以资讯技术优化物理学习的范例——低成本的电脑辅助物理实验。《大学物理》，20（2），68-72。
- 黄晓、杨友源、江绍祥（2009）。RFID 应用于教育述评。《电化教育研究》，11，73-77。
- 游战清、刘克胜、吴翔、林汉宏等编著（2007）。《无线射频识别（RFID）与条码技术》。机械工业出版社，285。
- Flick, L.B., & Lederman, N.G. (2006). *Scientific Inquiry and Nature of Science: Implications for Teaching, Learning, and Teacher Education*. Netherlands: Springer.
- Hofstein, A., & Lunetta, V. N. (2004). The Laboratory in Science Education: Foundations for the Twenty-First Century. *International Journal of Science Education*, 88, 28-54.
- Holliman, R., & Scanlon, E. (2004). *Mediating Science Learning Through Information and Communications Technology*. London: Routledge Falmer.
- Scanlon, E., Morris, E., Di Paolo, T., & Cooper, M. (2002). Contemporary Approaches to Learning Science: Technologically-mediated Practical Work. *Studies in Science Education*, 38, 73-114.

Outcome-oriented Review of Twenty-Four Important Game-related Studies on Joyful Learning and Society

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Abstract: *This literature review summarizes game-based learning studies based on the categories of research outcomes. The analysis includes total of 24 research papers that were published in the recent decade. In this paper, the basic research information was reviewed, and their outcomes were analyzed in-depth based on the three categories including cognitive aspect, affective and social aspect, and psychomotor skill aspect, as well as behavior aspect. The result showed that the participants were covered from elementary school students to graduate students, and has the potential to be applied in different level courses. Moreover, experiment design was usually used, and qualitative research methods are seldom used alone. In spite of the cross-aspect nature of each study, we found that more studies focus on the impact of digital games on students' cognitive and affective and social aspects as well as fewer studies focus on the psychomotor skill aspects. However, psychomotor skill aspect has large effect; cognitive and affective and social aspects have only medium effect.*

Keywords: digital game-based learning, literature review, cognitive, affective and social, psychomotor skill

1. Introduction

Digital game has become an important educational tool that teachers and scholars are trying to figure out its impact to our students. Prensky (2001) mentioned that the 21st century is a generation of game-based learning, and he called the people who were born after 1975 as the G generation. As more researchers investigated the effects of digital games to students' learning, this study attempts to conduct an outcome-oriented literature review on game-based learning research papers in the aspects of cognitive, affective and social, and psychomotor skills.

2. Method

Journal articles from social science citation index journals about game-based learning were selected. There were total of 423 research papers selected, among which 24 of them discuss the effects of digital games on students' learning. They were found to be published within the recent decade. In the review process, a database system was developed to store, organize, and share research papers among researchers. Each paper was reviewed by four researchers working in pairs. Review results were cross-reviewed for validity. The studies were analyzed not only on their basic research elements but also the three aspects of outcomes.

3. Results

3.1. Analysis on the Basic Research Elements

Concerning the participants of the studies, games were used in all student levels, such as elementary school students [9][10][11][13][14][18][20][24], middle school students [5][12][17][21][22], undergraduate and graduate students [1][2][3][4][6][7][15][16][19], and other participants [8][23]. Among them, only seven studies presented the gender distribution of their samples [1][7][9][11][19][21][22].

In terms of the content subjects the digital games integrated in, it was found that digital games were usually integrated into different kinds of courses such as Math courses [10][11][14][18], fire-safety course [5][20], undergraduate decision science course [4], middle school economics course [12], geographical course [24], research methodology course [6], physics course [17], science course [13], electromagnetism course [21], teleworking training

course [23], and software engineering course [3]. For those studies not focusing on specific learning outcomes, one study examined the effect of game on learners' auditory perception and selective attention [1]; one examined learners' feeling about the empathic agents [2]; one examined the effect of game on learners' spatial skills [7]; one examined the effect of game on learners' motor controlling [8]; one examined learners' flow experience in the game environment [9]; one examined learners' perception about game-based learning [15]; one examined the effect of game on learners' hand-eye coordination [16]; one examined the effect of game on learners' shorten-memory [19]; one examined the effect of game on learners' word guessing ability [22].

Regarding the data collection methods of the studies, it showed that in game-based learning studies quantitative method are mostly used [1][2][4][5][7][8][11][12][14][16][17][18][19][20][22] [23], and mixed method were often applied [3][9][10][15][21][24], but only two studies used qualitative methods [6][13].

3.2. Analysis on the Aspects of Outcome

In spite of one study might cover more than one research aspect, we found that there are 16 papers researched about issues on cognitive aspects, 17 on affective and social aspect, and 4 on psychomotor skill aspect. It can be seen that more researches focus on the impact of games on cognitive and affective and social aspects, and less on psychomotor skill aspects.

3.2.1 Cognitive Aspect

In the cognitive aspect, there are six themes discussed in the research papers. Meta-cognition refers to one's knowledge about his own thinking. Among the studies, one focused on meta-cognitive awareness [10] and one other on meta-cognitive strategies [12]. Subject matter learning refers to the content learned such as language, math, history, and so forth. Most studies focused on cognitive performance of the studied subjects [1][3][6][10][16][24], and a few of them talked about subject learning achievement [12][5][18][21], while others focused on assessment [8][18]. Ability to learning subject matter refers to issues about the abilities students need to effectively learn subject matters; such as learning by doing [1][3][16] and the ability of learning subject presentation [1][11][18]. Lower-level thinking refers to simple thinking abilities such as understanding and memory; they include fact/recall processes [5], short-term psychological effects [19], short-term working memory [1], and working memory/distracter loads [8]. Higher-level thinking refers to more complex thinking abilities that require application, analysis, synthesis, evaluation, and so forth; such as challenge and complexity [9] and mental computation skills [14]. Problem-solving ability refers to the ability that requires students to critically and creatively solve complex problems around them; there are three studies [3][5][12].

3.2.2 Affective and Social Aspect

In the affective and social aspect, there are eight themes discussed in the research papers. Interests refer to the stimulation of getting attention of learning specific thing; issues including attraction [24], interest [4], visual attention [1], and engagement [17]. Attitude refers to the way of seeing and treating things; there were two studies [10][11]. Motivation refers to having drive the continuously learn something; while most studies focused on motivation [16][10][4][15][17][18][20][24], one focused on intrinsic motivation [23]. Value refers to ways to see worth of something and even self; issues include gender, socio-economic status [11], perception [4], and self-esteem/self-concept [14]. Efficiency refers to the amount of believing oneself to achieve the goal; issues include independent learning [3], perceived exertion [19], and self-perception [14]. Emotion refers to the feeling players have at the end of the game; issues include learning experiences [22][9][20][19], social isolation [23], and psychological effects of emotion [2]. Responsiveness refers to the reaction players have in terms of visual and audio responses; there was one study focused on auditory perception [1]. Communication ability refers to the interaction players have with their surroundings after playing the game; issues include collaborative interaction [4][10][17], and socio-cultural [13][18][23].

3.2.3 Psychomotor Skill Aspect

In the Psychomotor skill aspect, there are three themes discussed in the research papers. Process refers to what player do in the process of gaming and how they respond and react to the game including the route and stage the player go in the game. The study of gaming process takes much efforts and time. Researchers have to observe each and every player for every gaming and make documents. Extensive and tedious qualitative analysis is required for the research on this issue. Speed refers to the calculation of time spent that players go through the game; one study is found on it [14]. Mastery level refers to the evaluation of the fluency of skills trained in the game. For example: accuracy [14], actual physical exercise output [19], motor control [8], and spatial cognitive skills/eye-hand coordination [7].

3.3. Effect Size of the Experiments in Different Learning Outcome Domains

An effect size is a measure of the strength of the relationship between variables in a statistical population, or a sample-based estimate of that quantity. It plays an important role in meta-analysis studies that summarize findings from a specific area of research. We calculated the effect size of the studies related to three different learning outcomes. The results showed that the effect size of cognitive aspect was 0.601 (medium effect); the effect size of affective and social aspect was 0.719 (medium effect); the effect size of psychomotor skill aspect was 2.392 (large effect).

4. Conclusion

The review results showed that the participants of game-related studies were covered from elementary school students to graduate students, and were applied in different level courses. Researchers are distributed in North American, Europe, Asia, and etc. Most studies used experiment designs, and qualitative analysis methods are seldom used alone. Generally speaking, cognitive and affective and social aspects are most in concern. In cognitive aspect, subject matter learning is most researched; and in affective and social aspect, motivation is most researched. On the other hand, issues such as meta-cognition, higher-level thinking, problem-solving ability, gaming process, and responsiveness of gaming are least focused. It is predicted that there will be more studies on these issues as game-based learning research grows to be more mature.

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Appendix: Game-related research paper list

- [1]. Barlett, C. P., Vowels, C. L., Shanteau, J., Crow, J., & Miller, T. (2009). The effect of violent and non-violent computer games on cognitive performance. *Computers in Human Behavior*, 25(1), 96-102.
- [2]. Brave, S., Nass, C., & Hutchinson, K. (2005). Computers that care: investigating the effects of orientation of emotion exhibited by an embodied computer agent. *International Journal of Human-Computer Studies*, 62(2), 161-178.
- [3]. Cagiltay, N. E. (2007). Teaching software engineering by means of computer-game development: Challenges and opportunities. *British Journal of Educational Technology*, 38(3), 405-415.
- [4]. Chang, Y. C., Peng, H. Y., & Chao, H. C. (in press). Examining the effects of learning motivation and of course design in an instructional simulation game. *Interactive Learning Environments*.
- [5]. Chuang, T. Y., & Chen, W. F. (2009). Effect of Computer-Based Video Games on Children: An experimental study. *Educational Technology & Society*, 12(2), 1-10.
- [6]. Delwiche, A. (2007). Massively multiplayer online games (MMOs) in the new media classroom. *Educational Technology & Society*, 9(3), 160-172.
- [7]. Gagnon, D. (2007). Videogames and spatial skills: An exploratory study. *Educational Technology Research and Development*, 33(4), 263-275.
- [8]. Houghton, S., Milner, N., West, J., Douglas, G., Lawrence, V., Whiting, K., Tannock, R., & Durkin, K. (2004). Motor control and sequencing of boys with Attention-Deficit/Hyperactivity Disorder (ADHD) during computer game play. *British Journal of Educational Technology*, 35(1), 21-34.
- [9]. Inal, Y., & Cagiltay, K. (2007). Flow experiences of children in an interactive social game environment. *British Journal of Educational Technology*, 38(3), 455-464.
- [10]. Ke, F. (2008). Computer games application within alternative classroom goal structures: cognitive, metacognitive, and affective evaluation. *Educational Technology Research and Development*, 56(5-6), 539-556.
- [11]. Ke, F., & Grabowski, B. (2007). Gameplaying for maths learning: cooperative or not? *British Journal of Educational Technology*, 38(2), 249-259.
- [12]. Kim, B., Park, H., & Baek, Y. (2009). Not just fun, but serious strategies: Using meta-cognitive strategies in game-based learning. *Computers & Education*, 52(4), 800-810.
- [13]. Lim, C. P., Nonis, D., & Hedberg, J. (2006). Gaming in a 3D multiuser virtual environment: engaging students in Science lessons. *British Journal of Educational Technology*, 37(2), 211-231.
- [14]. Miller, D. J., & Robertson, D. P. (2009). Using a games console in the primary classroom: Effects of 'Brain Training' programme on computation and self-esteem. *British Journal of Educational Technology*, 41(2), 242-255.
- [15]. Whitton, N. (2007). Motivation and computer game based learning. *Whitton*, 1063-1067.
- [16]. Orvis, K. A., Horn, D. B., & Belanich, J. (2008). The roles of task difficulty and prior videogame experience on performance and motivation in instructional videogames. *Computers in Human Behavior*, 24(5), 2415-2433.
- [17]. Ravenscroft, A., & Matheson, M. P. (2002). Developing and evaluating dialogue games for collaborative e-learning. *Journal of Computer Assisted Learning*, 18(1), 93-101.
- [18]. Rosas, R., Nussbaum, M., Cumsille, P., Marianov, V., Correa, M., Flores, P., Grau, V., Lagos, F., Lo'pez, X., Lo'pez, V., Rodriguez, P., & Salinas, M. (2003). Beyond Nintendo: design and assessment of educational video games for first and second grade students. *Computers & Education*, 40(1), 71-94.

- [19].Russell, W. D., & Newton, M. (2008). Short-term psychological effects of interactive video game technology exercise on mood and attention. *Educational Technology & Society*, 11(2), 294-308.
- [20].Smith, S., & Ericson, E. (2009). Using immersive game-based virtual reality to teach fire-safety skills to children. *Virtual Reality*, 13(2), 87-99.
- [21].Squire, K., Barnett, M., Grant, J. M., & Higginbotham, T. (2004). Electromagnetism supercharged! learning physics with digital simulation games. *International Society of the Learning Sciences*, 513 - 520.
- [22].Tzeng, J. Y. (2004). Toward a more civilized design: studying the effects of computers that apologize. *International Journal of Human-Computer Studies*, 61(3), 319-345.
- [23].Venkatesh, V. (2000). Creating an effective training environment for enhancing telework. *International Journal of Human Computer Studies*, 52(6), 991-1005.
- [24].Virvou, M., Katsionis, G., & Manos, K. (2005). Combining software games with education: Evaluation of its educational effectiveness. *Educational Technology & Society*, 8(2), 54-65.

References

Prensky, M. (2001). *Digital Game-Based Learning*. New York: McGraw-Hill.

Reviews of Social Cultural Issues in Digital Game-based Learning

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Abstract: *This study reviews 19 papers regarding social cultural issues in digital game-based learning. These papers were selected from a pool of 423 journal papers published in the last two decades and were divided into two categories: social cultural comparisons and social cultural impacts. Social cultural comparisons included gender differences, teachers' and parents' views, and cross cultural comparison issues. Social cultural impacts concerned aggression, addiction and self-identity issues. Future research are suggested to compare western and eastern culture's interactions with game-based learning, especially regarding teachers', parents' and students' acceptances and attitudes toward game-based learning. Also the terminological uses between "game-based learning" and "game playing" should be distinguished in future research.*

Keywords: digital game-based learning, literature review, social-cultural issues

1. Introduction

Digital game-based learning is one of the main streams of the e-learning research domain in the next decade. Game designers and educators are attempting to figure out digital games' impacts on students' learning outcomes in both cognitive and affective domains. On the other hand, researchers also paid attentions to the social cultural issues that existed in digital game-based learning or resulted from game playing. Therefore, this study reviewed 19 research papers regarding social and cultural issues in game-based learning. These papers were selected from a pool of 423 papers, which were mostly selected from the SSCI database published in the last two decades by using "game-based learning" and "game playing" keywords to search.

In order to draw out papers relating to social cultural issues, the authors search the pool by using the following keywords: social, cultural, gender, addiction, aggression, parent, teacher, cross-cultural comparison, discrimination and identity. Then, a total of 19 research papers were selected for meta-analysis. These papers include 8 papers about gender issues, 2 papers about teachers, 1 about parents, 3 about aggression, 3 about addiction, and 2 are about self-identity. Therefore, this study analyzed and discussed these studies in the following two dimensions: one is the *social cultural comparisons* between genders, parents, and teachers regarding game playing or game-based learning; and the other is the *social cultural impacts* due to game playing or game-based learning. Suggestions for future studies are discussed and summarized at the end of this paper.

2. Social Cultural Comparisons

2.1. Gender differences

There are 8 studies concerning gender issues in online game-based learning or online game playing. Among these studies, three studies [1] [2] [3] are non-empirical studies or review papers, four studies [4] [5] [6] [7] used quantitative methods and only one study [6] used a mixed method. Regarding the subjects, two studies [5] [6] are concerning about high school students, one study [8] is for junior high school students, one study [4] is for college students and one study [7] is for all online players.

Several gender differences can be summarized according to the above studies. First, Bonanno and Kommers [4] concluded that, for college students, males show a very positive attitude towards gaming while females show a less positive or neutral attitude towards gaming. Secondly, both Chou and Tsai [5] and Karakus, Inal, and Cagiltay [6] reported that, for high school students, males played more computer games than did females. In addition, Gender differences exist in the play motivations and frequency and the types of games the students played. Yee [7] also indicated that, for MMORPG, gender differences are also existed in players' motivations for playing online games. Karakus, Inal, and Cagiltay [6] even reported that, for high school students, there is no significant difference in both genders' views regarding games can be useful for educational aims. They suggested parental control, appropriate game content, appropriate game genres and academic courses etc. issues should be emphasized in future research. Finally, Li [8] reported that cyberbullying has become an increasingly significant problem in schools. The tools used for cyberbullying includes emails, chatrooms, mobile phones and other type of technologies. This actually suggests that

some technological means are used negatively. Furthermore, gender is a significant predictor for cyberbullying. Males are more likely to cyberbully others than females. They concluded that to establish effective anti-bullying programs and create a caring and kindness culture is the most important issue for schools.

Review articles or non-empirical papers [1] [2] [3] have pointed out some important directions for future studies. Both Wang and Wang [1] and Jenson and de Castell [3] suggested that educational technology researchers should take gender difference into consideration in the development and validation of the theories of educational technology acceptance. They concluded that conducting a longitudinal and careful observation of online communities within the games is a good approach to enhance our understanding of relationships between variables which are important for user acceptance and continuance of online games. In addition, [2] claimed that there is much to be learned about how the design of digital games can inform learning design for all learners (male and female). He indicated that, although more research requires to be conducted about the design of interactive learning environments, game design could provide insights along with strategies and methods to help educators in creating compelling and engaging learning experiences for both male and female learners. Based on the above review, one thing worth noting is that only two studies [2] [6] have touched the issues about game-based learning. More studies are required to examine the gender differences in issues about game-based learning, not about game playing.

2.2. *Parents' and teachers' views*

Three studies concerning parents and teachers views about game-based learning or game playing are summarized in this section. Concerning *teachers'* views, Can and Cagiltay [9] reported that a majority of their sample teachers held the opinion that they will plan to use computer games with educational features in their courses in the future. Only 13 participants (11%) responded that they will not use such games in their teaching. In addition, Cheung, Jong, Lee, Lee, Luk, Shang, and Wong [10] introduced a VISOLE pedagogy, which encompasses scaffolding, online game-play, and teacher-facilitated debriefing and reflection. Besides the main game, they also created various mini-games to make the whole VISOLE process more pleasurable and challenging. Sudden events provide opportunities to sharpen students' skills on dealing with contingency and emergency, while the teacher console helps VISOLE teacher(s) conduct various VISOLE facilitation task more easily.

Regarding *parents'* views, Khoo, Cheok, Nguyen, and Pan [11] has highlighted the general methodologies for designing computer games for the elderly. The steps involved are level of understanding of computer technologies, awareness of popular computer/video games currently in the market, medium of game play, preference of team work/collaborative/multi-player/competitive or individual game, level of opponents, usability, user studies, and re-iteration of all the steps above. However, these studies need large scale studies to explore their learning effectiveness.

2.3. *Cross cultural comparisons*

Colwell and Kato [12] conducted a cross-cultural comparison study between junior high school students in London and those in Tokyo about video game playing. They reported several comparative results relating to game exposure, parents' concerns, time spent, self-esteem, aggression, frequency of play, duration of play, the prediction of aggression by sex and frequency, preferences of aggressive games, and finally the prediction of aggression by sex and time spent in aggressive games. This study concluded with an argument that aggression causes play of video games, many of which are aggressive in nature.

3. Social Cultural Impacts

3.1. *Aggressions*

Three studies [13][14][15] have explored the relationships between violent game play and aggressions with a mixed results. Recently, Markey and Scherer [13] reported that university students who played the violent video game *tended to be* more hostile and have greater accessibility of aggressive cognitions than those who played the non-violent video game. The results could have important implications for parents and policy makers. However, there is *no empirical evidence* to suggest that it actually *affects* students' hostility or aggressive cognitions any more than using a traditional controller. Furthermore, not all individuals are affected by violent video games in a similar way. In addition, Barlett and Anderson [14] examined both negative and positive effects of video games. Finally, Hobbs and Yan [15] used a multiple baseline research design with one single subject to examine the impact of a computer-based intervention on students' cognitional, emotional and behavioral aspects of aggression and indicated that the game shows *intervention effects*, especially on the cognitive and behavioral aspects of aggression among three highly aggressive students.

3.2. *Addictions*

Game playing has been discussed a lot in the literature about Internet addiction [16]. Only two studies were included in this study. Chou and Ting [17] examined the relationship between flow experience and addiction. They suggested that players who have experienced flow are more likely to be addicted. Besides, Charlton and Danforth [18] considered whether the distinction between core and peripheral criteria for behavioral addiction, previously proposed regarding general computing activities, can be applied to the specific domain of MMORPG. Their study supported the

idea that the general computing observations were replicable for a specific Internet-mediated activity (e.g. online game playing) with addictive properties. It has also been pointed out that online gaming is a male-dominated activity according to the observation of around 85% of respondents were male which was consistent with the socio-demographic analysis of MMORPG players by Griffiths et al. [16]. However, no paper in the pool has discussed about the students' addictions with online game playing and the impacts resulted from online game playing.

3.3. Self-identity

Only two studies were concerning about identity constructions in game-based interactive environments from different angles. Squire [19] argued for framing game play as a designed experience and using games as new educational media. Zhao and Martin [20] investigated 63 university students' identity construction on Facebook by focus-group interviews and online content analysis. Their findings challenged the distinction between "real selves" and "virtual selves" or "true selves" and "false selves." They concluded that Facebook is a multi-audience identity production site and suggested future study to control for the effects of individual characteristics while examining identity construction in different environments.

4. Conclusion

According to the above reviews of literature concerning social cultural issues in digital game-based learning or game playing, it is worth noting that most of the papers included in this review are concerning game playing, not game-based learning or joyful learning. This may be due to the game-based learning or joyful learning is relatively new in e-learning domain. Students, parents or even teachers are still not familiar with the definition of game-based learning or joyful learning. The terminologies should be used carefully for the future studies.

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References

- [1] Wang, H. Y., & Wang, Y. S. (2008). Gender differences in the perception and acceptance of online games. *British Journal of Educational Technology*, 39(5), 787–806.
- [2] Dickey, M. D. (2006). Girl gamers: the controversy of girl games and the relevance of female-oriented game design for instructional design. *British Journal of Educational Technology*, 37(5), 785–793.
- [3] Jenson, J., & de Castell, S. (2008). Theorizing gender and digital game play: Oversights, accidents and surprises. *Journal for Computer Game Culture*, 2(1), 15–25.
- [4] Bonanno, P., & Kommers, M. A. P. (2008). Exploring the influence of gender and gaming competence on attitudes towards using instructional games. *British Journal of Educational Technology*, 39(1), 97–109.
- [5] Chou, C., & Tsai, M.-J. (2007). Gender differences in Taiwan high school students computer game playing. *Computers in Human Behavior*, 23(1), 812–824.
- [6] Karakus, T., Inal, Y., & Cagiltay, K. (2008). A descriptive study of Turkish high school students' game-playing characteristics and their considerations concerning the effects of games. *Computers in Human Behavior*, 24(6), 2520–2529.
- [7] Yee, N. (2006). Motivations for play in online games. *CyberPsychology & Behavior*, 9(6), 772–775.
- [8] Li, Q. (2007). Bullying in the new playground: Research into cyberbullying and cyber victimization. *Australasian Journal of Educational Technology*, 23(4), 435–454.
- [9] Can, G., & Cagiltay, K. (2006). Turkish prospective teachers' perceptions regarding the use of computer games with educational features. *Educational Technology & Society*, 9 (1), 308–321.
- [10] Cheung, K. K. F., Jong, M. S. Y., Lee, F. L., Lee, J. H. M., Luk, E. T. H., Shang, J., & Wong, M. K. H. (2008). FARMTASIA: an online game-based learning environment based on the VISOLE pedagogy. *Virtual Reality*, 12(1), 17–15.
- [11] Khoo, E. T., Cheok, A. D., Nguyen, T. H. D., & Pan, Z. (2008). Age invaders: social and physical inter-generational mixed reality family entertainment. *Virtual Reality*, 12(1), 3–16.
- [12] Colwell, J., & Kato, M. (2005). Video game play in British and Japanese adolescents. *Simulation & Gaming*, 36(4), 518–530.
- [13] Markey, P. M., & Scherer, K. (2009). An examination of psychoticism and motion capture controls as moderators of the effects of violent video games. *Computers in Human Behavior*, 25(2), 407–411.
- [14] Barlett, C. P. & Anderson, C. A. (2008). Video Game Effects—Confirmed, Suspected, and Speculative A Review of the Evidence. *Simulation & Gaming*, 40(3), 377–403.
- [15] Hobbs, L. J., & Yan, Z. (2008). Cracking the walnut: Using a computer game to impact cognition, emotion, and behavior of highly aggressive fifth grade students. *Computers in Human Behavior*, 24(2), 421–438.

- [16] Griffiths, M.(2003). Internet gambling: Issues, concerns, and recommendations. *CyberPsychology & Behavior*, 6(6), 557-568.
- [17] Chou, T. J, & Ting, C.C. (2003). The role of flow experience in cyber-game addiction. *CyberPsychology and Behavior*, 6(6), 663-675.
- [18] Charlton, P. J., & Danforth, W. D. I. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior*, 23(3), 1531-1548.
- [19] Squire, K. (2006). From Content to Context: Videogames as Designed Experience. *Educational Researcher*, 35(8), 19-29.
- [20] Zhao, S., Grasmuck, S., & Martin, J. (2008). Identity construction on Facebook: Digital empowerment in anchored relationships. *Computers in Human Behavior*, 24(5), 1816-1836.

Review of Game-based Learning—from the Design Perspective

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Abstract: *This paper attempts to review literature about game-based learning from the design perspective for getting a complete understanding about game-based learning. Some common elements among different game genres are identified after these genres are introduced. Then, we review game-based learning design in terms of four dimensions: design for motivation, design of game play process, game framework, and adopted pedagogy. Though this reviewing, we anticipate this review work could be helpful to get a clearer picture, particularly from the design perspective, about what researchers have done so far, and highlight some worthwhile research directions in game-based learning.*

Keywords: game-based learning, literature review, game design

1. Introduction

Over the past decade, game-based learning (GBL) attracts a number of researchers' interest. On one hand, digital games have become a pervasive and popular vehicle for the game generation who were born after 1975 and familiar with various interactive media (Prensky, 2001). If digital games could be applied to educational or learning purposes, they might impact students' learning more. On the other hand, some studies have reported potential benefits that digital games might bring, such as visual attention and spatial abilities (Barlett et al., 2009), problem-solving (Kiili, 2007), analogical reasoning (Williams et al., 2007), subject matter mastery (Ricci et al., 2007, and so forth. The two reasons described above result in an increased attention paid to GBL.

However, Kiili (2007) pointed out that most studies do not provide sufficient information about how to utilize GBL in practice, although GBL issues attract more and more researchers' attention. In other words, the current research still lacks enough studies investigating how GBL could be applied in practical setting. To solve this "how" issue, we believe that the "what" and "why" issue should be tackled first—what are the common elements in various game genres? Why are these elements important for GBL design? Therefore, this paper reviews literature from the design perspective to get a more complete picture about GBL design. Some common elements among different digital games are first identified, which is followed by the introduction of various game genres. Then, we review GBL design in terms of four dimensions: *design for motivation, design of gameplay process, game framework, and adopted pedagogy*. The review is expected to contribute to orient the development of GBL, which could, in turn, bring more practical impacts on students' learning.

2. Game genres and game elements

2.1 Game genres

According to the gameplay interaction, digital games could be categorized as four major genres (Bryceson, 2009): (1) *Shoot-'em-ups and beat-'em-ups*: the former refers to shooter games emphasizing a series of combats that involve projectile weapons; the latter means fighting games focusing on a series of battles against large numbers of antagonists. This genre of games requires players' eye-hand coordination but require little knowledge. (2) *Flying, racing, and sports*: they are also called sports games that emulate traditional physical sports. Some games emphasize the playing of the sports, while others highlight the realistic and authentic vehicle simulation. (3) *Strategy and puzzle games*: games in this genre require skillful thinking and planning for managing resources or solving complex problems, either in turn-based or real-time form. The game scope ranges from solving a small puzzle, running a farm, to managing a city, or a planet. (4) *Adventures and role-playing games*: although these games involve somewhat exploration, puzzles, obstacles, and enemies to overcome, one common characteristic is that the main character reflects the players' alter ego. The main character often evolves with the progress of the players' advantage and the advance of the storylines.

2.2 Game elements

Although there exists different genres of games, these digital games seem to hold some common elements that could be extracted as key references for designing GBL environments. According to Bryceson's work (2009), the five elements of a game are *graphics and sound, logic, interface, game plan, and story*. Graphics refers to 2D or 3D objects and informational overlays, while sound means music or sound effects. Logic is the progresses of a game, which

includes some scenario like simulation, calculations, and decision making. Interface is which players directly interact with to play the game. Game plan is rule set that produces outcomes. Story is the game framework including the background and other information needed in the playing process.

Since some essential design concepts appeared in different papers and were difficult for game designers to locate and apply systematically, Hu (2008) found some commonly-seen core elements. The elements related to game are *puzzle*, *obstacle*, *reward*, and *prompter*. According to Hu, the puzzle in a virtual course can also be called task or examination. The purpose is to evaluate players' (learner) input in specific questions designed. The use of obstacle can increase challenge because it stimulates the players to solve problems in order to remove obstacles. Rewards are used for the players to overcome obstacle or to solve a puzzle. A prompter is like a non-player character whose function is to help the players to identify their location and what to do next.

3. Design of Game-based Learning

3.1 Design for motivation

In designing educational games, it is important to enhance learners' motivation by applying methods that focus on their emotional aspects. Some commonly seen emotional concepts for GBL environments are: engagement, immersion, flow, fun, entertainment, imaginary, challenges, competition, fantasy, curiosity, and uncertainty. Jia-Jiunn Lo, Nai-Wei Ji, Ya-Huei Syu, Wan-Jyun You, & Yi-Ting Chen (2008) review literatures and state that fun is one of the three basic requirements for successful educational games. Some other factors that can be applied to influence players' motivation and learning are: scenario, level of reality, cast, role of the players, relationship of learning to the educational objectives, skill versus chance, wins and losses, choices, information flow, turns, types of actions, and modes of interaction (Alessi & Trollip, 2001, cited by (Jia-Jiunn Lo, et al., 2008)).

With careful consideration, these emotional constructs can be included in GBL context using different strategies. For example, Prensky & Wright (2007) suggests to extract factors from commercial games to make the educational game engaging. He reviewed literatures about "rules of engagement" and claims that in order to ensure engagement, designers need to employ some rules in designs: goal, decisions/discussion, emotional connection, cooperation/competition, personalization, review/iteration, and fun.

3.2 Design of gameplay process

Regarding the vision of gameplay, Gunter, Kenny, & Vick (2008) state that the key for designing educational games is to "embed into its interaction design content-based choices that require player-learners to implicitly and naturally learn the desired content in order to advance while, simultaneously remaining true to its ludological (i.e., gameplay) roots." Gunter, et al. (2008) explain two ways to integrate learning content with game context. In the first game type, player-learners learned specific concepts and then practice the concepts in a game scenario. The design of the target content and the game is in a hierarchical manner, in which the content is rooted in the story line so that students can apply learned knowledge in the game. Students not just have to master the gameplay rules but also internalize the acquired knowledge in a next higher level. This is to some extent similar to the mini game concept mentioned in Prensky & Wright's work (2007), in which only single skill or idea can be learned in a mini game. A curriculum can be break down into some small units (individual skills, information and competencies) for learners to master.

In the second type of game, the targeted content needs to be intrinsically combined with the game context so that the entire game teaches academic content. This is related to the concept of "placing the content on the plotline" as mentioned by Malone and Lepper (Gunter, et al., 2008). In this approach, the targeted skills or knowledge are integrated into the gameplay process. This is somewhat similar to the concept of complex game (Prensky & Wright, 2007), in which it covers the entire course materials. There are often multiple goals, challenges, and quests to be achieve in a complex game. Learners have to master multiple skills in order to achieve the goals.

3.3 Game framework

With respect to game framework, Amory (2007) propose more updated and inclusive GOM version as a framework that can be used to develop and evaluate education computer games. There are six subsections in this model and each of them includes some core concepts. In this model objects are represented by five kinds of space objects (game, visualization, element, problem, and social). The game space objects include the visualization space objects, while the visualization space objects consist of element and problem space objects. Each of them includes some abstract interfaces (pedagogical and theoretical constructs) and concrete interface (design elements). Those abstract and concrete interfaces can be further categorized into six subsections mentioned in above. For example, the concepts in the narrative subsection are narrative spaces, story, plot, and backstory, which respectively belongs to three different space objects.

Another example is an edventure framework proposed by Hu (2008). The framework contains eleven elements: *curriculum*, *achievement*, *course*, *classroom*, *puzzle*, *examination*, *textbook*, *teacher*, *obstacle*, *reward* and *prompter*. Challenge is an important factor for adventure game and puzzle and obstacle are two objects used to increase challenge and entertainment. According to him, a puzzle works as a task or examination that requires the player to

solve some questions in order to escape from confinement. While obstacles were placed in players' way to increase challenge, reward brings sense of accomplishment that helps to overcome obstacle.

3.4 Adopted Pedagogy

In terms of adopted pedagogy, *computer-based training*, *situated learning*, *experiential learning*, *learning by design*, and *learning by investigation* are five major pedagogies adopted in GBL design. Although computer-based training (CBT) is not a novel theory and application, a 3D virtual reality (VR) training could offer a new immersive way for students to master specific skills, which might be dangerous or expensive by traditional approaches (Stone et al., 2009). Next, situated learning (Lave & Wenger, 1991) and experiential learning (Kolb, 1984) attract researchers' attention as well. A possible reason for this might be that digital games could engage students in specific contexts or scenarios to explore, investigate, experience, and reflect what they do, instead of providing abstract concepts for students (Lo et al., 2008). Another reason might be that digital games could offer clear goals, immediate feedbacks, and challenges that match students' ability to contribute to their flow experience (Kiili, 2005).

In addition, the "learning by design" pedagogy refers to the use of game to engage students in learning by asking them to design and produce educational games. Studies ((Lepper, Corpus, & Iyengar, 2005) cited by (Lim, 2008)) show that students' intrinsic motivation steadily declines because the current ways of learning fail to capture students' intensive engagement. By designing and building games for learning, students can practice the materials and skills covered in class and translate the traditional learning experience into more engaged form (Prensky & Wright, 2007). Finally, the "investigation by design" pedagogy was used to design games that implement collaborative dialogue to improve students' conceptual understanding of specific subject domains. In his paper, Ravenscroft & Matheson (2002) mention two dialogue games in which the system provides collaborative dialogue between the tutor system and learners to question the learner's reasoning and thinking process in order to refine and form more integrate concepts.

4. Conclusion

By reviewing the literature, some preliminary conclusion could be drawn. First, GBL seems to still lack design theories that could guide educators or designers to incorporate gaming and learning well, although some game elements or even game framework are emerging. Some work tries to generate design principles, but further research efforts are required to develop a theory for GBL. Second, domain subject and curriculum are not placed in the central position. Most work targets a piece of learning materials or some specific subjects, instead of considering the whole curriculum or long-term development of students' capability. Third, towards developing a GBL environment, most work was conducted more from a technology-centered perspective, rather than a subject-centered perspective. It implies that technique designers are involved in the GBL design more and deeper than domain experts. For a well-developed GBL environment, how to harmonize the two groups of people is a crucial issue in the future.

References

- Amory, A. (2007). Game object model version II: a theoretical framework for educational game development. *Educational Technology Research and Development*, 55(1), 51-77.
- Alessi, S.M., Trollip, S.R.: *Multimedia for Learning: Methods and Development*. 3rd edn. Allyn & Bacon, Needham Heights Massachusetts, USA (2001).
- Barlett, C. P., Anderson, C. A., & Swing, E. L. (2009). Video Game Effects—Confirmed, Suspected, and Speculative: A Review of the Evidence. *Simulation & Gaming*, 40(3), 377-403.
- Bryceson, K. P. (2009). The development of VAG—a 3D virtual agribusiness environment and strategy game. *Electronic Commerce Research*, 9(1-2), 27-47.
- Gunter, G., Kenny, R., & Vick, E. (2008). Taking educational games seriously: using the RETAIN model to design endogenous fantasy into standalone educational games. *Educational Technology Research and Development*, 56(5), 511-537.
- Hu, W. (2008). A reusable edventure game framework. *Transactions on Edutainment I*, 74-85.
- Jia-Jiunn Lo, Nai-Wei Ji, Ya-Huei Syu, Wan-Jyun You, & Yi-Ting Chen. (2008). Developing a Digital Game-Based Situated Learning System for Ocean Ecology. *Transactions on Edutainment I*, 51-61.
- Kiili, K. (2007). Foundation for Problem-Based Gaming. *British Journal of Educational Technology*, 38(3), 394-404.
- Kolb, D. A. (1984) *Experiential Learning: experience as the source of learning and development* New Jersey: Prentice-Hall
- Lave, J. and Wenger, E. (1991) *Situated Learning: legitimate peripheral participation* Cambridge: Cambridge University Press.
- Lepper, M., Corpus, J., & Iyengar, S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology*, 97, 184-196.
- Lim, C. (2008). Spirit of the game: Empowering students as designers in schools? *British Journal of Educational Technology*, 39(6), 996-1003.
- Lo, J. J., Ji, N. W., Syu, Y. H., You, W. J., and Chen, Y. T. (2008). Developing a Digital Game-Based Situated Learning System for Ocean Ecology. In: Pan, Z., Cheok, D.A.D., Müller, W., El Rhalibi, A. (eds.) *Transactions on Edutainment I*. LNCS, 5080, 51–61. Springer, Heidelberg.
- Prensky, M. (2001). *Digital game-based learning*. NY: McGraw-Hill.

- Prensky, M., & Wright, W. (2007). Students as Designers and Creators of Educational Computer Games. *British Journal of Educational Technology*, 39(6), 1004-1019.
- Ravenscroft, A., & Matheson, M. (2002). Developing and evaluating dialogue games for collaborative e-learning. *Journal of Computer Assisted Learning*, 18(1), 93-101.
- Ricci, K., Salas, E., & Cannon-Bowers, J. A. (1996). Do computer-based games facilitate knowledge acquisition and retention? *Military Psychology*, 8(4), 295-307.
- Stone, R., Caired-Daley, A., & Bessell, K. (2009). SubSafe: a games-based training system for submarine safety and spatial awareness (Part 1). *Virtual Reality*, 13, 3-12
- Williams, D., Yuxin, M., Feist, S., Richard, C.E. and Prejean, L. (2007), "The design of an analogical encoding tool for game-based virtual learning environments", *British Journal of Educational Technology*, 38(3), 429-437.

Review of game-based learning: An Immersion Process Perspective

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Abstract: The computer game recently has been prompted as a potential learning tool by many educational researchers. The game-based learning environment engages learners in a process of immersion through a series of challenges or quests. By completing quests, learners not only actively construct necessary knowledge and skills of relative subject matters but also are encouraged to work collaboratively in solving the problematic scenarios. Based on the flow theory, the immersion process has been deemed as the core issue of affecting the optimal experience in the game-based learning environment. The learner's motivation is another important issue to directly influence learners' involvement process and should be taken into account. It is thus the main purpose of the present study to discuss the possible elements involved in affecting the process of achieving the optimal experience in the game-based learning environment.

Keywords: game-based learning, immersion process, flow theory, literature review, motivation

1. Introduction

“What is a game?” It is a combination of procedures of human mental activities and body movements which has long being recognized as a fundamental component in human social and cultural development (Huizinga, 1950). Based on inner motivations, players actively engage with the game which provides not just easy amusements but also endeavoring challenges to increase their enjoyment levels. The computer game recently has been prompted as a potential learning tool by many educational researchers (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Gee, 2003; Rieber, 1996). The game-based learning environment engages learners in a process of immersion through a series of challenges or quests. By completing quests, learners thus not only actively construct necessary knowledge and skills of relative subject matters but also are encouraged to work collaboratively in solving the problematic scenarios (Garris, Ahlers, & Driskell, 2002; Kaptel & Cole, 2002). Based on the flow theory (Csikszentmihalyi, 1998), the immersion process has been deemed as the core issue of affecting the optimal experience in the game-based learning environment. The learner's motivation is another important issue to directly influence learners' involvement process and should be taken into account (Novak, Hoffman & Yung, 1997). It is thus the main purpose of the present study to discuss the possible elements involved in affecting the process of achieving the optimal experience in the game-based learning environment.

2. Immersion

Immersion is the term to describe the psychology and physical states of a person when he/she attend fully in events or activities (Chen, Wigand, & Nilan, 1999). Many researchers considered the immersion experience can effectively enhance users' performances, positive emotions, and cognitive abilities: Finneran & Zhang (2005) indicated that users' performances evidently related with their degrees of experiencing the flow; Skadberg & Kimmel (2004) found the high immersion experiences could increase the user's motivation to search or to perceive more information; Shin (2006) studied how the immersion experience might impact learners' performances in an online learning environment. The immersion experience had significant effect to learners' subjective feelings of satisfaction toward the instruction and the learning system. The immersion experience obviously acts as a critical role to influence learners' performances, which is also the essence of the game-based environment (Radford, 2000). By definition (Finneran & Zhang, 2005), immersion is a state of consciousness where a person is so absorbed in an activity that s/he excels in performance without consciously being aware of his or her every movement. It highly relates with the peak experience and the peak performance (Privette & Bundrick, 1987). The peak experience describes the highly enjoyment feeling during actions and the peak performance describes the best personal status of actions (Csikszentmihalyi, 1998). Such cognitive experiences in turn satisfy or reinforce learners' inner motivations (Maslow, 1971).

Csikszentmihalyi (1993) proposed 8 factors that are related to the immersion / flow experience, and Novak, Hoffman, & Yung (1997) further categorized them into three groups: antecedent conditions, characteristics, and consequences of experience. Similarly, Chen, Wigand, & Nilan(1999) re-grouped them in terms of antecedent, experience, and effect as Hoffman & Novak (1996) described them in three immersion stages: antecedent, experience, and consequence. In general (Table 1), in a game-based environment, the learner's immersion process can be seen as three stages: A) Antecedent: it is the lowest level of immersion occurred when a learner starts interacting with a game. Attention and perception elements take the most responsibility to lower the barriers to enter this level. B) Experience: The user become further involved with the game and feels engrossed because of the game construction. Fantasy of the game story and plot are the important issues to form this quality. There is a high level of emotional involvement which makes people like to keep playing with game. Players will becomes less self-consciousness and will feel “emotionally drained” when they stop playing. C) Consequence: By suspending disbelief, players telepresent themselves into the

virtual world. Their ideas, feelings and wishes thus appear in consciousness so as to receive virtual as reality (Csikszentmihalyi, 1975).

Table 1 The immersion process

Related Studies		The Immersion Process	
Csikszentmihalyi (1993)	I	Clear goals and immediate feedback;	I Action and awareness merge
	I	Personal skills are well suited to given challenges	I Concentration on the task at hand
			I A sense of potential control
			I Loss of self-consciousness
			I Altered sense of time
			I Experience becomes autotelic, an experience requires no goals or rewards to the self
Chen et al (1999)	Antecedent	Experience	Effect
Hoffman & Novak (1996)	Antecedent	Experience	Consequences
Skadberg & Kimmel (2004)	Factor	Experience	Result
Brown & Cairns (2004)	Engagement	Engrossment	Total immersion

3. Motivation

Except the learner’s immersion experience, the other important issue relates to learning process in the game-based learning environment is motivation. Csikszentmihalyi & LeFevre (1989) indicated that the motivation issue could directly affect the learner’s involvement process based on their 1989 flow study of working and leisure activities. For the field of educational videogames, scholars like Malone and Lepper (Malone, 1981a, 1981b; Malone & Lepper, 1987) tried to define elements that make computer games intrinsically motivating. The intrinsic motivations of gaming can be indentified as two classes: individual and interpersonal (Table 2).

Table 2 Intrinsic motivation of gaming

Intrinsic Motivation of Gaming			Scholars
Individual motivations	Challenge		Malone (1980, 1981c) Rouse (2001)
			Malone (1980, 1981c) Rieber (1996)
	Fantasy		Crawford (1997) Rouse (2001)
			Malone (1980, 1981c)
	Curiosity		Malone (1980, 1981c) Rieber (1996)
	Control		Malone (1980, 1981c) Rieber (1996)
	Amusement	Emotional Experience	Rouse (2001)
	Self Identity	Proving Oneself	Crawford (1997)
		Self	Rieber (1996)
		Cognition	Malone (1980, 1981c)
Interpersonal motivations	Social Interaction	Socialize	Rouse (2001)
		Social Lubrication	Crawford (1997)
		Need for Acknowledgement	Crawford (1997)
		Cooperation	Malone (1980, 1981c)
		Social Competition	Malone (1980, 1981c) Vodeler et al. (2003)
		Progress	Rieber (1996)
	Escaping Belonging	Nose-Thumbing	Crawford (1997)

In the present study, these two classes of intrinsic motivation factors will form the second dimension together with the above 3-stages of immersion experiences to structure the analysis framework of literature review. Among which, they are Antecedent/Individual motivations (AIndiv); Antecedent/Interpersonal motivations (AInter); Consequence/Individual motivations (CIndiv); Consequence/Interpersonal motivations (CInter); Experience/Individual motivations (EIndiv); Experience/Interpersonal motivations (EInter).

4. Results and Discussion

Based on three criteria (topic relatedness, journal article, impact factor of journal), a total of 65 papers were selected from 239 papers. Each paper was then read in details before categorized them according to the above analysis framework. As a result, up to 53% of the reviewed papers were to observe the issues of “Antecedent” stage (AIndiv 26%; AInter 27%), and 31/% of the reviewed papers were to observe the issues of “Consequence” stage (CIndiv 15%; CInter 16%). “Experience” stage acquired less concern (16%) (EIndiv 9%; EInter 7%) by these previous studies. To look from the “intrinsic motivation” dimension, the numbers of papers took “individual motivation” as their major focus were almost identical to the numbers of studies which took “interpersonal motivations” as their major focus.

In comparing the category of AIndiv and AInter, the percentage of various independent variables is as Table 3, and the comparison of dependent variables as Table 4. The comparison of the percentage of various independent variables of EIndiv and EInter is as Table 5, and the comparison of dependent variables is as Table 6. The comparison of the percentage ranking of independent variables of CIndiv and CInter is as Table 7, and the comparison of dependent variables is as Table 8.

Table 3 Comparing the the percentage of independent variables of AIndiv and AInter,

Independent variables	AIndiv	AInter
Environment design issues (sensory stimuli, interface elements)	20%	25%
Control issues (usability, interactivity, avatar)	24%	10%
Individual characteristics (personality, prior experience)	50%	28%
Challenge issues	3%	14%
Instructional methods	3%	10%

Table 4 Comparing the percentage of dependent variables of AIndiv and AInter

Dependent variables	AIndiv	AInter
Learning performances	46%	36%
Emotion and enjoyment	16%	6%
Learning attitudes and motivation	20%	23%
Problem-solving strategy	12%	0%
Cognitive ability	6%	6%
Collaboration performance	0%	23%

Table 5 Comparing the percentage of independent variables of EIndiv and EInter

Independent variables	CIndiv	CInter
Environment design issues (sensory stimuli, interface elements)	40%	37%
Story construct	0%	0%
Control issues (usability, interactivity, avatar)	20%	25%
Individual characteristics (personality, prior experience)	20%	25%
Challenge issues	20%	13%
Interpersonal interaction	0%	0%

Table 6 Comparing the percentage of dependent variables of EIndiv and EInter

Dependent variables	EIndiv	EInter
Learning performances	32%	27%
Emotion and enjoyment	22%	27%
Learning attitudes and motivation	24%	21%
Problem-solving strategy	0%	0%
Cognitive ability	11%	9%
Story construct	11%	15%

Table 7 Comparing the category of CIndiv and CInter, the percentage ranking of independent variables

Independent variables	CIndiv	CInter
Environment design issues (sensory stimuli, interface elements)	27%	30%
Story construct	21%	21%
Control issues (usability, interactivity, avatar)	15%	21%
Individual characteristics (personality, prior experience)	16%	14%
Challenge issues	10%	7%
Interpersonal interaction	11%	0%

Table 8 Comparing the category of CIndiv and CInter, the ranking of dependent variables

Dependent variables	CIndiv	CInter
Learning performances	31%	33%
Emotion and enjoyment	15%	23%
Learning attitudes and motivation	14%	18%
Addition	13%	8%
Cognitive ability	7%	4%
Story construct	5%	0%

References

- Barab, S., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology Research and Development*, 53(1), 86-107.
- Chen, H., Wigand, R. T., & Nilan, M. S. (1999). Optimal experience of web activities. *Computers in Human Behaviour*, 15, 585-608.
- Costikyan, G. (1994). *I have no words and I must design*. Last retrieved on June 3 2005, <http://www.costik.com/nowords.html>
- Crawford, C. (1997). *The Art of Computer Game Design*. Washington State University Vancouver. Retrieved January 15, 2010 from: <http://www.vancouver.wsu.edu/fac/peabody/game-book/Coverpage.html>
- Csikszentmihalyi, M. (1975). *Beyond Boredom and Anxiety*. San Francisco, California: Jossey-Bass.

- Csikszentmihalyi, M. (1993). *The Evolving Eelf: A Psychology for the Third Millennium*. New York:Harper & Row.
- Csikszentmihalyi, M. (1998). The flow experience and its significance for human psychology. In M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), *Optimal Experience: Psychological Studies of Flow in Consciousness* (pp. 15-35). New York: Cambridge University Press.
- Csikszentmihalyi, M. & LeFevre, J. (1989) Optimal experience in work and Leisure. *Journal of Personality and Social Psychology*, 56(5), 815-822.
- Finneran, C. M., & Zhang, P. (2005). Flow in computer-mediated environments: promises and challenges. *Communications of the Association for Information Systems*, 15, 82-101.
- Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation & Gaming*, 33(4), 441-467.
- Gee, J. P. (2003). *What Video Games Have To Teach Us About Learning and Literacy*. NY: Palgrave Macmillan.
- Gredler, M. (1992). *Designing and Evaluating Games and Simulations: A Process Approach*. London, Kogan Page.
- Hoffman, D., & Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*, 60, 50-68.
- Huizinga, J. (1950). *Homo Ludens: A Study of the Play Element in Culture*. Boston: Beacon Press.
- Kaptelin, V., & Cole, M. (2002). Individual and collective activities in educational computer game playing. In T. Kosmann, R. Hall, & N. Miyake (Eds.), *g2057. CSCL 2: Carrying Forward The Conversation* (pp. 303-316). Mahwah, NJ: Lawrence Erlbaum.
- Liao, L. F. (2006). A flow theory perspective on learner motivation and behavior in distance education. *Distance Education*, 27(1), 45-62.
- Malone, T. W. (1980). What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games. *Cognitive and Instructional Sciences Series*, 162-169, CIS-7, SSL-80-11. Palo Alto: Xerox Palo Alto Research Center.
- Malone, T. W. (1981a). What makes computer games fun? *Byte*, 6, 258-277.
- Malone, T. W. (1981b). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 5.
- Malone, T.W. (1981c). Heuristics for designing enjoyable user interfaces: Lessons from computer games. *Human Factors in Computer Systems*.
- Malone, T. & Lepper, M. (1987). Making learning fun: A taxonomy of intrinsic motivations of learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, learning, and instruction: Vol. 3. Cognitive and affective process analyses*, 223-253. Hillsdale, NJ: Lawrence Erlbaum.
- Maslow, A. (1971). *The Farther Reaches of Human Nature*. New York: Viking Press.
- Novak, T. P., Hoffman, D. L., & Yung, Y. F. (1997). *Modeling the structure of the flow experience among web users* (Project 2000). Psychometric Laboratory: Vanderbilt University.
- Privette, G., & Bundrick, C. M. (1987). Measurement of experience: Construct and content validity of the experience questionnaire. *Perceptual and Motor Skills*, 65, 315-332.
- Radford A., (2000). Games and learning about form in architecture. *Automation in Construction*, 9, 379-385.
- Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research & Development*, 44(2), 43-58.
- Shin, N. (2006). Online learner's 'flow' experience: An empirical study. *British Journal of Educational Technology*, 37, 705-720.
- Skadberg, Y. X., & Kimmel, J. R. (2004). Visitors' flow experience while browsing a web site: Its measurement, contributing factors and consequences. *Computers in Human Behaviour*, 403-422.
- Trevino, L. K., & Webster, J. (1992). Flow in computer-mediated communication. *Communication Research*, 19(5), 539-573.
- Vodeler, P., Hartmann, T. & Klimm, C. (2003). *Explaining the enjoyment of playing video games: the role of competition*. Electronic Edition. DOI: 10.1145/958735.

网络协作学习活动中文化共同体的培育^{*}

Cultivating the Cultural Community in Web-based Collaborative Learning Activities

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【摘要】 社会交往和社会知识构建是网络协作学习活动的重要特征，这种学习活动发生于流动的文化空间中。在学习进行中，学习者有可能经历既有文化价值的冲突、理解、传递、融合的过程，且逐渐保留较为固定的或产生新的价值取向。以网络协作学习活动中文化共同体的发生和演变为解释线索，理解学习者新的学习环境中的社会文化情境脉络，可从文化研究的层面，探究隐含在网络学习活动中文化共同体由浅入深的发展阶段，以及对学习者个体心理和学习效果产生关键影响的深层文化因素，从而为网络协作学习活动提供文化解释的路径，进行有效的学习活动设计。

【关键词】 网络协作学习活动；文化；共同体；教学设计

Abstract: Social interaction and knowledge construction are important characteristics of web-based collaborative learning activities that take places in the flowing cultural space. Learners will not only experience the collision, comprehension, transmission and integration of culture, but also regulate or generate new values. To the occurrence and change of cultural community as a clue, we can have a profound comprehension of learners' social culture context, probing the development stages of cultural community and deep-seated cultural factors which have critical impact on the learning effects, and then advance collaborative learning activities design in effect.

Keywords: web-based collaborative learning activities, culture, community, instructional design

1. 前言

网络学习环境中设计者和参与者的文化背景、文化需求之日益多元化，以及现代信息技术所承载的文化价值负荷，形成了文化多元的网络学习环境。学习者带着不同的文化身份参与到网络学习活动中，形成新的关系联结。由于突破了传统教学的班级、学校和地区的局限，来自不同地域或是不同文化背景的学习者，他们价值观念、思维方式和行为倾向所存在的差异，使之对于学习情境、学习资源与工具、交流方式、学习成果评价等的理解也不同。

文化在一定的历史维度和人的生活环境中生长起来，它在一个复杂群体的多种因素作用下内生，又被这一群体所处的环境所引导。当把文化研究的视角引入网络协作学习的探讨中，以网络协作学习之交流商讨、协同工作、知识建构和意义共享的要旨为导向，窥探这种文化异质共享的群体的变化机制，可以从文化的层面深入理解网络协作学习者的价值观念、思维方式和行为倾向，从而解释隐含在网络学习过程中极少被揭示，但却对网络学习的参与者及学习行为、学习成果产生关键影响的深层文化因素，尝试一种新的综合和超越。

2. 共同体与文化共同体

斐迪南·滕尼斯指出，与一般的松散的社会组织相比，共同体这一人际结合具有自己的特性：它是积极的现实的有机的生命；使人拥有一切亲密的、秘密的、单纯的公共生活，使人休戚与共，同甘共苦，相互地赋有责任，相互地占有和享受共同的财产；它是人的一种真正的结合，在共同体里，尽管有着种种分离，但其显然的关系是结合¹。

^{*} 本文为广西壮族自治区研究生教育创新计划项目“基于多媒体技术的教学环境优化”(200710602R19)研究成果之一。

可见，共同体所建立的是一种紧密的交往和联系，其中相互结合与相互分离的关系，体现了个体自由与群体规则、自我价值与群体价值的张力。因此，一个真正的共同体，并不是一个松散的个体的集合，也并非整齐划一的僵硬整体，而是一个个体自愿自由的集合，享有平等的关系、资源的共享和意义的协商。值得注意的是，共同体既作为一个整体又不完全丧失个体的独立性，体现了共同体寻求个体独立和归属的张力。此外，在理想共同体中，成员能够相互肯定，相互理解，相互配合，充分共享利益。可见，共同体发展需要经历时间的维度，在不同阶段有可能构成不同方面、不同范围、不同程度的共同体，而非既定的理想状态。

文化共同体是一个流动的整体文化空间。它有可能承载着多种异质的文化价值，同时又指向充分理解、融合、共享的文化目标。费孝通教授曾将由多元一体的国际社会所并成的文化共同体概括为「各美其美，美人之美，美美与共，天下大同」的理想模式，同样蕴含着文化共同体中文化异质与文化共享的重要特征。这种看似矛盾的意义双方，却隐含着由多元文化价值所构成之群体的变化与发展的契机。当文化共同体的参与者把一种文化角色或文化身份用于另一场合，其原有的价值观念、思维方式和行为倾向会相应调整或变形；通过多种调整和变形，一些相异的成分保留下来，而另一些产生变化的，或是在调整中保留下来的成分则成为了共享的部分。由此，文化的异质为共同体文化空间的流动提供了可能，同时也凸现或是沉淀了共享的成分，从而就有可能以一个新的文化共同体的形态呈现出来。

3.文化共同体的培育路径解析

3.1. 概念界定

3.1.1. 网络协作学习 通常认为，网络协作学习是在网络环境支持下，学习者通过交流、沟通、商讨的学习活动，进行学习资源与意义的共享，协同完成知识的社会建构。

为了打开一种新的分析视角，本文试图将网络协作学习本身视为一种对学习思考和研究的角度。它是现代网络技术为教育打开的另一个新的领域，从整个教育和技术的发展历程来看，这本身就是一种可能性，一种不同场育中教育的可能，即网路技术和协作活动是如何促进学习的。由此，才能试图用关注客观现实抽象本质的方式，去求证这种可能。

3.1.2. 文化共同体 基于共同体的内涵，本文将文化共同体描述为：它是通过某种共有的价值观、思维模式和行为模式相互配合，共同实现与相应角色相联系的理念和行动的团体。团体成员既有自身独特的文化特性，又能信奉和遵守共同的价值原则，成员之间是平等的、理解的、协商的、资源共享的。值得强调的是，网络学习环境中的文化共同体，由于学习者的多样性，因此,来自不同的地区、有不同的身份认同等等；此外，由于网络学习环境中人际交流非面对面的特征，学习者更多通过符号、文本的形式展开信息交互。

因此，（1）学习者由于受到固有观念的影响，在学习活动中所产生的价值取向、思维方式和行为方式，由此对学习情境、学习资源、学习策略和认知工具具有某种较稳定的倾向；（2）学习者主要通过文字符号的交互，从而与其他学习者、蕴含在学习内容和认知工具中文化价值达成协商、共享、传递、融合，使自身原有的文化价值观得以巩固，或在文化冲突与包容的环境中内生出新的价值倾向，从而使自身更好地融入当前网络学习环境的文化场域中。

3.2. 网络协作学习与文化共同体的内在关联机制

参考现代意义上的共同体的内涵²，对应网络协作学习的关键特征，探究二者异质共享之共有特质，并建立内在关联。

表 1 网络协作学习与文化共同体的关联

网络协作学习	文化共同体
个体学习与协作学习的相互补充 （个体性与社会性）；	个体寻求文化独立和文化归属两个方向张力的产物；

学习者特征、学习需求多样化；	从本体性的共同理解转变为经过协商的「文化共识」；
网络学习者群体脱离传统的地域限制；	个体有可能在多个共同体中拥有不同的身份认同；
交流、沟通、商讨的学习； 协同完成知识的社会建构； 学习资源、意义的共享；	从基于文化同质性到基于文化异质性； 文化共同体成员从共同生活在同一地域到成员关系的「脱域」；

3.3. 分析路径

网络协作学习活动中文化共同体的培育，这是指这种文化共同体的形成是内生的和环境外力作用的共同结果，即包含了其共同体自然生长和学习活动人为设计两个方面。

3.1.1. 文化认识论

文化认识论是对认识进行文化学反思的科学，它从文化学的特定视角研究认识问题，把人的认识当作文化现象来研究。³

认识主体、认识中介和认识客体共同构成了认识系统的有机整体。也就是说，作为认识主体的人是文化的。同样，认识客体是人创造的对象性存在，而认识中介是认识活动中双向文化性的桥梁，因此，认识客体和认识中介也是文化的。

由此考查网络协作学习活动。首先，支持学习开展的技术条件、网络学习活动本身，以及学习者都是文化的。其次，网络协作学习中的诸多文化因素，包括人和技术力量本身都承载着不同的文化价值观。在文化的碰撞与融合过程中，人作为具有能动性的活动的主体，本身隶属于一定的文化共同体，而在新的文化环境中，又促使了文化异质的凸现和文化共享的发生，并使新的文化共同体在二者矛盾关系推动中形成。再次，可尝试在运用理性分析方法的同时，将网络协作学习环境作为调查的田野，借鉴包括田野调查在内的研究方法的运用。

3.1.2. 社会文化理论 协作学习中的关键特征，就是学习者之间的社会交互和知识的社会建构。维果茨基的社会文化理论认为，人所特有的高级心理机能以社会文化的产物为中介，人的心理发展源于人类历史过程中不断发展的文化，即社会生活的产物。因此，在强调个体心理功能时，应优先对个体已有的文化背景，以及社会文化过程进行分析。

网络协作学习活动中,知识本身与学习过程都存在于一定的社会文化背景中，而学习活动中所产生的心理活动也是与一定的文化、历史、风俗习惯等背景知识密切联系在一起的。同时，作为网络学习交互的基本中介，语言以及其它符号系统等文化表现形式，对网络学习中的文化碰撞、文化理解和文化融合产生了关键作用。因此，围绕这些文化符号所开展的学习活动，既是个体的又是社会的，个体知识建构过程和社会文化共享过程不可分离。以文化研究的视角，考察网络协作学习活动学习者的文化背景，以及新的学习群体形成过程中的文化过程，应成为进一步探究个体学习心理和学习行为的基础。

3.1.3. 文化心理学

坎特的意义文化观认为，不同的种族，由于所处的环境不同，人与世界所发生的对象化关系以及由此产生的对象化活动也不同，因而他们所赋予对象的意义也各不相同。⁴

由于来自不同的文化背景，面对相同的网络学习环境，不同的学习者有可能表现出不同的适应水平，并由此带来不同的心理感受，甚至带来不同于学习环境设计者期望的学习行为和学习结果。

文化心理学的一个显著特征是它对意识过程的种族和文化差异的关注，它致力于这些差异与解释活动和在社会中建构的刺激的意义或表征怎样相一致或符合。⁵

用文化心理学对网络环境中的学习进行解释，有助于在学习者的文化差异与产生有意义的学习之间建立关联。在进行网络学习环境设计时，不仅要考虑到文化对学习者的感受、解释、反馈学习信息的方式产生影响，还要考虑到，只有创设能够有效帮助学习者认识、解释所提供的刺激条件的网络学习环境，才能使学习活动、学习资源的文化意义真正得以显现。

基于以上分析，首先，教育是进行文化传递、发展、交流的形式之一，网络协作学习是随时代发展、技术进步而生长出的一种教育形式，用文化来解释是可能的；其次，文化共同体与网络协作学习内涵间有深层的关联，用文化共同体的语境来阐释网络协作学习共同体，是一种可行的解释途径；再次，强调在理解个人的心理功能时，应优先对社会文化过程进行分析，即先分析学习的社会文化环境，再到个体的心理层面。

由此，可将网络协作学习中文化共同体培育的路径表示如图 1。

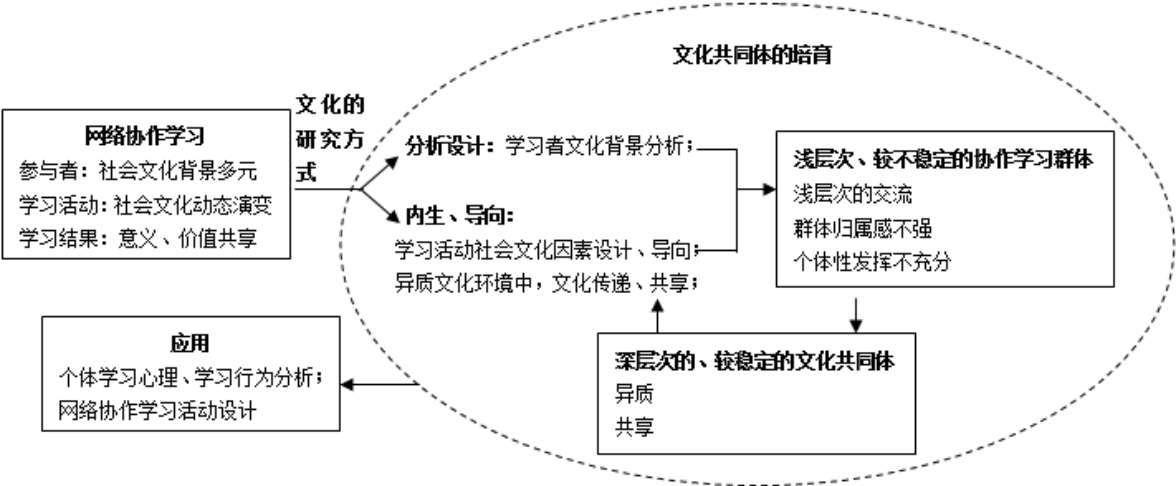


图 1 网络协作学习中文化共同体培育的路径

4. 对网络协作学习活动设计的启示

4.1. 分析前提

以社会交往和社会知识构建为重要特征的网络协作学习活动，学习者文化背景的分析，以及在新的环境中所产生的文化心理的变化，是个体心理层面研究的前提。

4.2. 网络协作学习活动的发生发展过程中，存在着内部生长与外部设计的张力。

网络协作学习发生于流动的文化空间中，通过既有文化价值的冲突、理解、传递、融合，从而沉淀下较为固定的，或是经历变迁后稳定下来的文化价值，形成了网络协作学习进行的新的文化基质。因此，从文化内部生长与设计导向的张力可见，不能完全依靠学习活动的精确设计来达到一定的学习活动目的，而是应在理解网络协作学习中文化共同体形成机制的基础上，把握设计的灵活度。

4.3. 网络协作学习中文化共同体生长的机理，是进行学习活动设计的基本导向。

从网络协作学习共同体由不稳定到稳定、浅层次到深层次的演变过程中，学习活动设计的内容和重心应有所不同。在文化共同体形成不稳定阶段，学习者交流程度不深，群体归属感不强，且个体性发挥也不充分，则学习活动设计的要点在于个体学习倾向的分析，交流途径的多样化设计；而在文化共同体已经较为成熟的阶段，则设计要点在于个体性发挥的空间提供，以及集体智慧的挖掘、共享、传递。

4.4. 网络协作学习中文化共同体的异质共享特征，决定了网络协作学习活动设计的多元包容。

由于不同文化价值对于交流方式、评价方式，乃至交流工具以及协作学习活动本身等的理解差异，不能用一种学习活动设计路径解决所有的学习需求，协作学习活动序列应能提

供多元化的组合方式，例如一对一交流或群体交流，自我评价为主或互动评价为主之间的不同组合路径，使学习者在不同学习环节都能灵活做出适切的选择。

附注

- 1.毛景焕(2003)。《班级作为一个共同体：成员的相互平等和资源共享》。《教育研究与实验》，2003年第2期，25。
- 2.赵键(2006)。《学习共同体——关于学习的社会文化分析》。上海：华东师范大学出版社，29。
- 3.吴家清(2009)。从普通认识论到文化认识论：认识论视角的新转换。《现代哲学》，2009年第1期，31。
- 4.5.李炳全(2007)。《文化心理学》。上海：上海教育出版社，122，125。

参考文献

- 王文静(2001)。社会建构主义研究。《全球教育展望》，2001年第10期，15-19。
- 高文(2001)。教育中的若干建构主义范型。《全球教育展望》，2001年第10期，3-9。
- 刘永富(2004)。文化共同体对共同生活的意义。《人文杂志》，2004年第3期，16-21。
- (德)斐迪南·滕尼斯(1999)。《共同体与社会》。北京：商务印书馆。
- (苏) IO·B·勃罗姆列伊(1981)。论历史文化共同体的基本类型及其发展趋向。《世界民族》，1981年第5期，21-29。

成语流动学习历程“成语，动起来！”中的课程设计

The Curriculum Design in the Mobile-Assisted Idiom Learning Process “Move, Idioms!”

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【摘要】 本文汇报一项我们在一所小学进行的“成语，动起来！”流动华文学习的研究项目，让学生一人一机（手机），上成语课、观看手机成语动漫、参与小组学习，然后在日常生活中随时随地将所见所思与在课堂内所学的成语连系起来，并利用手机拍摄相关照片和造句，张贴上网以进行同侪互评，和回到班上进行学习整合。本文着重于讨论参与教师在去年的九周的先导实验期间的五堂成语课的教案设计，及这些教学活动的执行经验和挑战，如何启发我们为正式实验设计出一套五阶段的成语教学蓝图，应用于今年为期十个月的正式实验。

【关键词】 流动学习、华语文学习、课程设计、无缝学习

Abstract: This paper reports on a research study on a mobile assisted Chinese learning design, namely, “Move, Idioms!” in a primary school. In the study, each of the participating students is assigned a smartphone. They attend the idiom lessons, watch idiomatic animations and participate in small group learning. They then associate their daily encounters with the learnt idioms, take photos and make sentences, and post them onto the Internet for peer discussions. In this paper, we focus on the participating teachers’ lesson planning of the idiom lessons in the last year’s nine-week pilot study, the challenges that we encountered in the enactment of the lessons, and how the experience gained has inspired us to develop a five-stage idiom lesson design framework to guide our subsequent ten-month full-fledged study.

Keywords: Mobile learning; Chinese Language learning; Curriculum design; Seamless learning

1. 前言

本文着重于汇报一项我们在南侨小学进行的“成语，动起来！”流动语文学习的研究项目。此项目的主要教学活动历程设计为应用流动设备即智能手机进行成语学习。参与的学生除了在班上进行由教师主导的强调成语的情境式应用的学习活动之外，也随身携带手机，捕捉生活场景，随时随地将所见所思与在课堂内所学的成语连系起来，利用手机拍摄相关照片和造句，张贴上网（应用集体写作工具 Wiki），并和同侪进行互评和讨论。换句话说，这是一套结合正式学习（课堂中的学习）和非正式学习（课外学习）的教学策略，两者相辅相成。因而实验期间在课室里进行的成语教学的教案设计，对学生至关重要。

本项目包含已经完成的九周先导实验（2009年7月至9月）和正在进行的十个月正式实验（2010年1月至10月）。这两个实验分别在两个不同的小学五年级班级进行。我们在先导实验中所获得的经验是：学生在上成语课时积极学习，但对课外的摄影及网络互动则一般上欠缺热忱，以致课内外的学习活动不能有机地结合起来。我们采取设计研究(design research)(Collins, 1992)方法，即是针对一个学习方面的问题，透过细致的研究提出解决方案，然后重复地为这个方案进行实验、评估、反思和修正。本文论述我们在先导实验中所面临的挑战，如何启发我们为正式实验设计出一套五阶段的成语教学蓝图，以期解决这些问题。

2. 理论依据及《成语，动起来！》学习历程设计

流动设备(mobile devices)为科技辅助学习提供了新方向。应用流动设备进行的“流动学习”，历经多年的摸索后，学者开始倡议建构人机比例为 1:1（每一名学习者拥有一台流动设备），以学习者能时时学、处处学为取向的“无缝学习空间”(seamless learning space) (Chan *et al.*,

2006)。在无缝学习空间中，学习者能衔接正式和非正式的学习情境，整合个人与社群学习、现实与网络学习、各种学科与课外知识领域。

对于语文学习来说，早在流动科技诞生以前，就有学者（如：Titone, 1969)提出了结合正式和非正式语文学习的语文学习理念。适当的流动／无缝学习的设计，应可激发学生在现实生活中活学语文的兴趣，并将之与他们在课堂所学结合起来。

应用无缝语文学习的理念，我们设计出《成语，动起来！》的无缝学习历程。这个设计有一个重要的语文学习理论依据—— Nation (2001)的词汇学习模式（成语可被视为一种特殊的词汇）。Nation 指出，成功的词汇学习应经历三步骤的心理历程：“注意”（noticing；“语文输入”，如学习者阅读或聆听别人说话时，注意到了一个关键性的生词）、“提取”（retrieving；即再次遇上这个生词）和“创造／生成”（creative/generative；这个过去注意并被提取过的生词，被用在跟过去已知的用法中不太一样的情境）。

这个包含四项活动的学习历程其实应该是递归的，即是应重复执行。四项活动简介如下：

(1)教师促成的情境式成语学习（属于正式学习）：强调 Nation 模式中的“注意”和“提取”，由教师进行学习设计。其活动流程，一般上由一些暖身活动开始，然后让学生观赏相关的成语动漫（我们使用台湾的《五子登科》动漫系列：www.5qchannel.com）。之后，教师执行一些强调使用情境的成语学习活动。

(2)情境式个人造句及摄影（非正式学习）：由于学生随身携带手机，他们除了可以随时重复观看成语动漫外，也受促积极地在日常生活中寻找或“制造”能让他们联想到所学过的任何一个成语的情境，然后举起手机拍摄这些情境及用有关成语造句——这也就是 Nation 模式中的“创造／生成”。所谓的制造情境，即是摆设某些物品，或邀请家人或好友“演戏”让他们拍照。他们最终必须把相片／造句贴上 Wiki 页面。

(3)线上同侪学习（非正式学习）：这个程序对应 Nation 模式中的“提取”。学生参阅各个 Wiki 成语页面（从同一成语生成的照片／造句贴在同一页），比较同学的照片和句子是否切合成语使用情境，并在留言区给同侪回馈或修改句子。学生可使用家用电脑上网编辑页面。

(4)学习整合（正式学习）：教师在流程（2）和（3）进行了一段时日后，在班上组织学习整合活动。活动可以包括在班上进行小组或集体讨论，讨论同学的句子和所拍摄的照片是否切合所用成语的情境；或让全班票选“人气照片”、“人气句子”，并邀学生提出投选理由。

3. 先导研究期间的教学设计和执行结果

从这个学习历程设计中可见，(1)的课堂学习活动的关键就在于引导，通过提供适当的鹰架，协助学生建立起进行(2)和(3)的兴趣和能力。在研究过程中，研究人员提供理论及设计框架以及技术支援，参与研究的教师主导正式学习，负责设计步骤（1）和（4）的教案。

在先导研究进行期间，教师共为实验班（40 名混合水平的小五生）设计及执行了五堂各 60 分钟的成语课（每周或隔周上课），每堂课所采取的流程均为引起动机—成语教学—小组活动。表格 1 总结这五堂课的大致设计。

综观这五堂课的教案设计，小组活动的设计原则是透过同侪间的脑力激荡，让学生循序渐进地掌握利用手机“产出”由简入繁的照片／句子组。其中，第一、二课着重于拍摄单张照片并造句；第三课强调分辨近似成语的差异；第四、五课则聚焦于融入课堂外的现实环境的拍造、造句活动。我们期望学生能把在课堂或校园小组活动中所学，转移到课后自行拍照并根据所拍照片造句。表格 2 展示五堂课堂上课时和放学后“产出”的一些学生作品。

表格 1 《成语，动起来！》先导研究期间的成语课教案设计简介

主要课堂活动				所学成语
	1.引起动机	2.成语教学	3.小组活动	
第一课	成语乱码游戏：投影片快速闪现单字，让学生组成成语	观看成语动漫及课堂讨论	学生分组构思、角色扮演，利用手机互相拍照以表现对本周所学个别成语的理解和运用	一鸣惊人、掩耳盗铃、一举两得、狐假虎威、火冒三丈、轻手轻脚

第二课	放映车祸视频，并由教师发表一段叙述短文，串连六个所学成语	(同上)	(同上)	横冲直撞、七嘴八舌、东倒西歪、大惊失色、怒气冲冲、异口同声
第三课	看图猜成语游戏	(同上)	<ul style="list-style-type: none">学生配对讨论“眉开眼笑”和“手舞足蹈”的差别、造句学生分组构思情境，着重表现“一言不发”和“闷闷不乐”的差异	眉开眼笑、手舞足蹈、一言不发、闷闷不乐、兴高采烈、筋疲力尽
第四课	看图猜成语游戏；着重比较五颜六色和万紫千红、目不转睛和聚精会神等的异同	(同上)	各组学生离开课室，到校园内不同角落寻找与成语相关的人或物，或以之为背景构思情境，拍摄单张照片	五颜六色、聚精会神、万紫千红、目不转睛、鸟语花香、目瞪口呆
第五课	比手划脚猜成语游戏	(同上)	各组学生离开课室，到校园内不同角落寻找与成语相关的人或物，或以之为背景构思情境，拍摄单张或连环照	一望无际、风平浪静、拳打脚踢、一模一样、津津有味

教师们对这五堂课的教案设计工作，多是在上完一堂成语课之后，依据学生的学习进展和教师的执行经验，进行下一堂课的设计，而非事先敲定所有五堂课的教学大纲。换句话说，如果把这五堂课的设计视为一体，则这是一个自下而上(bottom-up)的设计历程。

这 40 学生在九周的实验期间，总共分享了 453 个照片/句子组；但学生的参与度的落差极大（全班平均值为每人贴 11.3 个照片/句子组，标准差为 25.9）。最勤的学生个人贴了 153 个照片/句子组；但全班有 75% 名学生平均每周张贴少过一个照片/句子组。我们观察并分析了学生的活动历程，并与教师和学生交谈，找出导致学生的参与度落差的原因如下：

- 学生态度：学生在五堂课当中，表现出极大的学习兴趣。可一旦放了学，他们基本上把手机当成一个新玩具而非学习工具；部分学生因而对于在课外拍照／造句活动提不起劲。
- 技术问题：由于我们所使用的技术有一些“先天”局限或偶尔故障，导致部分学生不时无法上网张贴照片和造句，造成他们对于课外拍照／造句活动意兴阑珊。
- 语文学习方面的挑战：部分学生还没有建立起“转移”课内所学（“输入”）到课外应用（联想、“输出”）的能力。学生的学习方式，或许仍是以强化针对考试题型的作答能力为目的，而非真正应用在生活中的能力。
- 成语的选择：可能是教案设计的意念先行，我们为首两堂课选择的多数成语，学生都不容易在他们的日常生活中寻找情境（如：掩耳盗铃、狐假虎威、一鸣惊人等）。学生能作生活联想的成语有限，进行拍照、造句的兴致就不大。
- 家长态度：无缝学习不单涉及学生、教师和学校当局，家长对学生使用科技进行非正式学习时的态度，也扮演了一定的角色。以这次实验来说，学生在校外所拍摄的照片中，超过 80% 是在他们各自的家中拍摄的。老师向全班查问，发现大多数学生的家长都不允许他们把手机带出家门（带回学校除外），以免孩子遗失或损坏手机。其实，这使到强调时时学、处处学的无缝学习无法实现，也窄化了学生能拍照及造句的情境。

表格 2 五堂课上课时和放学后“产出”的一些学生作品

	第一课	第二课	第三课	第四课	第五课
上课时的作品	 小青正在睡觉，小	 小华怒气冲冲地把	 因为没人陪弟弟玩足球，所以他感到	 这些五颜六色的水壶很美。	

	蓝不想吵到小青所以她 <u>轻手轻脚</u> 地走了过去。	明华臭骂了一顿	<u>闷闷不乐</u> 。		这位老师在食堂里吃得 <u>津津有味</u> 的。
放学后的作品	 <p>我<u>轻手轻脚</u>地走进家里因为我很迟才回家。</p>	 <p>妹妹<u>怒气冲冲</u>地看我好像要打我似的。</p>	 <p>哥哥应为考试不格，<u>闷闷不乐</u>地坐在角落头。</p>	 <p><u>五颜六色</u>的身体得上这只孔雀。</p>	 <p>小宝宝喝奶喝得<u>津津有味</u>。</p>

4. 正式实验所采取的五阶段教学蓝图

为了能在后续的正式实验中排除或减轻上文所述的学生参与度落差的五个原因，我们在此轮实验展开前便进行了针对性的策略制订。其中，在技术问题方面，我们开发新手机应用程序，为学生直接从手机张贴照片／造句提供方便；在家长态度方面，我们安排了家长沟通会，向家长详细介绍我们的研究，并鼓励他们参与孩子的学习。而针对学生态度、语文学习挑战和成语的选择这三方面，我们参考去年的教案设计和执行经验，订出一套“五阶段教学蓝图”（参阅表格3），在前述的“无缝学习历程”框架和教师的个别成语课的教案设计这两大设计层次之间，提供教师一个更具体的设计指导框架。换句话说，教师的教案设计历程，会从自下而上转变为自上而下。

这个蓝图中的各个阶段，可以由一个或若干个成语课组成。教师应依学生的学习进展，而决定在何时结束一个阶段，晋入下一个阶段。此外，在这个蓝图中，学生不会在阶段一开始就使用手机，而是得先为了解成语的使用情境打下良好的基础之后，才开始让他们在生活中寻找或创设情境。此外，我们也建议教师在排列成语的学习次序方面，照顾到由简入繁，从“五颜六色”、“东倒西歪”等这些身边随处可见相关物件或情境的成语开始，而非一开始就教导如“狐假虎威”这样的典故型成语。教师受鼓励在为各个成语课选择成语时，与当时正在上的正课课文中出现的成语，或即将来临的节日或学生活动配合。例如，教师可选择在春节前一周教导“人山人海”、“张灯结彩”、“眉开眼笑”等，以便学生现学现用，在过年期间拍摄及分享相关的照片及造句。

表格 3 正式实验所使用的五阶段教学蓝图

阶段	学生的学习目标	课堂成语教学（推荐方式）	小组活动（推荐方式）
一	引起成语学习动机；学习成语的意义及使用情境；提高判断成语使用准确度的能力	教师利用成语动漫讲解成语的含义、感情色彩、使用情境；检查学生对成语的理解程度	教师提供句子，由学生判断句中所用成语的准确性
二	加强对成语情境的认识；根据所提供的情境，利用成语造句	（同上）	教师提供照片，让学生提出相关成语，并进行造句，贴上网互评
三	能同时使用几个成语串成小段，呈现一个情境	（同上）+教师创设一个情境，串连应用数个成语描述之	教师提供图片或静态元素，并提出数个成语，要求学生写段描述以串连这些成语，贴上网互评
四	能在生活中寻找素材，完成情境描写句	（同阶段一）	教师把习过的成语按主题分类，每一组学生针对所分派的成语组，在课室或校园内寻找或创设情境，拍照及写段，贴上网互评
五	能在生活中观察、想象，创设情境，并利用成语来描述情境	（同阶段一）	教师组织情境设计比赛，每周提供竞赛主题，引导学生在生活中寻找素材，拍照及造句或写段，贴上网互评

5. 后续研究及总结

本文汇报一项我们在南侨小学进行的“成语，动起来！”流动语文学习的研究项目，让学生一人一机（手机），上成语课、观看动漫、参与小组学习、课外摄影和造句、张贴上网以进行同侪互评、回到班上进行学习整合。本文的重点在于说明在去年九周的先导实验中，参与教师的执行经验和所遇见的挑战，如何启发我们为正式实验设计出一套五阶段的成语教学蓝图。我们在先导实验中采取自下而上的教学设计对学生的成语学习和“产出”照片／造句的认知历程有了进一步的了解，在对学生认知历程了解的基础上，我们在正式实验中改而采取自上而下的教学设计，并着手验证、反思、改进这套教学蓝图，使研究更贴近“研究设计”的精神，并能全面地发挥无缝语文学习的潜力。

参考文献

- Chan, T. W., *et al.* (2006). One-to-one technology-enhanced learning: An opportunity for global research collaboration, *Research and Practice in Technology-Enhanced Learning*. 1(1), 3-29.
- Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New Directions in Educational Technology* (pp. 15-22). Berlin: Springer.
- Nation, P. (2001). *Learning Vocabulary in Another Language*. Cambridge, UK: Cambridge University Press.
- Titone, R. (1969). Guidelines for teaching second language in its own environment. *The Modern Language Journal*, 53(5), 306-309.

网络 2.0 与建构式学习 e 教学单元

Web 2.0 and Constructivist e-Learning Units

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【摘要】 本文针对时下教改提倡自主学习和协作学习的目标，提出我们如何利用一个以网络 2.0 的概念为基础的网络生成器，设计建构式学习 e 教学单元。我们相信根据有意义的学习的模式，我们所设计的 e 教学单元，应该能够促进学生自主学习和协作学习的能力。

【关键词】 网络 2.0；建构式学习；教学设计；华语文学习

Abstract: This paper reports on a web authoring tool grounded in the notions of self-directed learning and collaborative learning for the design and generation of constructivist e-learning units. We believe that the e-learning units based on the meaningful learning model will be able to nurture students' ability in self-directed learning and collaborative learning.

Keywords: Web 2.0, construtivism, pedagogy design; Chinese Language learning

1 · 前言

新加坡教育部于 2009 年推出了第三个资讯科技总蓝图(IT Master Plan 3 或 MP3)，蓝图中四个主要的目标为：一、学生必须具备利用资讯进行自主学习和协作学习的能力；二、教师必须实践利用资讯科技帮助学生进行自主学习和协作学习；三、学校领导要创造有利于实现自主学习和协作学习的条件；四、学校的资讯科技设备必须让学生能随时随地学习。

要实现以上的目标，网络 2.0 的许多应用软件都可以大有可为。本文介绍一个新加坡教育学院开发的网络 2.0 形态的网页生成器，并以有意义的学习 (meaningful learning, Jonassen et al., 2008) 为教学模式，利用该网页生成器设计了一个建构式学习 e 教学单元。我们希望借本文抛砖引玉，探讨如何充分开发网络 2.0 的潜能，帮助教师们应付 MP3 所带来的新挑战。

2 · 文献考察

网络 2.0 的潜能

网络 2.0 技术的特征是强调个人化、互动化和内容共建 (Millard & Ross, 2006)。网络 2.0 技术使网络超越单纯的固定网页内容和网页标签 (即网络 1.0)，而晋入一个具备上述三大特征的博客、维基、社交网站、第二人生等网络 2.0 工具横扫网络的时代。网络开始从产品导向 (类似印刷书刊) 过渡到历程导向 (对应我们的现实生活)。对于语文教学来说，网络 1.0 提供给师生的仅是沟通和参考的功能，而网络 2.0 则进一步提供了整体的学习环境(Alm, 2006)。

自主学习与协作学习

自主学习所涵盖的学习活动，包括学生主动判断自己的学习需求，设定学习目标，选择学习资源和学习策略，执行自己设定的学习计划，并适时检查自己的进度，根据学习进展调整学习策略。它也包括在学习过程结束后，进行反思以建立对自己在学习上的特性的认

识，为自己的学习设定更高的目标，并将新知运用于适当的生活场景（Knowles, 1975）。

协作学习的主要理论基础，来自维高斯基的研究（Vygotsky, 1978）。维高斯基发现幼儿的思维能力的发展，主要是通过内化交际语言而来。协作学习着重通过学生之间的交流沟通，来促进学生的学习。成功的协作学习，能为学生带来多方面的好处，这包括交际能力的加强，小组协调能力和批判性思维也能获得提升。通过观察较优秀的同侪的思维和学習模式，协作学习也能间接的加强学生的自学能力，并巩固所学的知识(Scardamalia, 2002)。

有意义的学习 (*Meaningful learning*)

Jonassen (2000) 于 90 年代末，就提出了如何使用电脑进行有意义的学习的架构。他所依据的学习原理，主要是建构主义与社会建构主义。建构主义坚信学习必须是积极的；学生将他们从老师或其他资源所获得的信息，根据自身经验与已备知识，重新诠释，使新讯息与既有基模 (schema) 加以整合，成为对自己有意义的知识 (Jonassen, 2006)。而社会建构主义，则是在建构知识的过程中，另外强调社会群体的作用，重视学生的互动协调 (Hung & Chen, 2006)。

要设计有意义的网络化学习，所设计的教学单元应含五个要素 (Jonassen et al., 2008)：

1. 真实性 (Authentic)，即学生应该在真实的情境下使用真实的工具解决真实的问题。
2. 建构性 (Constructive)，即学生须主动建构所学事物意义。
3. 积极性 (Active)，即学生亲自动手动脑，运用工具和思考方法等对素材进行加工。
4. 目的性 (Intentional)，即学生应主动设定目标，并通过反思调整方法和策略。
5. 协作性 (Collaborative)，即学生应以小组方式进行学习。

建构式学习

无论是建构主义或社会建构主义，都提倡以电脑作为建构知识的工具。两派学者认为教师可以将电脑当成帮助学生建构知识的智能工具 (mindtool/cognitive tool)。繁复和机械式的运算工作应交由电脑去承担，而学习者则集中精力于高层次的思维。在这样的知识建构过程中，学生对信息的吸收，比被动地聆听老师的讲解深入。智能工具所使用的开放式软件如 PowerPoint 或 Excel，及各种网络 2.0 工具，在加入适当的教学设计后，也能成为认知工具。这类软件让学生能对已有的信息进行编辑、比较、分类、归纳等，将信息提升为符合自己学习目标的有用知识。此外，应用开放式软件的一大好处是老师们不必再为寻找适合的教学软件烦恼了，也不必再考虑是否有足够的软件供学生使用，因为几乎所有的电脑都能直接运用此类软件(Jonassen, 2006)。

三、网络化建构式教学单元

据文献所载，E 学习在促进自主学习和协作学习方面，具有良好的效益。有鉴于此，我们在新加坡的师范教育中，要求职前教师设计网络化建构式教学单元。网络化建构式教学单元的设计概念，基本上结合了黄修群(Lim & Chan, 2007)微型课件的理念与 Bennie Dodge (2007) 的求知网 (Webquest) 的理念。依此，我们设计了网络化建构式教学单元的组成网页：

- 引言：简略地交待课题，设定学习目标，并界定学习对象。
- 情境：通过多媒体叙述故事、难题或个案，营造真实的学习情境，激发学生的学习兴趣，并帮助学生建立所学技能与现实生活的联系。
- 活动：针对情境提出的挑战，设计导引学生解决问题的活动，例如上网搜寻资料、收集数据、组织资料、建立电脑化概念图、建构多媒体文件等。
- 分组指示：指示学生该如何进行分组，分配组员任务等。

多媒体。这些活动都能从资讯科技得力。学生可以使用我们的网页生成器里附属的电脑概念软件（mind-mapping tool）来进行脑力激荡，决定内容大纲。图三是一个活动网页的例子，它显示了一个电脑化的概念图。这个活动可以刺激学生的思维，帮助学生把个别资料组织成有意义的篇章和报导。设若学生对什么是构成一篇好的自我介绍没有具体概念，老师就需要指引学生阅读近似的网页，并设计活动帮助学生对他人的自我介绍进行评估。类似的材料，现在都能在互联网上轻易找到。使用资讯工具进行各样的讯息处理，让学生积极建构自己所知，符合有意义的学习对**积极性与建构性**的要求。随着学生对此类学习逐渐熟稔，活动也应逐渐交由学生自行策划。

以在活动网页下面的讨论区的形式存在的网络 2.0 的所提供的高度互动和共建内容的功能，在这里发挥了重要的作用，为社会建构主义式的学习提供支援。但单只提供工具，学生不一定就能有效应用。为了培养学生协作学习的能力，丰富学生对不同课题的认识，为学生分组分角色是有必要的。在本课题中，我们建议每组三人，角色为组长、电脑操作员、提问者，每次开始新的活动，角色就必须进行轮替。这样的安排能让学生感受群体合作的滋味，他们碰到问题时，有机会合力解决。图四也列出一些小组交际时应注意的规则，以帮助学生进行有效的沟通。

末了，当学生完成所有的活动之后，我们按学生的学习历程设定一些反思性的问题，鼓励学生对自己的学习历程作出反省，并吸取重要的过程知识。这样做能够加强学生在学习过程中的**目的性**，提高学生的自学能力。

五、结论

本文概要的介绍如何设计网络化建构式教学单元网页。我们希望能有意设计课件的老师们提供多一点的想法。这一类型的课件，应该能在某种程度上促进学生的自主学习与协作学习的能力，我们也计划针对网络式建构教学单元进行进一步的教学研究，以便验证我们所提出的构想并加以改进，使电脑科技在课堂上的运用，更趋近于培养 21 世纪知识工作者能力的宗旨。

参考资料

- Alm, A. (2006). CALL for anatomy, competence and relatedness: motivating language learning environments in Web 2.0. *JALT CALL*, 2(3), 29-38.
- Dodge, B. (2007). Webquest.org. Retrieved 14th Oct 2008 from <http://www.webquest.org/index.php>
- Hung, D., & Chen, D. (2006). Transactional-constructivist perspective to learning: Implications for the design of learning activities. In Khine, M. S. (Ed.). *Teaching with Technology: Strategies for Engaged Learning*. (pp. 63-76). Singapore: Prentice Hall.
- Jonassen D. H. (2000). *Computers as Mindtools for schools* (2nd ed.). Upper Saddle River, NJ: Prentice-Hall.
- Jonassen, D. (2006). *Modeling with Technology: Mindtools for Conceptual Change*. (3rd ed). Upper Saddle River, NJ: Prentice Hall.
- Jonassen, D., Howland, J., Marra, R., & Crismond, D. (2008). *Meaningful Learning with Technology* (3rd ed.). Upper Saddle River, NJ: Pearson.
- Lim, C. P. & Chan, B. C. (2007) microLESSONS in teacher education: examining pre-service teachers' pedagogical beliefs. *Computers & Education*, 48(4), 474-494.
- Knowles, M. (1975). *Self-directed Learning: A Guide for Learners and Teachers*. New York: Cambridge.
- Millard, D.E., & Ross, M. (2006). Web 2.0: hypertext by any other name?. *Proceedings of the 7th Conference on Hypertext & Hypermedia* (pp.27-30), Odense, Denmark.
- Scardamalia, M. (2002). Collective cognitive responsibility. In B. Smith (Ed.), *Liberal Education in the Knowledge Age*. Chicago: Open Court.
- Vygotsky, L. S. (1978). *Mind in Society*. Cambridge, Massachusetts: Harvard University Press.

選擇權理論下的華語教學實踐

A Practice of Teaching Chinese as a Second/Foreign Language under the Theory of Xuan-Ze Quan

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【摘要】 此篇論文所探討的是研究者於過去數年，基於華語研究現場與教學實踐之發現，所提出的選擇權理論。在文中，研究者首先說明當前華語教學領域典範轉移的重要性，並分析華語語言中的參與者特性；再者，提出選擇權理論下的七大範疇：教學觀、教材發展觀、文化觀、知識觀、學習觀、意識觀與社會觀，並隨後列舉實例以說明各大範疇下的計算機應用方式；最後，在結論上，研究者論證選擇權理論在華語教學上的意義，且說明未來華語教師在實踐選擇權教學時，可能會遭遇的限制與困難，並提出可行之建議。

【关键词】 華語、選擇權理論、典範轉移、參與者

Abstract: This article is to discuss the Xuan-Ze Quan theory, which was raised by the author based on his findings in research and teaching of Chinese as a second/foreign language (CSL/CFL) in the past few years. The author first explains the importance of paradigm-shifting in the present field of teaching Chinese as a second/foreign language (TCSL/TCFL) and analyzes the feature of participator in Chinese language. The seven categories, including pedagogy, material development, culture, knowledge, learning, ideology and society, under the Xuan-Ze Quan theory are then discussed with uses of computers in real teaching examples. In conclusion, the author discusses the significance, limitations and difficulties when applying Xuan-Ze Quan theory in the field of TCSL/TCFL and provides some useful suggestions for future practice.

Keywords: CSL/CFL, Xuan-Ze Quan theory, paradigm-shifting, participator

1.前言

若檢視台灣及中國過去五、六十年的華語或對外漢語教學（以下統稱華語教學）發展，則會發現華語教學領域，一直未能針對漢語的語言特性，建構出得到多數教學者認同的語言教學觀。換言之，教學與研究者或許可從西方的溝通式（或稱交際式）或全語言（whole language）等教學觀中得到養分，但這些語言教學背後的語言理論概念及教學情境畢竟是奠基於西方的語言、歷史、政治與文化脈絡之下。這並不是說，這些語言教學觀不能適用於華語教學現場中，相對的，教學現場早已見到許多優秀的教師將這些教學觀謹慎的應用於其華語教學中，並獲得良好的教學效果。在此，我想說明的是，在經過多年的教學探索與研究成果的累積之後，華語教學現場該是到了思考與進行典範轉移（Kuhn, 1996）的時候了。換句話說，經過多年在漢語語言特性及華人社會特有的語言、歷史與文化場域等概念的探討之後，華語應該要能在教學概念與實踐上更加深化，兼及華語語言與言語社群（speech community）的特性，建構出能讓全球華語學習者與教學者得到更多裨益的華語教學觀。在下文中，因考量華語與漢語此二詞彙在新加坡、台灣與中國等華人言語社群中所指涉的意涵雖有重疊，但卻不完全相同，所以為便於行文之解說，我以個人之書寫習慣做出概略的區分，即是：與語言學相關的主題，以漢語名之；而與教學相關的主題，則以華語稱之。

從過去幾年的華語研究與教學中(鍾鎮城a、b、c, 2009; 鍾鎮城, 2010; 鍾鎮城、黃湘玲, 2009; 南洋台灣姊妹會、鍾鎮城, 2010), 我發現若是漢語的意合與參與特性, 能在教學當中得到凸顯的話, 則學習者就會更為精準與流利的透過漢語以表達自我。漢語有強烈的意合趨向, 著重意旨的內蘊與呈現, 並在語意表現上強調情境的結合, 漢語此種明顯的意合趨向與拼音文字中強調動詞中心的形態變化趨向相較, 有著極大的本體差異性。我個人認為, 之所以促成漢語此種意合趨向的重要關鍵, 是因語言使用者的參與所致。換句話說, 漢語在本質上, 是一種非常強調使用者本位的語言, 因使用者的時間、空間及個體的實體或虛擬(如計算器的使用)介入性, 而使得漢語的語言形式呈現出與許多拼音文字不同的結構、功能與文化特性。

也是因為漢語的使用者本位特性, 所以使用者對於語言意合的參與, 就會藉由口語或書面語在書寫、閱讀、說話、聆聽等表現形式及真實或計算器虛擬情境中呈現。不過, 若漢語使用者在各類的表現形式中缺少了參與的行動, 則不僅使用者可能無法從漢語中獲得意義的理解, 亦可能會致使語言內容呈現出歧義、多義及一字多音等現象。然則, 必須說明的是, 在此所指陳的「歧義、多義及一字多音等現象」不必然是負面的。

在以上種種探究與研究基礎之下, 我個人在過去幾年中陸續補充、研究、驗證及完善出所謂的選擇權教學觀, 希望此種具語言性、動態性及社會性的語言教學理論的提出, 能讓眾多從事華語教學相關領域的研究者與教師, 對華語教學的特性有更多的論述與理解。而在英譯上, 我以「xuǎn zé」兩字的漢語拼音直接呈現「選擇」一詞, 考量的是, 不管是英文原型動詞形式的choose與select, 或名詞中的choice與selection, 甚至是動詞型態的過去、現在、完成與未來式也好, 都不能完全的呈現漢語文字「選擇」一詞所表達出的時間、空間、事態與參與者等概念, 因此, 我認為選擇兩字以直接的音譯呈現英譯, 最能表達我對華語教學的選擇觀。以下說明選擇權理論在華語教學中的內涵與實踐型態:

2.選擇權理論的內涵

所謂的選擇權理論, 強調與語言相關的教學觀、教材發展觀、文化觀、知識觀、學習觀、意識觀與社會觀等「至少」七類觀點。以下呈現的是這七類觀點的相關內涵:

- (一) 選擇權是以學習者為中心的語言教學觀
- (二) 選擇權是以習得概念為核心的語言教材發展觀
- (三) 選擇權是尊重學習者主體存在的語言文化觀
- (四) 選擇權是理解語言表現能力與形式的語言知識觀
- (五) 選擇權是協助學習者建立自學模式的語言學習觀
- (六) 選擇權是引導及發展學習者解決問題能力及態度的語言意識觀
- (七) 選擇權是培育學習者具有未來公民及民主素養的語言社會觀

上述七類觀點, 包含了華語教師在教學準備前、實踐中及完成後的進程。在語言研究相關議題上, 包括了語言認同、語言教學、語言習得、語言教材、語言心理、語言文化、語言功能、語言形式、語言本體、語言策略、語言態度、語言意識、語言生態及語言社會等項次之思考。雖然, 我建議華語教師以此來思索、設計、檢驗、評估與探究自我的華語教學歷程, 但需提醒的是, 這七類觀點, 只是選擇權理論概念下的華語教學之基礎, 華語教師需依教學場域與目的多樣性, 從中選擇數項或全部類別以為應用, 甚至可在這七類觀點上予以擴充。另外, 需提醒的是, 在過去幾年的選擇權理論探究中, 我所強調的選擇權理論, 視華語教師

與學生之間為一互動的有機體，是一不可分割的存在；然則，本文的意旨在於呈現華語教師的選擇權教學，因此偏於以教師為讀者主體的敘寫方式。

3.選擇權理論的實踐

上一節中所提到的七類觀點，在實際的華語教學現場中，可以有無數種的應用與變化。以下，我依次解釋各項類別的實踐內涵，並舉教學實做之活動或策略予以參考。而為契合此次的大會主題—計算器教育應用，在每類觀點的教學實例舉例中，我都會提到在過去應用選擇權理論於華語教學之課室時，研究上顯示具有實效的計算器與資訊教學實踐。

3.1.選擇權是以學習者為中心的語言教學觀

語言的學習與教學，事實上是一種非常個別化的過程，最後的趨向，往往會決定於學習者與教學者本身對於該語言的認同、覺知與動機。在一般華語教學的課室情境裡，雖然華語教師所面對的往往是群體而非個人，可是，因為學習者在經驗、多元智能、家庭、族群等背景上的個別差異，所以，語言對於學習者的意義，總是會朝個別化的路線發展。選擇權式的華語教學尊重學習者個別的語言認同選擇，而在真實情境下的教學活動中，為體現此項觀點，最常見的具體華語教學實例包括：透過影音多媒體讓學生觀賞漢字字源動畫，然後，鼓勵學生選出最喜歡的漢字，以連結其對該字之感受；或閱讀文本之後，選出最喜歡或最不喜歡的句子，以表達句意與其學習及生活經驗選擇後的連結。這些課堂教學實例體現的都是一種華語參與的行動，學生作為語言使用者，在這樣無形的教學活動中選擇把華語納入其當下的生活與生命意義之中。

3.2.選擇權是以習得概念為核心的語言教材發展觀

自從Krashen(1985)匯集過去學者之研究成果而提出習得概念之重要性後，其影響所及，當前的第二語言或外語教學者或多或少都會把習得概念應用於教材及其教法中。在作法上，一方面考慮教材中語言使用的真實性；另一方面則會在可理解性輸入(comprehensible input)的觀點下，思索教材內容與學習者語言能力之間的關係。選擇權式的華語教學教材強調的是一種習得觀點之下的發展觀，換句話說，教材應根據學生的習得現象而予以發展，教材的來源、內容與呈現方式都是在動態情境所做的選擇。在實際的華語教學實例上，主要的作法可以是：依時間、學習進度與科技設備資源針對教學對象實施華語語言需求調查，之後根據調查結果，發展出合適的或專業的(Chinese for specific purpose)華語教材。但須體認到，教材與華語學生的學習選擇並非是固定不變的，且不應過度仰賴紙本或網路資訊等單一類型，是要隨時且動態的基於學生的興趣與能力，師生之間共同進行調整、修正與轉換的。

3.3.選擇權是尊重學習者主體存在的語言文化觀

教學者必須認知到，學習的主體是學習者本身，是學習者在學習如何使用語言而不是教師，只有學習者自身最為清楚這個當下正在學習的語言對於其存在主體的意義。而教師要做的，就是尊重學習者彼此之間的生理及文化差異現象，而後依各式的主體差異以協助其在語言上的適性發展。選擇權理論下的文化觀點體現於華語教學實踐時，所強調的是對於文化及語言差異現象的尊重；華語教師視差異的存在為常態，且體現處理多元差異時的專業。具體的華語教學活動實例可以是：在教室中，教師理解母語非華語學生的語言沈默與文化衝突(cultural shock)現象，或是以行動或言語肯定並鼓勵學生既有的雙語或多語能力，並視華語以外的語言為華語課堂學習的重要語言資源。另外，華語教師對於具有特殊需求(special

need) 或需以手語及手寫版溝通學生之存在狀態的接納與學習權利及文化的尊重，也是一種文化觀點下的選擇權概念表現。

3.4. 選擇權是理解語言表現能力與形式的語言知識觀

第二語言或外語學習者的語言本體知識，常常並不來自於當下正在學習的目標語言，也就是因為人類如此的語言認知現象，使得第二語言或外語學習者在目標語言的表現形式上，常出現一些遷移 (transfer) 現象。事實上，學習者若能以多種的語言形式表達出自我對於目標語的理解與運用，該學習者即在概念上，表現出藉由語言的使用以參與某種意義建構的過程；換句話說，該學習者正在發揮與建立屬於該語言的語言功能。在選擇權理論下的華語知識觀，教師所聚焦的是對於「學生如何運用及表現其原有語言知識歷程」的理解，具體的華語教學實例包含：華語教師理解與欣賞學生透過多元媒介 (multimodality)，以口語、文字、網路、影像、音樂、肢體等方式呈現其語言知識的選擇方式；而在教學上，教師也會適度的運用多元媒介以深化學生對於華語的認識，甚至使用各類的評量形式，以幫助學生有效的使用華語以表達自我之概念。

3.5. 選擇權是協助學習者建立自學模式的語言學習觀

任何學科或類別的學習，其最終目的常是要養成學習者的獨立性，換言之，就是要讓學習者養成其自學模式與策略。知道如何自學語言，就是一種能反思自身情況、觀察周遭場域及理解自我語言知識的一種後設語言 (或稱元語言) 行為；而這種後設語言行為，也可以解釋為是：學習者檢視與思考其參與語言符號使用以建構意義的循環過程。在選擇權式的華語學習模式裡，華語教師會幫助與鼓勵學生發展自學模式與策略，具體的華語教學實例有：在課堂上，華語教師教導學生華語工具書及電子網路字典或搜尋引擎的使用方式，或是以 Google Map 標示出學生彼此之間的居住位置，幫助學生建立同儕或社群互助自學的華語學習習慣；以上自學模式的建立，能讓華語真實的融入 (或是參與) 學生的日常生活。

3.6. 選擇權是引導及發展學習者解決問題能力及態度的語言意識觀

由反思與後設思考，學習者建立了個人的語言學習觀。但是，選擇權的理論概念不僅著重於學習者自學模式與策略的培養，亦重視引導學習者發展其解決問題的能力及合宜的語言態度。而關於問題解決能力及語言態度，所體現的是學習者對於語言結構、場域知識、語言資源與類別、表現形式與語言文化等概念下的選擇結果，這種比較與選擇的表現，我將其視為語言的意識觀。具體的華語教學活動實例包含：在華語課堂中，教師讓學生針對某些自發性或指定課題，有意識的以圖書及網路之方式查找資料，而一般所謂的華語語言任務教學 (task-based teaching) 型態，也是典型的選擇權理論下的華語語言意識觀教學。

3.7. 選擇權是培育學習者具有未來公民及民主素養的語言社會觀

語言的使用，是參與人類活動的一項重要能力，也是一種社會實踐形式的體現。尤其在當前全球化社會及民主化浪潮之下，雙語、多元語言及語言溝通能力更是成為基本的公民素養；而不同語言之間因科技與人類移動所致的語言接觸及轉換 (translanguaging)，更促使各地的語言生態產生了各式的全球化與在地化轉變，華語當然亦在其中。選擇權理論下的語言社會觀，希望的是，華語學習者能有意識的以華語參與、決定、表達、協調、整合、討論與分析各類議題，在具體的華語教學實例上，包含下列作法：華語教師用小組研究計畫之方式，引導學生以華語語言及文字為媒介，採面對面或網路會議、Facebook、電子郵件及MSN等方式參與討論，並溝通彼此之意見，最後，完成研究探究結果之分析與彙整。

4. 結論

我之所以提出選擇權理論，旨在說明於華語教學中，應思考與融入語言教學觀、語言教材發展觀、語言文化觀、語言知識觀、語言學習觀、語言意識觀與語言社會觀等「至少」七類觀點，並強調華語的教學，應發展出如選擇權理論般強調符合華語意合、使用者本位及參與選擇等特性之教學觀。不過，要特別提醒的是，華語教學現場的教師在應用上述七項選擇權理論下的觀點時，可依各自的場域背景（如：計算器的使用習慣與資源）及教學目標，以其中的幾項為優勢觀點進行華語教學活動及課程設計，亦可以此七項觀點，進行華語教師及學生的教學與學習評量。

選擇權理論的提出，奠基於研究者過去數年在華語教學研究及現場的觀察結果，它是一種嘗試性的華語教學典範轉移。所以，在實踐上，首先，考驗當前華語教師的是其在教學與學習理論、教材編輯、多元文化、漢語語言學、教育哲學、公民社會及華人與當地言語社群等議題知識跨領域的綜合理解；事實上，這種過程即是一種對以上各類跨領域知識議題的選擇性理解過程。再者，當把以上選擇性的理解實踐於華語教學時，具有選擇理解概念的華語教師，在教室場域面對瞬息萬變的學生動態，且考量外部的語言與教育政策、資源、同儕及家長等因素後所做的教學活動，又是一種理解與教學現場碰撞之後的選擇行動。也就是說，選擇權理論下的華語教學視選擇為一種知識、理解、思索、實踐與改變的循環歷程，其中，漢語的意合、使用者本位及參與等三項是此理論的核心要旨。

對於選擇權理論於華語教學上的應用，我的建議是：選擇權理論的實踐雖不是一件簡單的過程，但對於當代的華語教師而言，這會是一項值得的嘗試。不過，可以預見的是，當前的華語教學尚須更多人透過各類的真實與虛擬途徑「參與」，而未來也會因為各類華語使用者的參與，使得華語的教學「選擇」更為豐富。

參考文獻

- 鍾鎮城 a(2009)。日籍學生之華語廣告招牌閱讀理解。中原華語文學報，3，93-106。
- 鍾鎮城 b (2009)。真實的移民華語教學：以「來去移民華語教學研究室」為例。載於周梅雀、謝斐敦、賴誠斌主編，*幼兒師資與多元文化教育研討會論文集*（頁 169-188）。臺南：崑山科大幼保系。
- 鍾鎮城 c (2009)。華語教學的轉變：全球在地化的觀點。載於鄧慧君等主編，*2009 應用語言學暨語言教學國際研討會論文集*（頁 577-584）。台北：文鶴。
- 鍾鎮城 d (2010)。華語批判讀寫與語言習得。第四屆以中/英文為第二語言之閱讀與寫作教學研討會會後論文集（出版中），中壢：中央大學。
- 鍾鎮城、黃湘玲 (2009)。客籍新移民女性之語言使用與自我移民認同形塑。高師大學報，26，49-64。
- 南洋台灣姊妹會、鍾鎮城等編 (2010)。來去移民華語。台北：新學林出版社。
- Krashen, S. D. (1985). *The input hypothesis: Issues and implications*. New York: Longman.
- Kuhn, T. S. (1996). *The structure of scientific revolutions (3rd edition)*. New York: The University of Chicago Press.

華語語音教學之多媒體素材元件開發與手機學習應用

The Development of Multimedia Teaching Source Materials and Components for Mandarin Chinese Sound System and its application to mobile learning

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【摘要】本系統乃針對華語語音系統教學及語音難點訓練，結合了教學理論與實務應用，使用者可在本系統瀏覽教學的原則與步驟，下載教學素材與元件，如：字卡、圖卡、學習單等，並可進行線上檢測，觀看影音教學示範。本系統旨在提供使用者針對某教學目標的教學素材與元件，希冀能引導教師將抽象的教學概念，轉化為具體的教學步驟。本工作坊的語音系統教學示範活動以單元呈現，包括：漢語拼音教學、聲調教學以及聽辨及發音難點教學，並將部分學習內容以手機學習模式呈現。

【關鍵字】 華語語音、多媒體教學、教學素材、手機學習模式

Abstract: This system is designed to teach the Mandarin Chinese sound system and introduces problem-based teaching modules for L2 Chinese teachers. A literature review of commonly made pronunciation errors by L2 Chinese learners serves as a blueprint for web design, which include teaching tones, and explicit trainings on pronunciation learning difficulties. Examples of how to employ and adapt the problem-based pronunciation teaching modules will be demonstrated at the workshop. Some of the teaching modules will be adapted to mobile learning. The instructional design combines teaching and learning theories with pedagogical applications. Teachers may use the teaching modules for teaching pronunciation directly, or download the source materials and the components, modifying them for classroom use. The goal is to reduce teachers' workload, foster effective learning with activities, animations and videos. Hanyu Pinyin is a basic tool for teaching Mandarin Chinese sound system. An online test of Hanyu Pinyin with automatic feedback will be introduced.

Keywords: Mandarin Chinese sound system, multimedia instruction, source teaching materials, mobile learning

1.前言

隨著華人社會在全球化經濟扮演重要的角色，使得學習華語文的人口逐漸增加，各地學校紛紛開設華語或華文課程。本工作坊關注的議題是有關如何培養更多具有專業華語教學能力的教師，藉由多媒體實務教學示範，將紙本教案轉變為活潑生動的多媒體教學演示。這一系列關於聽辨及發音技能以及語音系統教學的教學示範結合了教學的理論與實務應用，使用者可在教學網站上瀏覽教學的原則與步驟，下載教學原件與素材，如：生字卡、學習單等。並觀看影音試教示範(華語聲調及變調教學)。

2.語音學習理論及聽力與口語訓練

Major (2001) 認為精通一個語言的語音包含了幾個層面：獨立的音段、音節、韻律（又分為：重音、節奏、聲調和語調）與整體性口音。曾金金（2001）指出聲調(tone)為語言中

運用音高區別字義的現象。由於音高與重音及語調有關，因此非聲調語言的華語學習者，其中介語會受母語重音及語調的影響。

筆者在與華語作為第二語言學習者的交流中，有不少學習者將華語聽辨視為主要學習難點，而華語語音教學又有重發音、輕聽辨的現象。因此，有關聽力訓練的部分參考了張本楠（2008）中文教學聽力導論一書重點討論六種與聽力教學相關的第二語言教學法：聽說教學法、聽力微技能教學法、功能教學法、溝通教學法、自然教學法及任務型教學法。提出三點相關的問題：教學方法與教學理念之分野、陳述性知識與程序性知識之區別、分技能教學與綜合性教學之比較。另外本工作坊也引用了曾金金（2009）事件結構與模擬情境於華語自我聽力檢測及發音之學習系統設計。

3. 華語語音學習難點與教學設計

毛世楨（2002）首先說明確定難點是為了有效解決教學上的困難，教學重點和難點雖有相似之處，也有差異之處，因為難點和學習者個人背景與學習能力有關，但與教學過程無關，而教學重點的確定卻與教學過程息息相關。作者將對外漢語語音難點分為：聲母難點（發音部位和發音方法）、韻母難點（單/複/鼻韻母）、音節難點（音節內和音節外）、聲調難點（單字調和連調）、語句韻律難點（輕重音/停頓/語調）、以及拼音學習引起的難點。筆者將就以上學習難點進行教學設計。

4. 元件素材庫建置

筆者依據教學設計與教材需求建置了教學元件與素材提供使用者自由下載使用。建置的素材包括：動畫示範教學、教案（pdf 檔、word 檔）、PowerPoint 示範活動、生字卡、學習單等。以下以送氣與不送氣音教學為例，本單元涵蓋了以動畫示範看圖識字、生字圖片卡、PowerPoint 示範、教案等，使用者可依所需下載使用，並視其適切性修改調整教學所需的元件素材。

Each teaching module consists of : (1)introduction; (2) read aloud; (3) language corpus; (4) learning activities.

Read Aloud :

① 送氣與不送氣音

• 簡介

步驟1 發音領讀

步驟2 結合單詞

步驟3 辨音活動

b / p j / q

d / t z / c

g / k zh / ch

b

p

示範 素材 PPT PDF WORD

Language Corpus for Teaching Module:

① 送氣與不送氣音

• 簡介

步驟1 發音領讀

步驟2 結合單詞

步驟3 辨音活動

鼻 皮

肚 兔

鼓 苦

雞 七

紙 尺

早 草

鼻

bí



示範 素材 PPT PDF WORD

Perception Activities:



5. 手機學習應用

手機學習為一種新的學習模式，屬於行動學習的一種。行動學習的特點為不受課室的限制，學習者能更具有學習的自主性，選擇如何學習(Kukulska-Hulme & Traxler, 2005)。以下畫面為擷取手機畫面的聲調教學頁面及動態聲調圖示頁面。



圖像 1. 漢拼教學頁面



圖像 2. 難點教學頁面



圖像 3. 動態聲調圖示頁面

6. 結論

筆者所開發之華語語音教學素材元件，目前設定的主要使用者為華語教師，教學對象為華語初學者，旨在減少教師負擔及幫助初學者克服華語語音的學習難點。希望各界能多多使用並建議後續建置應注意或改進之事項。

参考文献

- 毛世楨 (2002)。對外漢語教學語音測試研究。北京：中國社會科學出版社。
- 張本楠 (2008)。《中文聽力教學導論》。北京：北京語言大學出版社。
- 曾金金 (2001)。語言學概論。台北：僑務委員會中華函授學校課程講義。
- 曾金金 (2008)。《華語語音資料庫及數位學習應用》。台北：新學林出版社。
- 曾金金 (2009)。〈情境式華語自我聽力檢測及發音學習系統設計〉，《第六屆全球華文網路教學研討會論文集》，pp.267-78。台北：中華民國僑務委員會。
- Kukulska-Hulme, A., & Traxler, J. (2005). Mobile learning: A Handbook for Educators and Trainers. New York: Taylor & Francis Inc.
- Major, R. C. (2001). Foreign Accent: The Ontogeny and Phylogeny of Second Language Phonology. Mahwah, N.J. : Lawrence Erlbaum Associates, Publishers.
- O'Neil, R. (1982). Why use textbooks? *ELT J.* 36: 104-111.

華語創意教學活動的設計概念

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【摘要】華語教學本來僅在華人區域進行，如今已成為全球風潮，本文旨在探討華語教師進行創意教學的途徑與策略，從教學的基本理念談起，引入 Gardner 的多元智慧理論，加上兒童心理的相互印證，提出創意教學的策略與實務，試圖引發更多華語創意教學的探索，提昇華語教學成效。

【關鍵詞】創意教學、多元智慧、策略、實務

***Abstract:** Teaching Chinese as the second language (TCSL), once restricted to areas of congregated Chinese inhabitants, has recently become popular all over the world. This article explores the paths and teaching strategies of TCSL. Starting with the basic teaching theory, it cross-examines Gardner's Multiple Intelligences Theory of diverse intelligence with child psychology, and proposes a strategy and application of creative teaching, in an attempt to trigger further exploration of creative teaching and to increase the effectiveness of TCSL.*

Keyword: Creative teaching, Multiple Intelligences, Strategy, Application

1.前言

二十一世紀是個知識經濟與創意發展的時代，為了培養具有競爭力的專業人才，在教育現場各國莫不傾全力推動創意教學，以提昇國家競爭力。本文旨在探討華語教師進行創意教學的途徑與策略，包括多元智慧的啟發、兒童心理素質的探究理解、如何融入多元智慧概念研擬教學策略、發展創意教學法。期能提供自我的教學經驗，引發更多華語創意教學的探索，提昇華語教學的成效。

2.華語教學的基本理念

教師在準備進行教學前，需先思考教學的基本目標，進而討論教學策略與教學方法，再由教學評量的結果，審視是否達成教學目標。

我認為華語教學的目的為：培養學生正確理解和靈活應用華語文字，使其具備良好的聽、說、讀、寫、作等基本能力，並能使用華語，充分表情達意，陶冶性情，啟發心智，解決問題。

再者培養學生能有效應用華語文，從事思考、理解、推理、協調、討論、欣賞、創作，激發學生廣泛閱讀的興趣，提昇欣賞文學作品的的能力，以體認中華文化精髓。

進而引導學生學習利用工具書，結合資訊網路，增進華語文學習的廣度和深度，培養其自學的能力。

3.學生的多元智慧

哈佛大學教授迦納教授 (Howard Gardner, 1994) 提出人類的智慧是多元的理論(Theory of multiple intelligences), 認為至少有八種智慧, 包括: 語文智慧、邏輯-數學智慧、空間智慧、肢體-動覺智慧、音樂智慧、人際關係智慧、內省智慧和自然觀察智慧, 這八項智慧是解決問題與完成產品的能力。從該論點而言, 每個人都擁有多種理解、學習和表現的途徑, 在解決問題的過程中, 能運用其不同的智慧展現創造力、批判性思考、完成任務的責任心。Gardner 主張每個人都具有多元智慧, 大多數的個體都有機會得到高度的發展, 在各種智慧能力的呈現亦是多樣化的。

植基於 Gardner 的多元智慧理論, 學生學習華語如能透過這些智慧的啟發, 教師依據學生的優勢智慧, 設計創意的教學方案, 自能達成學習目標。教師的創意教學能力, 則由自我所受的各種訓練中發展創新概念, 整合教學方法與學生個殊特質, 佐以夥伴互動, 自能發展出具備多元智慧的創意教學策略。

4. 兒童心理發展

兒童自從 0 歲起, 即有語言溝通的能力, 簡單的丫丫聲、哭聲、笑聲、叫聲, 都在表達他的情緒與需求, 而後學會模仿聲音, 建構語言的意義, 直到可以由語言轉為文字的學習, 這是一段很漫長的歷程, 也是稍縱即逝的重要階段。

6 歲以前的兒童心理特質, 包括自我中心、玩具比朋友重要、自言自語、重複性行為、模仿、好奇心、模糊的時間觀念、要求公平。

6 歲至 12 歲的兒童心理特質如下: 結交朋友, 找夥伴; 團體活動、接受圖像、大量與人溝通、好奇心、強烈模仿、開始有時間概念、競爭。

這些特質提供教師重要的訊息, 教學活動必須依照兒童的身心發展規劃適當的內容, 不應逾越其能力過多, 造成因缺乏成功經驗而拒絕學習。

5. 多元智慧在教學上的運用

學生的智慧既是多元的, 在課堂上即應安排多樣的教學活動, 每堂課至少安排二至三種教學方式, 刺激孩子不同的反應。並掌握下列教學原則: 學生主體化、目標生活化、進程自然化、活動多元化、教學趣味化、取材平衡化、文法配角化、測驗合理化、語文一體化、應用全面化。茲舉例如下:

5.1. 練習法: 基本語文練習, 生字教學、句型練習

5.2. 肢體反應法(Total Physical Response 簡稱 TPR): 趣味遊戲, 生字的聲調、意義; 生詞; 句型。

5.3. 合作學習: 利用小組成員之間的分工合作, 共同利用資源, 互相支援, 去進行學習; 並利用小組本位的評核及組間的比賽, 製造團隊比賽的社會心理氣氛, 以增進學習的成效。

5.4. 評量多元化

口頭問答: 學生的發音、語調、語法的正確性。

紙筆測驗: 學生對知識的文字化表達, 理解多少。

表演活動: 對所用的語言內涵了解程度為何?

資料蒐集: 學生主動學習的結果。

討論對話: 能否運用流利的語言表達、析辨。

作業整理: 對於所學的知識是否能有序整理。

5.5. 發表活動

作業展覽：回家作業、學習檔案

節慶表演：利用節慶時間，配合課程設計主題性表演，如：舞獅。

總結性表演：學習至一階段，讓學生以朗讀、演說、戲劇等方式演出。

教師能靈活運用教學法，如何達成教學目標，能讓學生學會、願意學、喜歡學，就是最好的教學法。

6. 華語教學策略

教師理解學生的心理發展與多元智慧後，便易於歸納影響華語創意教學的關鍵，進而發展教學策略。

6.1. 模仿

跟我做：跟我做動作，跟我說這個字、跟我唱這首歌。

學...做：學動物的叫聲、動作，學我說的話，學媽媽說的話，照樣造句。

6.2. 跟隨

我說你演：依據我所說的做動作，雙簧。

接龍：接續前面的動作、語句。

6.3. 角色扮演

劇本角色：扮演故事裡的人物，順著劇情發展學習對話。

生活角色：扮演身邊的人物、動物，表演平常所發生的小事件，理解彼此的關係。

假面具：戴上面具或操弄布偶，藉由替代的面具、玩偶，表現自己。

6.4. 半具體操作

圖卡想像：繪本、圖片的提示，引發想像空間。

情境轉移：佈置相仿的學習情境，讓孩子投攝，表達感受。

教具操作：利用教具協助理解問題。

6.5. 遊戲

團體遊戲：設計有趣的遊戲，大家一起參與，增加趣味。

個別遊戲：提供遊戲器材(積木、電腦)，讓孩子個別操作。

7. 創意教學法

本文所說的創意教學，主要包含兩個層面：一為培養創意的「創造思考教學」，一為教師教學創意的「教學創新」。教師營造活潑愉悅的學習情境，以提升學生創造思考的能力，教學設計則嘗試新穎的教材教法，引發學生突破固著思考模式，展現創造能力。

創意教學方法包括：腦力激盪、模擬或角色扮演、自由聯想、六六討論、連接點子、心智圖、想像練習、核對清單、問題列表、創意解決等等。教師先體驗過這些方法，再融入課程設計，自能找出創意教學設計的脈絡。

華語教學強調語言的學習與運用、文字的認知與創新，大多數教師是以反覆練習，大量灌注的方法教學，因此學生倍感辛苦。教師如能掌握語言文字的特質，透過生活體驗、新舊概念交替，加強感官與直覺的運用；藉由回憶式的省思、慎思熟慮式的省思、行動的省思強化記憶，熟練運用語彙；發動動態的活動，以鷹架理論支持教學，不斷的適應、演化學習內涵，讓學生成為學習的有機體。

8.創意教學活動設計

創意教學並非摒棄基本能力，而是透過創意教學讓學生獲得基本能力。教師仍要進行從準備活動、發展活動到綜合活動的流程，在各階段中發展創意。

8.1.準備活動

以引發學生學習興趣為主，時間不宜超過整節課的五分之一。設計內容可包括：兒歌、趣味問答、圖畫、影片、短劇、布偶、舊經驗複習、聆賞音樂、遊戲...等。

8.2.發展活動

正式進入課程主題，包含生字、語詞、課文內容深究、再創造。

生字教學有兩個方向，其一是先從句型熟練開始，再由句子中對應出語詞，最後認讀生字。另一個方向則相反，先認讀生字，再由生字發展出語詞，最後完成句子的學習。其中識字部分最為困難，教師可依據六書說明字的來由，也可拆解字的部件，反覆組合並找出其他有相同部件的字，加以延伸學習，又可讓學生以望文生義的方式繪出生字的意思。

語詞的發展則以生活用語為介入點，先用熟悉的語詞，再轉入新詞的學習，句型學習亦如此。課文內容深究則是文章賞析與探索的重點，學生能透徹明瞭之後，再創造新文章便不難了。為使學生達到完全學習，茲以「拼圖教學」為例說明：

每5人分成一個小組，每人依序報數，1號到第一主題，2號到第二主題學習，依序類推。

老師及助教(或由學生擔任)5人，每人負責一個主題教學，講解5分鐘。

學生回到自己的組，互相說明方才各組老師教學的內容，並設法讓夥伴理解，計時5分鐘。

每組推派一人上台報告該組學習的內容，教師與學生共同評量報告內容。

教師針對各組的學習態度、報告內容給予總評。

8.3.綜合活動

完成課程主題後，為檢視學習成效，可規劃簡短的整合統整教學，諸如：分組發表、競賽遊戲、角色扮演、創意討論...

9.創意趣味教學範例

試以兩個創意趣味教學為例說明之。

9.1.自由聯想法

教學目的：激發多元創意思考，置入情境學習

題材：老師提供一根木棒、一塊布

學習活動：先請學生用這兩樣東西自由聯想，可以做什麼事情，分組討論5分鐘。再讓學生分組上台表演他們的構思。

綜合活動：

看到別人的表演，自己有何感想

共評誰演得最好

把故事寫下來

9.2.共同創作

教學目的：統整生活中所發生的事件，形成篇章

題材：老師提供一個想像的物品，如：籃球

學習活動：

全班為成個圓圈，老師對學生拋球(僅有動作，沒有球)，學生要立即接球。

每個人要有不同的動作，不同的事件。

可以邊作動作邊發出喊叫、加油聲。

綜合活動：

大家一起把這場拋球活動敘述成一篇文章、一個故事。

確認活動中最驚險刺激的高潮。

共同寫成文章。

創意教學關心的是學生的學習效果，在學校裡我不斷鼓勵教師嘗試，起初總有畏懼與不安，當發現學生提升學習興趣，並獲得理想的學習成績時，便不再以為花費這麼多精神是件辛苦的事了。

參考文獻

洪久賢、洪榮昭、林麗娟和蔡長艷(2007)。影響教師創意教學因素之研究—以綜合活動領域為例。《師大學報》，52 卷第二期，P49-71。

Gardner, H. E. (1994). Multiple intelligence theory. In R. J. Sternberg (Ed.), *Encyclopedia of human intelligence* (pp.740-742). NY: Macmillan.

让作文有声有色动起来--四年级作文行动研究

Bring Composition to life with sound, colour and animation

---- P4 Composition Action Research

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【摘要】四年级的老师在每周会议上讨论如何通过思维技巧进行作文教学。教师探讨几个问题：教什么、为何教、怎样教思维技巧。这点让老师们成立研究小组一起来探讨。同时，我们也采用了电脑与资讯科技作为我们的教学工具，加上颜色、声量和动画效果，抛开传统的作文教学方式，进入了创意与创新的教学策略来提高学生对写作的兴趣，激发他们积极地参与。通过我们的调查，90%的学生有显著的进步。

【关键词】电脑作文简报、观察、反思、联想、教案

***Abstract:** Teachers in the P4 level have been holding weekly meeting to discuss how to infuse thinking skills into writing. (Essay writing). Teachers deliberated on the what, why, how are we going to teaching thinking skills. This led the team to embark on a Research. We used IT as our tool, with the addition of pictures with colour, sound and animation effect, we moved from the traditional way of teaching compo to more creative and innovative measures so that pupils can have greater impact on the lesson and be more enthusiastic in class participation. With our survey, 90 % of our pupils have shown great improvement.*

Keywords: IT Powerpoint, observe, reflect, infer, lesson plan

1. 前言

美国学者麦克纳 (Mckernan, 1996) 提出了‘课程行动研究’ (Curriculum Action Research) 是指：“教师和课程合作开发者为提高实践而去解决面临的实际问题。”它更关注于改善人类行为和反应的质量而不是构建行动理论。我们的作文教学就是关注于如何提高学生的写作兴趣。

2. 论文标题

在华文教学中，最使老师感到束手无策的应该是作文教学。其实“束手无策”这四个字使用得并准确，因为老师们已经想尽办法，竭尽所能，教导着一批又一批似乎冥顽不灵的学生，批改着一份又一份惨不忍睹的作文。偶有佳作，眼睛为之一亮，仿佛发现了珍宝，必顿感欣慰，然后再接再厉，“苦战”到底。可是学生似乎永远不领情，他们继续胡乱写着作文，交差了事，或干脆缴械投降。

这种作文教学的现状，绝不是危言耸听，只不过在各间学校表现的程度不同罢了。但是，它确实是我们迫切要解决的燃眉之急。

新年伊始，我们四年级的老师就已经围桌而坐，讨论着如何进行四年级的作文教学。学生作文中存在的问题提了一大堆，但是不外乎是：

1. 观察作文图片不仔细。
2. 图意叙述得不详尽。
3. 段落之间没有逻辑。
4. 错别字连篇。

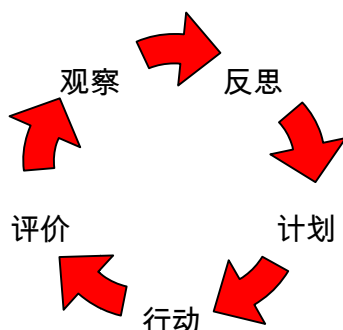
5. 英文式的华文句子。

归根究底，除去一些大家共识的客观因素，如英文背景家庭的学生越来越多等，有一个不争的事实，那就是学生对写作文没有兴趣。我们的教学理念：“兴趣是学生最好的老师”。托尔斯泰 (Leo Tolstoy, 1828-1910)

孔子曰：“知之者不如好之者，好知者不如乐之者。”（《孔子·雍也二十》）

现在的学生可以说是在“声色”中成长起来的。电脑早已经是他们不可或缺的“伙伴”，而我们的作文图片还停留在黑白的平面纸张上。如果作文图片不能够引起他们的兴趣，那么他们就很难做到认真观察图片，除了学习自觉性高的学生。而随之而来的恐怕就是被动的、机械的学习。因此，我们决定让作文图片“有声有色，动起来”。

那么，让作文图片“有声有色，动起来”是否能够提高学生写作文的兴趣呢？学生写作的兴趣提高了，能够提高他们的写作能力吗？让作文图片“有声有色，动起来”究竟是能够让学生作文的内容更详细、生动还是能够提高他们的表达能力？我们于是采用勒温 (Kurt Lewin) 的行动研究模式，一种螺旋上升形式的研究模式：



我们首先做了作文前测，根据学生作文中存在的问题，对症下药，当务之急就是解决学生对作文没有兴趣的问题。而第一步要解决的就是让学生对作文图片的内容有兴趣。

首先，我们利用电脑的图画 (Paint) 和图文简报 (Powerpoint Animation) 功能把作文图片制作作文简报。(请见附件一) 同时，我们也尽可能地为图片配上声音，这样当学生在观看图片时，声音会从听觉上引起学生的注意，再加上视觉效果，学生对作文内容的兴趣也就水到渠成，自然而然地引发起来。一套作文图片简报分两大部分，第一部分只是有声有色的作文图片，共四张；第二部分是配上与之相配合的词语的作文简报，目的是帮助同学完成作文，也是四张。这样老师在教学时，就会充分发挥这两部分作文简报的作用。



附件一：利用电脑图画和图文简报制作成作文简报

其次，教案的设计。为了确保教学策略的实施，全体老师采用统一的教案。教案的设计，以回忆、比较、联想、用已有的知识解决新问题的思维技巧的运用作为教学策略。(请见附件二)。

首先老师让同学回忆与图片内容相关体验，或是见闻，把学生带入情境中，其目的是在让同学叙述经历或说出感受时，能够建立起与作文图片内容相关的语料，以利于他们在概括图片内容时，摆脱穷词的窘境，建立起学生表达的自信心。然后，老师利用作文简报的第一部分图片，让学生观察仔细图片，并根据作文的六要素概括出图片的内容；同时，鼓励学生质疑图片内容的逻辑性，培养学生逻辑思维能力和认真观察的好习惯。之后，老师利用作文简报的第二部分，完成作文训练图。这个教案是属于模板性质的教案，老师还可以根据自己班级学生的学习能力和华文程度，做出一些调整，真正做到达到教学目的。

高育小学		2008-2009 学年度作文训练图	
教案设计者：周玉老师			
课题/语言 通过对学生观察能力的培养，达 到提高学生对语言的表达能力		教学重点 情感描述 (Elaboration) 回忆、比较、联想三种思维方法	
Lesson 课题：四年作文六			
时间 ：2 小时 30 分钟			
教学使用的材料 为学生使用的材料：图片、和式练习			
教学的目标 (准备) 通过培养学生详细描述 (elaboration) 的能力，提高学生的写作能力，			
教学过程		时间	
I 过程 1 教师让学生观察 (Kasali) 1 (1) 自己有没有看见过用奇怪的方式转动的场景？ 想一想，这个同学把转动的场景？ 提示：如果自己没有见过这样的事，也可以讲一讲当时的 情景，以及自己这样做的理由和后果。 (2) 自己有没有见过奇怪的场景，被老师发现了？场景 如何？ 想一想，自己当时做了什么，有没有奇怪的事？		15 分钟	
II 自己有没有见过过相似的情景的图式： - 可以参考学校所给的图式。 - 《新大陆》里的图式。 可以用图式来描述。 (老师可以根據自己的图式情况，使用不同的方法。)			


附件二：教案的设计（用已有的知识解决新问题的思维技巧）

最后，设计与每一篇作文相配合的作文训练图。其目的是有的放矢地让学生积累词语。同时，培养学生基本的对话、心理活动的描写能力。（请见附件三）采用小组讨论的教学策略，让学生以合作的方式完成训练图。然后让小组呈现，让其他同学质疑或是评价，老师随机指导，使同学们能够学会使用准确的描写性词语，以及神情、心理和人物对话描写。当然，老师可以根据自己班级学生的学习能力，采取变通，学生华文程度比较差的班级，可以在老师的引导下，全班共同完成训练图；学生华文程度中等的班级，可以是某些图片的训练图让学生以小组形式完成，某些则在老师的引导下共做；华文程度很好的班级，老师可以让学生自己先完成训练图，然后才小组讨论，取长补短，最后再全班小组呈现，同学相互质疑点评，老师随机指导。完成训练图之后，学生就可以在规定时间内，独立完成作文了。

四年級作文六 (六) 训练图	
姓名：_____ 班级：_____	

附件三：作文训练图（培养学生基本的对话、心理活动的描写能力）

同时，每次作文教学过后，老师们就会写出他们此次作文的心得体会，然后开会分享。根据老师们教学过程所观察到的学生学习的情况，以及作文批改情况，进行反思。主要分

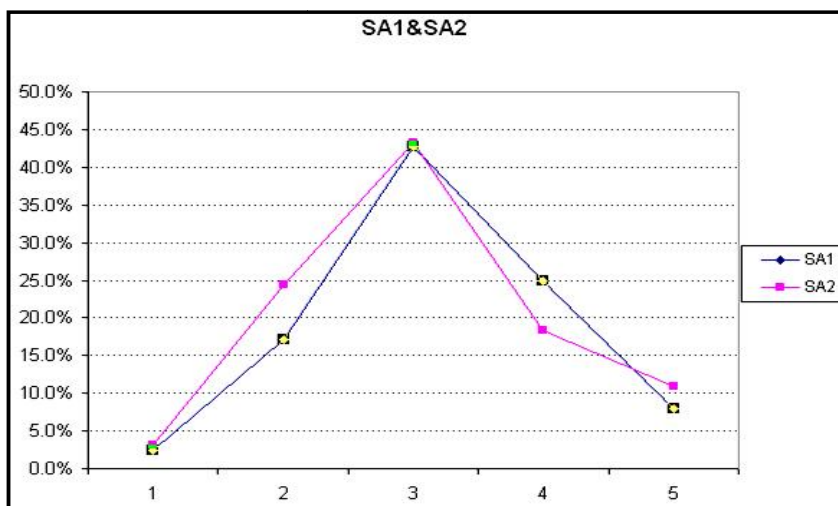
 P4 Chinese Pupils' Expression Survey
The Use of Colour of Pencil in Essay Writing

Collation of Data for P4 Level

SA		A		N		D		GD		
Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree		
CLASS : JS-3										
N-3										
Date Recd : 26										
Grouply Agree		Agree		Neutral		Disagree		Strongly Disagree		
Qn Nos	Total	%	Total	%	Total	%	Total	%	Total	%
1	11	52.38%	12	55.56%	4	18.18%	1	2.78%	0	0.00%
2	8	41.67%	9	42.22%	9	42.22%	3	9.09%	2	5.56%
3	8	41.67%	9	42.22%	7	33.33%	3	9.09%	2	5.56%
4	11	36.81%	11	27.78%	7	18.44%	3	6.23%	3	6.23%
5	3	25.00%	11	44.44%	7	10.44%	1	2.78%	3	6.23%
6	10	36.36%	11	38.89%	5	16.67%	3	9.09%	1	2.78%
7	11	41.67%	11	38.89%	9	25.00%	0	0.00%	1	2.78%
8	11	44.44%	11	36.67%	5	10.00%	0	0.00%	1	10.00%
9	11	38.89%	11	38.89%	4	11.11%	2	5.56%	2	5.56%
10	12	33.33%	12	33.33%	11	27.78%	1	2.78%	1	2.78%

我们同时把前测、年中和年终的作文成绩进行了对比，结果是令人振奋的，学生的成绩有了提高，尤其是中等和中等偏上的学生的进步最为显著。（请见附件五）

2		成绩对比表					164				
3		SA1									
4		4/1	4/2	4/3	4/4	4/5	Total	%			
5	17-20	3	1	0	0	0	4	2.4%			
6	14-16.5	22	6	0	0	0	28	17.1%			
7	10-13.5	14	20	26	5	5	70	42.7%			
8	5-9.5	0	3	10	15	13	41	25.0%			
9	0-4.5	1	0	0	5	7	13	7.9%			
10											
11		SA2									
12		4/1	4/2	4/3	4/4	4/5	Total	%			
13	17-20	5	0	0	0	0	5	3.0%			
14	14-16.5	22	14	4	0	0	40	24.4%			
15	10-13.5	13	23	23	5	7	71	43.3%			
16	5-9.5	0	1	9	12	8	30	18.3%			
17	0-4.5	0	0	0	8	10	18	11.0%			
18											
19											
20											
21		4/1		4/2		4/3		4/4		4/5	
22		SA1	SA2	SA1	SA2	SA1	SA2	SA1	SA2	SA1	SA2
23	17-20	3	5	1	0	0	0	0	0	0	0
24	14-16.5	22	22	6	14	0	4	0	0	0	0
25	10-13.5	14	13	28	23	26	23	5	5	5	7
26	5-9.5	0	0	3	1	10	9	15	12	13	8
27	0-4.5	1	0	0	0	0	0	5	8	7	10



附件五：中等和中等偏上的学生的进步最为显著

结论：

从整体上看，我们最终相信，只有把科技引用到作文教学中，引起学生们对作文图片内容的兴趣，才能够提高他们写作文的兴趣。学生也能够有意识地运用从作文书中学习的佳词佳句，占全班人数的三分之一左右；大部分同学还是只根据老师提供的词句来完成作文。但也有很少部分的同学明显地表现出已经基本掌握了老师所教导的思维技巧，自己可以独立运用各种信息，写作技巧来完成一篇作文。

我们所面临的挑战，是如何训练学生进行有逻辑的、合理的想象，以及用正确的华文语句来表达图画的内容。除此之外，我们下一个挑战将是让学生多注意到优良传统的价值观和道德观。

参考文献

- Smith, M. K. (2001) 'Kurt Lewin, groups, experiential learning and action research', *the encyclopedia of informal education*, <http://www.infed.org/thinkers/et-lewin.htm>
- 陈柏华《论课程行动研究——兼论头脑风暴法和中立主席法》。中国教育和科研计算机网《外国教育研究》
- James. Mckernan 美国学者麦克纳《课程行动研究》（1996）。北京师范大学出版社。
- Costa, A and Kallick, B (2000) *Habits of Mind: A Developmental Series*. Alexandria, VA: Association for Supervision and Curriculum Development: *Book II: Activating and Engaging Habits of Mind (Chapter 3, 4 & 5)*
- Leo Tolstoy《托尔斯泰传 1828-1910》(1981)。天津人民出版社。

The Use of Collaborative Storytelling Platform for Reducing Elementary School Students'

Anxiety in English Learning

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Abstract: *English is an efficient language in the world. Being aware of its importance, English education has been Taiwan government's focus on national development policies for several years and has lowered the age in English learning since 2005 (Ministry of Education, 2008). Nowadays, with more emphasis on students' abilities to comprehend, synthesize and analyze, traditional formal English instruction can no longer meet the need. Instead, how to reduce students' foreign language- learning anxiety and enhance their learning motivation have become the key. In view of this, more and more researches have tried to find a direction for English education of the younger generation and many of them show the potential of picture books to improve the situation. With the technology of web2.0, traditional storytelling has a new face. Here uses storybird.com as the main example to show what this new storytelling platform can do for better effect on English education by reducing students' foreign language- learning anxiety and enhancing their learning motivation.*

Keywords: collaborative storytelling, foreign language-learning anxiety, digital learning, storybird

1. Introduction

In this competitive global village, the importance of English ability is more obvious. As an international trade-driven nation, Taiwan depends deeply on the connection with the world. Thus, English ability has become an indispensable skill to survive economically. Being aware of this, in 2001 Taiwan government implemented the Nine Year Education Program which turned English into a required subject and in 2005, the government even decided to lower the age of English-learning to third grade in elementary school (Ministry of Education, 2008). All these English education programs show the intention of Taiwan government to make English the basic ability of the people and thus increase our international competitiveness.

In Taiwan, since parents have fewer children than before and face the extremely high social pressure, they tend to turn this pressure into high standard and expectation on their children and make them learn various talents and skills as music, art and languages when they are still very young. Cram schools have almost become Taiwan children's common childhood memory. However, parents' over-enthusiastic about children's education may do harm to their learning achievements in the end. Being forced to learn in such a small age may bring out pressure, anxiety, negative attitude and low learning motivation which impair learning quality (Hsueh Hui-yueh, 2007). Moreover, when it comes to foreign language-learning, although there are many factors such as cognitive ability, learning interest, motivation, attitude, and language anxiety that will affect a learner's learning achievements (Pan, 2002), among those factors, language anxiety plays an important role in either language learning or teaching (Horwitz, Horwitz, & Cope, 1986). Anxiety, according to Horwitz, Horwitz, and Copes' research (1986), is the subjective feeling of tension, apprehension, nervousness, and worry. Depending on different degrees, there would be various behavioral responses of a learner's language anxiety such as difficulty in concentrating, forgetfulness, or avoidance behavior. The learning process will become a vicious circle. These behavioral responses of language anxiety tend to cause low learning achievements. As a consequence, low

learning achievements will then reduce learning interest and enhance language anxiety. In view of this, it shows the significance of reducing language anxiety in elementary English education.

Furthermore, from the basic idea of the Nine Year Education Program, the content and design of the curriculum are expected to be ordinary, practical and interesting (Ministry of Education, 2008). That is, different from the circulation of memorizing and testing in old days, *students' abilities to comprehend, synthesize and analyze are taken much more seriously. Therefore, traditional formal English instruction can no longer meet the need for elementary students in Taiwan.*

Considering problems mentioned above, many scholars have tried to find English-teaching methods which have low sense of incursion for children, accessibility, entertainment and high achievements. With their efforts, it turned out that the picture book instruction seems to be the solution. Picture book itself contains both educational and entertaining characteristics. Also, the content is short so that children can read and learn easily even with their brief attention. Moreover, many researches have exhibited that picture book in elementary English education will achieve the effects of encouraging creative thinking, promoting learning motivational, understanding cultural differences, appreciating art and so on (Yen, Yiu, Hung & Li., 2008). Nevertheless, picture book instruction still has many restrictions such as price of a picture book, choice of story subject, limit of school book collection and teaching related equipments (Yen et al, 2008). It is because of restrictions mentioned above that picture book instruction haven't been popularized.

With the technology of web2.0, the new form of collaborative storytelling platform has emerged. The combination of both characteristics of traditional picture book and web2.0 technology may success in improving the restrictions of picture book instruction and become a practical way to reduce students' language anxiety, enhancing their interest and learning achievements at the same time.

2. Collaborative storytelling platform

In the era of web2.0, the concept of collaborative intelligence has bloomed over the last few years and successfully applied to many different fields, so does the emergence of collaborative storytelling websites. Therefore, collaborative storytelling websites contain not only components of a story but also some concepts of web2.0. As it showed by its name "collaborative storytelling", stories on the platform can be created, revised, edited by two or more people. It presents a non-linear style of story creation. Except some central story units, the content is totally user-contributed and thus can be personalized. Also, by various types of computer-generated resources, story can be expressed in a multimedia way. More importantly, no matter during the creating process or after finishing the work, people can always get feedback from others. This kind of platform makes story no longer an indoor creation. Instead, story creation becomes an activity under the sun where people can join and have fun together. (Cao, Y., Klamma, R. & Martini, A., 2008)

2.1. The educational applications of collaborative storytelling platform

The use of collaborative storytelling platform in classroom can increase the quality of both learning and teaching in the ways as follows. To begin with, this technology application provides the combination of powerful, yet affordable technology hardware and software which not only matches the needs of classroom but solves the restrictions of expenses and equipments in picture book instruction (Robin, 2008). Secondly, as Robin said, the materials on the platform include various types as pictures, recorded audio, text, video, and music (2008). This multimedia-rich platform is able to seize students' attention, enhance their interest in learning and thus reduce the possibility of language anxiety. Third, the mode of learning makes students more creative. Fourth, the creation depends on personal daily experience which will facilitate children's motivation to do since the threshold of doing it is low. Finally, the idea of share and collaboration will help children's social learning and emotional intelligence during the process of criticizing and being

criticized by others (Robin, 2008). In a word, the experience on collaborative storytelling platform will not only cultivate children's ability to create, organize, and build social association but further reduce language anxiety and enhance their learning interest. All these amazing achievements need only affordable technology hardware and software.

2.2. The Storybird.com

Many function- similar collaborative storytelling platforms have emerged. In addition to, the common characteristics of collage, collaboration and sharing, they all have their unique features. For instance, in the SPORE creator (<http://www.mashon.com/spore/creator/>), one is able to create his own comic book. The storynory (<http://storynory.com/>) is mainly audio story creations which provides various languages and is also available in iTunes, iPhone and podcast. Moreover, mixbook.com (<http://www.mixbook.com/>), although it is mainly about photo book creating, has similar form as collaborative storytelling platform for its combination of visual images, written text, and collaborative idea. Among all these choices, here I prefer the storybird (<http://storybird.com/>) as the major platform to demonstrate the idea of collaborative storytelling because the images in the website are neutral, which will delight both girls and boys, and with clear direction, it is very easy to use. Furthermore, the storybird has provided many artwork resources with several limited way to use them, instead of giving user total freedom. In this way, you will have to follow the specific procedures it provides to create a story. In other words, it will be much easy for teachers to control. Hence, I think using storybird.com can help demonstrate more clearly.

Storybird.com provides a very user-friendly way of combining images and text to tell a story, and then share that story with other people. What you have to do is to click the bottom "Start a Storybird Now". There are basically two ways to create a story. One is to get inspired directly by art. By browsing "story art" from the growing list of artists, you can start a story while choosing a picture style one likes. Just click the picture and you can see all artworks of the artists and with a click on "Start a Storybird" on the top, you will see a white canvas and three-step directions clearly.



Figure1. Three-step directions to start a story

First step is to type texts on the white canvas. Second step is to find the picture that speaks your words most perfectly, drag the picture in the white canvas and then choose the perfect position to place. You can add or remove pages freely. The other way to create a story is by the key words of the theme you decided. Choosing tags which matches your story theme and then you can find different picture styles of the same key word. By the click on your favorite picture and following the three-step direction, the storytelling time is coming. After finishing the story, don't forget to create the cover.



Figure2. The cover creation

Give the story a title or even a small summary and write down your name as author, and then there is a picture book of your own. If you have the account of storybird.com, you can even publish the story and share with others.

Here follows roughly some steps how the platform can be implemented.

- Step 1. Since most students are beginners at this period, the teacher can create a story first and customize the content to match up to students' English level such as alphabets and simple vocabularies. Thus, the learning won't be stressful and students can be familiar with the manipulation of the storybird.com.
- Step 2. After students know alphabets and some vocabularies, the teacher can give them a word they have read before and ask them to find the related pictures. This activity can be held as group competition which is actually more like a test in order to know whether students really understand or not.
- Step 3. The teacher can lead students to read other published online stories. In this way, students will know English structure about how words construct a sentence. The teacher can take the opportunity to teach simple grammars and at the same time cultivating students' English sense.
- Step 4. With the accumulation of English knowledge, students can try to write sentences. So the teacher can start a story and then let students finish it. This can be a group work. The work will be shared online. As homework, students have to browse other groups' work and give their personal comments
- Step 5. In the end of the semester, the teacher can make each group create their own story or even perform their stories on stage to substitute for the final examination.

Still, these are not the only ways to use the platform. In general, with the teacher's creativity, the designs of the collaborative storytelling platforms will make teaching methods more flexible and diverse. In order to see the effect on foreign language learning anxiety, Horwitz, Horwitz, & Cope (1986)' Foreign Language Classroom Anxiety Scale (FLCAS) can be used to investigate.

3. Conclusion

As we have mentioned above, by the concept of web2.0, collaborative storytelling platform can be viewed as traditional picture book instruction 2.0. That is, it is more powerful now since it reserves the advantages of traditional picture book instruction and at the same time has the potential to ameliorate the weaknesses such as the limit of expenses and equipments that prevent it from popularizing. What is more, it contains the function beyond the imagination of traditional ways. Taking the storybird as an example, collaborative storytelling platform is able to provide multiple ways for teaching to receive different effects, and thus with its flexibility, it can meet the needs for children in different degrees. Furthermore, the entertaining environments, and interactive system like sharing and

exhibiting make foreign language-learning more like a game than a lesson. Based on Krashen's theory of second language acquisition, this environment allows students to achieve both conscious and subconscious acquisition (Retrieved Yen, Yiu, Hung & Li, 2008). Hence, children learn foreign language imperceptibly which is similar to the situation how we learn our native language. To sum up, the low incursion of collaborative storytelling platform environment results in low language anxiety and comparatively high learning achievements. New era always comes with power to molt from old times. The collaborative storytelling platform has opened a new page for elementary education of foreign language.

Reference

- Cao, Y., Klamma, R. & Martini, A. (2008, September). Collaborative Storytelling in the Web 2.0. In Stefanakis, E. (chair), *Story-Telling and Educational Games – The power of narration and imagination in technology enhanced learning*. Symposium conducted at the meeting of First International Workshop on Story-Telling and Educational Games (STEG'08)
- Horwitz, E. K., Horwitz, M. B., & Cope, J. (1986). Foreign Language Classroom Anxiety. *The Modern Language Journal*, 70 (2) 125- 132.
- [Hsueh](#) H.Y. (2007). *Relationships between Picture Book Reading Instruction and English Learning Motivation for Elementary School Students*. Unpublished MA, National Kaohsiung Normal University, Kaohsiung
- Klamma, R. (2008). Collaborative Storytelling in the Web 2.0. Retrieved March 3, 2010, from <http://www.slideshare.net/klamma/collaborative-storytelling-in-the-web-20-presentation>
- Ministry of Education. (2008). *The Syllabus of Nine Year Education Program (English)*. Retrieved March1, 2010, from Taiwan Elementary and secondary school Educator Community: http://teach.eje.edu.tw/9CC/index_new.php
- Pan, P.S. (2002). *A Study of Interrelationship between language anxiety and English Proficiency for the Student in Different Grades in Junior High School*. Unpublished MA, National Kaohsiung Normal University, Kaohsiung
- Robin, B. R. (2008). Digital Storytelling: A Powerful Technology Tool for the 21st Century Classroom. *Theory Into Practice*, 47, 220-228.
- Yen, P.R., Yiu, T.T., Hung, J.C. & Li, C.C. (2008, December). A Study on the Instruction of English Picture Books in a Primary School of Taiwan. In L.S. Li (Chair), *Subject Teaching Theory and Practice*. Symposium conducted at the meeting of the 19th session of the Forum on Curriculum and Instruction-E Generation International Symposium on Teaching and Research, Taichung.

基于 iGoogle 平台构建 PLE 的研究

The Research about Building PLE Based on the iGoogle Platform

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【摘要】 PLE (Personal Learning Environment) 代表了去中心化、非正式和随意的学习范式，把对学习的管理从教育机构转移到学习者自身，使自我导向式学习和个人知识管理成为可能。iGoogle 作为 PLE 构建平台，具有操作简易、个性化定制、在线交互和共享及有利于学生自主管理学习过程等功能优势，以笔者自己的 PLE 为例，探索基于 iGoogle 平台的 PLE 构建过程。

【关键词】 iGoogle；PLE；个人学习环境

Abstract: PLE (Personal Learning Environment) which represents a decentralized, informal and casual learning paradigm, makes the management of learning transfer to the learner from the educational institution itself. Self-directed learning and personal knowledge management is possible. As a PLE building platform, iGoogle has some functions advantages, such as simple operation, personalized customization, on-line interaction and sharing, and facilitating the learning process of students self-management. Also, an example about my PLE was introduced in the paper to explore how to build PLE based iGoogle platform.

Keywords: iGoogle, PLE, Personal Learning Environment

1. 前言

学习环境是学习活动展开过程中赖以持续的情况和条件，是学习者进行建构性学习的各种学习资源的组合，是学习者在其中进行自由探索和自主学习的场所，是学习资源和人际关系的一种动态的组合。它在个体和群体的学习与成长过程中发挥着极为重要的作用（关中客，2008）。随着 Web2.0 技术的发展，社会化软件的流行，在非正式学习、E-learning、终身学习、实践社群、知识管理等理念的催化下，教育技术领域内对学习环境的研究重心开始转向 PLE——个人学习环境。

PLE 代表了去中心化、非正式和随意的学习范式，把对学习的管理从教育机构转移到学习者自身，使自我导向式学习和个人知识管理成为可能。笔者认为，PLE 内涵是以学习者个人兴趣为中心，根据个人喜好集合了日常使用的各种学习工具，特别是 Web2.0 应用和社会化软件，为学习者提供设置学习目标、管理学习内容和过程、在学习过程中与他人进行交流、协作等支持，并经由来实现知识获取和个人能力发展。从大范围上讲，PLE 既包括网络环境，也包括教室、图书馆、培训中心等物理环境。人们常常把 PLE 与网络联系起来，是因

为随着社会化软件的不断出现，在网络环境下获取、共享和管理知识显得更为方便。本文的研究主要针对网络环境。

iGoogle 平台为 PLE 构建提供了方便学习者创建内容、沟通、分享以及学习与协作的小工具，尤其是它提供了将这些林林总总的小工具进行集成和整合的功能，使得这些工具能够根据学习者的需求，进行个性化的组合。同时它还提供了开发工具供学习者自行设计开发小工具，并与其他人分享。具体而言，iGoogle 从以下几个方面为学习者构建和驾驭个人学习环境带来便捷：完全免费，操作简易；个性化定制，“一站式”服务；在线交互和共享，构建社会性学习网络；有利于学习者自主管理学习过程。

3.基于 iGoogle 构建 PLE 的实例

为了使基于 iGoogle 构建 PLE 的研究具有可操作性，笔者以自己的 PLE 为例，具体说明基于 iGoogle 的 PLE 构建过程。

3.1.注册属于自己的 iGoogle 的个人主页

打开 iGoogle 英文版 (<http://www.Google.com/ig>) 的页面，点击 iGoogle 主页右上方的“Sign in”，如果已有 Google 帐户直接输入用户名与密码登录即可，没有 Google 帐户选择“Create an account now”，按要求进行注册，申请一个帐户。登录成功后点击查看各个选项功能，初步熟悉 iGoogle 的各项操作。

3.2.新增小工具

iGoogle 有众多的网络小工具、小帮手以及信息，例如：天气、新闻、字典等。在构建 PLE 时，学习者需要选择和使用所能掌握的并适合自己学习风格和需要的小工具，我们可以先把工具分类，然后从各类中选择你喜欢的工具。笔者在了解 iGoogle 小工具的基础上利用概念图软件 MindManager 将工具分为在线时间管理、在线学习和在线娱乐三大类，其中在线学习的工具又分为信息获取、信息处理和信息交流，如图像 1 所示。这一步为后面 PLE 的调整提供了一个系统、清晰的知识图景，为选择更适合的 iGoogle 小工具以及学习方式提供了依据。梳理概念图的过程其实也是对 PLE 的一个再思考过程，以下对在线时间管理和在线学习的小工具进行详细介绍。



图像 1 iGoogle 小工具分类

在线时间管理：利用 Google Calendar、To Do List 和 My Notes 可以在线进行个人时间管理，这里最重要的一项是“To do list”，可以添加 3 个列表，分别命名为“重要任务”、“不重要任务”和“业余思考”，其中前两个是学习期间要完成的任务，在学习期间，每当接到一个新任务，就按照“时间四象限法”将其分为重要且紧急，重要不紧急，不重要且紧急，不重要不紧急，添加一个新事项后，将其级别调整为“高”则代表“紧急”，调整为“低”则代表“不紧急”，非常方便。Google Calendar 可以用来写年学习计划、月学习计划、周学习计划等，还可以在日历中添加邮件提醒；My Notes 可以用来记录“临时事情”（龙威廉，2006）。当然我们应该清楚，iGoogle 只是一个工具，不能指望 Google 能主动改变自己的学习效率，关键在于个人的观念能否转变，计划能否坚持。

在线学习：在线学习要求学习者具备信息技术基本知识和应用技能，即利用信息技术进行信息获取、加工处理以及呈现交流的技能。

- I 信息获取：在个人学习环境中，学习者能否占有信息、如何占有信息以及占有信息的及时程度，是学习者学习能否成功的关键。在 iGoogle 平台中有两种途径：利用搜索引擎和利用各种信息推送服务。常用的网络搜索引擎有 Google、Wikipedia、Google Scholar、Google Books 等，其中利用 Google Scholar Search 可以从一个位置方便地搜索各种资源、查找报告、摘要及引用内容，也可以通过图书馆或在 Web 上查找完整的论文以及了解本专业科研领域的重要论文。音、视频搜索引擎有 Quick image Search 和 Google Video Mini Search，可以方便地在当前页面搜索图片和视频。搜索引擎是“一对多”的信息服务方式，Google Alerts 和 Google Reader 则属于“一对一”的个性化信息推送服务。Google Alerts 是当学习者在 Google 上搜索的字词出现新的搜索结果时，自动发送给学习者的电子邮件。即了解新闻和网页中自己感兴趣的内容，输入关键词，就可定期获得新出现的搜索结果。Google Reader 能够自动更新学习者订阅的网站内容，保持信息的及时性，不必再担心错过重要信息。学习者可以添加多个定制的 RSS 来源，从而可以从多个不同网站的来源搜集信息展现到阅读器中，而不必一个一个网站去登陆查看。这两个提供信息推送服务的小工具共同的特点是，随时掌握新信息，随时随地使用，完全免费。Random Wikipedia Article 是一个充电小工具，每次随机显示一篇维基百科日志，每天长知识！
- I 信息处理：Delicious 和 Google Bookmarks 是对信息进行分类存储的小工具，利用 Delicious 社会化书签，学习者可以把有价值的网站随时加入自己的网络书签中，用多个标签标示和整理书签，并且可以与其他学习者共享。Google Docs 是个人发布和展示自己的学习体会、观点和思想的最好的基地，也是个人的文献中心。利用 Google Docs 将自己收集到的资料、信息等进行选择、过滤、归类整理，形成个人电子文档库。学习者可以在 Google Docs 中创建在线文档、电子表格和演示文稿，也可以上传现有文件到 Google Docs 中进行编辑，接受最常见的文件格式，包括 DOC、XLS、ODT、ODS、RTF、CSV 和 PPT 等。由于文档被安全地存储在互联网上，学习者在任何地方都可以访问文档。在 Google Docs 中可以创建文件夹，把在线文档添加到相应的文件夹中。Google Docs 不仅可以把文档保存为普通的文档方式，还可以把文档下载为网页、PDF、Open Office 等格式，极大地方便了用户。另外，正在编辑的文档可以直接以电子邮件附件的形式发送给其他人。学习者还可以使用“发布”功能将你编辑的文档直接发布到互联网上或自己的 Google Docs 上，发布到互联网上时，Google 会为你的文档提供一个唯一的网络地址，这样全世界的人都可以看到你的文章了（孙兴华和郝丽，2009）。Picasa Web Album 小工具支持图片浏览、搜索和上传。

- I 信息交流：通过即时交流工具 iChat 和异步交流工具 Gmail、Google Group 等，学习者可与其他人进行各种深度交流和信息分享，促进信息向知识的转化，并对自己的观点进行修正。学习者可以利用 iGoogle 左导航栏集成的 chat 标签在当前页面内和好友进行即时交流，不仅可以进行普通的文字聊天，通过安装一个插件还可以进行语音和视频聊天。除了即时交流外，通过将 Gmail 小工具嵌入到 iGoogle 页面，学习者可以在当前页面内阅读，删除邮件，或者把邮件归类为垃圾邮件，甚至可以创建新邮件，又方便又省时间。Google Group 是 Google 公司提供的网上论坛服务，利用它，可以快速架起一个多人讨论区，在里面发起新的话题或者回复别人的话题。更妙的是，它还有邮件列表的功能，可以用 Email 张贴自己的发言或者接收别人的发言。此外，它还提供了基于 Web 的更多功能，如共享文件、创建页面、帖子评分等。

学习者可按照自己的个性化需求将各类小工具整合到 iGoogle 首页。点击页面右上角“Add stuff”打开 iGoogle 目录，默认选项卡为 Gadgets，然后按关键词搜寻或左边分类来浏览选择想要的小工具，一次可以选择多个。点击下方的“Add it now”，小工具即被添加到 iGoogle 首页。如果添加过多的小工具会让页面加载很慢，而且添加新工具时可能会觉得空间不够用，不方便管理。因此，“Compound gadget”会是一个不错的选择，添加这个小工具后，它会自动监测到个性化主页上的所有模块，学习者只需要勾选希望添加进来的模块就可以了。例如，笔者就把 Google Mini Search、Google Book、Google Scholar Search、Wikipedia Search 和 Delicious 等信息搜索工具组合在一起，使得页面内容丰富而又简洁。

3.3. 页面布局及信息呈现方法

学习者按个人喜好设定小工具在首页中的排列方式。按住小工具上方标题栏拖曳，即可将其移动到理想位置。点击小工具标题栏的倒三角键并选择“Edit setting”即调整该小工具的设置。

3.4. 修改背景主题

点击页面右上方的“Change Theme from...”或者在 iGoogle 目录中选择 Themes，学习者可以从艺术家、游戏、动物、自然等类别中挑选喜欢的图案作为该主页的背景主题。找到合适的，点击相应主题下的“Add in now”，主题就能生效了。另外值得一说的是，还可以通过右边的“Sort by”找到最热门的、使用最多的或最新的主题。笔者基于 iGoogle 的 PLE“学习”页面如图像 2 所示。

3.5. 添加分页

学习者可在 iGoogle 中建立多个标签页，将小工具分门别类。点击现有分页右方倒三角键，选择“Edit this tab”[编辑此分页]，进入“版面设置”区域，点击“Add a tab”（添加一个分页）便可建立新分页并自行命名，还可以设定这个分页的背景主题和栏数。如图像 2 所示。



图像 2 基于 iGoogle 的 PLE“学习”页面

以上是基于 iGoogle 平台构建 PLE 的主要步骤。我们处在一个不断变化的世界，任何事物每天都在发生改变，也许今天构建的个人学习环境在明天就会“过时”，因为社会化软件在不断地更新，环境中的你、我都在流动，构建 PLE 的思想是：日益趋向理想中的个人学习环境，即内容和对话可以在不同的平台之间流动。因此，构建 PLE 的关键在于“建立相对稳定的互动规则”（尚佳，2008）。

4. 结语

基于 iGoogle 平台的整合，在技术手段上没有任何困难，它为学习个体构建起一个初步的个人学习环境，为下一步开展学习和交流做好了技术平台上的准备，难就难在学习个体开放、共享、交流的理念有没有建立起来，以及学习个体本身是否做好了融入互联网的思想和学习上的准备。无论对学习个体来说还是对整个社会来说，这都是需要相当长时间的过程，它同时也是一个学习个体网络化和学习活动社会化的过程。

参考文献

- 关中客 (2008)。个人学习环境(PLE)漫话。《远程教育杂志》，1，80。
- 尚佳 (2008)。Web2.0 时代的 PLE 建构初探。《远程教育杂志》，1，18-20。
- 孙兴华和郝丽 (2009)。Google Docs 及其教育应用。《电化教育研究》，7，45-48。
- 张豪锋和王小梅 (2009)。基于 Mashup 聚合技术对网络学习的有效支持探微。《现代教育技术》，19(4)，109-112。
- 龙威廉 (2006)。使用 Google 进行时间管理。取自 <http://www.williamlong.info/archives/661.html>。
- Graham Attwell(2007). Social software and web 2: a challenge to the future of schooling?. from http://project.bazaar.org/wp-content/stall_project_uploads//2007/02/bazaar_seminar_athens_2007.pdf.

应用新型 Web 2.0 线上工具发展创意学习策略 - “无线学习、学习无限@新科技中学”

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【摘要】 本文简要阐述身为“未来学校”的新科技中学，在全天候无线上网的有利环境中，如何探索且利用 Web 2.0 的线上工具进行不同层面的创意教学，积极培育学生探究的精神、提升学生深度思考的能力、创造让学生有效沟通的平台，从而实践“无线学习、学习无限”的教学理念和学习机制。

【关键词】 无线学习; 应用学习; 协作创造

1. 前言

本文将尝试说明在一个学生和笔记本电脑 1 对 1 比例下的学习环境中，教师如何有效应用校内全天候无线上网的有利环境，并积极探索且利用 Web 2.0 的线上工具进行不同层面的创意教学，积极培育学生探究的精神、提升学生深度思考的能力、创造让学生有效沟通的平台，从而实践“无线学习、学习无限”的教学理念和学习机制。

2. “无线学习”的背景

2.1. 创校简介

在新加坡教育部的见证下，新科技中学（以下简称“科中”）于 2008 年 3 月 3 日正式创校，并于 2010 年 1 月 4 日正式开课。其首 200 名学生在历经直接招生计划 (Direct School Admission) 和小学离校考试 (Primary School Leaving Examination) 的挑战和检测后，成绩水平均为全国小学离校考试的前百分之 30。科中也获选为“未来学校@新加坡”专案 (FutureSchools@Singapore Project) 的第六个成员。其主要以资讯和通信科技和崭新的硬题设备，全面推行与实践创意教学法，从而调动并达成学生学习的积极性。此外，科中的数码教育伙伴——“苹果企业”(Apple Inc) 也积极共同开发“1 对 1”的创意学习策略。科中精英将于如此得天独厚的四年中学课程里，浸濡在资信通讯科技的教学环境中 (ICT-enabled environment)，通过各个应用学习科目，实践并发挥个人最大的学习与创新潜能。

科中的办学愿景为——放眼天下、环抱全球、引领未来的高等科技学院 (“A Globally Connected Institution of Science and Technology”)。学院的使命则是培育蓄势待发、放眼未来、具备即战力的领导人才 (to develop “World-ready and Future Looking Leaders through Innovative Technology and Applied Learning”)。由此可见，科中的办学特色集中在科学与科技 (Science

and Technology)的研发、应用学习(Applied Learning)的实践、以及创新与创业(Innovation and Entrepreneurship)的督导。

2.2.“无线设备”

科中虚拟世界中支撑起“无线学习”的脊梁，即庞大的谷歌云端运算以及 Web 2.0 的应用工具。科中在 GoogleSite 的体制下，创立了一个庞大的网上系统，将所有的班级和科目放上网，并利用谷歌网站提供划一的网络学习服务。除此之外，科中为了贯彻学校提倡的资讯科技教学法，校方特地要求每位科中学生都配备一本“苹果”，把科技和课程完美地结合在一起，让师生享受利用科技教学的便利和好处。

3. Web 2.0 平台的深度应用学习

Web 2.0 的学习文化主要关注并推动三个环环相扣的应用功能，即参与(Participation)、协作(Collaboration)和分布(Distribution)。这三大应用功能在不同的线上工具上，皆有其凸显之处。例如部落格和脸书的“发表评论”就让其参与性的功能发挥得淋漓尽致；再如维基(Wikis)得协作功能更是有目共睹。这两个线上工具能触及的分布面就足以说明其广度无界限。以下将阐述教师如何以 Web 2.0 平台，探究并实践线上工具的创意学习策略，从而达到培育学生创意思维(Critical Thinking)、协作创造(Collaboration)以及有效沟通(Communication)的能力目标。

3.1.脸书的学习共同圈(The Facebook Learning Community)

3.1.1.会员俱乐部 学生以“粉丝”的身份加入这个学习共同圈，其最大的优势就是建立学生的归属感。师生之间可分享共同的话题，进而培养互信互重的感情，拉近彼此的距离。

3.1.2.资讯广播站 教师利用这个平台与学生分享不同的教学资讯，同时也可将其作为交待课业的网上广播站。如此以来，学生逐步养成到此平台查看资讯，自行完成活动的自立习惯。

3.1.3.活动布告栏 脸书中的 Events 功能，可以协助教师邀约学生参与某个特定活动，例如课堂观摩（<http://www.facebook.com/event.php?eid=463035190205&index=1>），然后请同学针对这个活动发表其看法或提出建议。

3.1.4.学习加油站 脸书中的 Link 功能非常便于链接 YouTube 里的视屏。教师可利用此功能进行歌唱教学，培养学生的音乐鉴赏能力。例如，以周华健《海阔天空》的词曲，让学生在享受澎湃的音韵之外，于“发表评论”(Comment)一处，写下个人的直观感受和领悟。此处学习策略所突出的是学习者在适度的引导下，发表个人的感悟。接着，在规定的时限内，可以即时一览全班 20 位同学的感言，并以小组或个人的方式，在班上与同学正面交流与沟通。教师即可从旁引导又可巩固所学。（<http://www.facebook.com/pages/Huang-LaoshiSST-huang-laoshi/237222777879>）



图像 1 “脸书”实例

3.2. 部落格的学习花园 (In Search of Blogs)

部落格在教学上的使用，已经有一段历史。在教学中，它的使用层面也逐渐演化。部落格在科中使用的广度涵盖各个科目。此外，应用的深度不单单至于让学生写下其感想而已。由于部落格自身可容纳不同多媒体的上载，这让教师在课程设计上提供了创意的想像空间，以及让学生经历与众不同的学习擂台。

学生可以在“私有”的空间，针对某个主题发表其看法，又可以根据其他同学的言论，发表意见或提供建议。如下：写作挑战（1）——请你以“生活是一张网”，写下你的感想。



图像 2 部落格实例

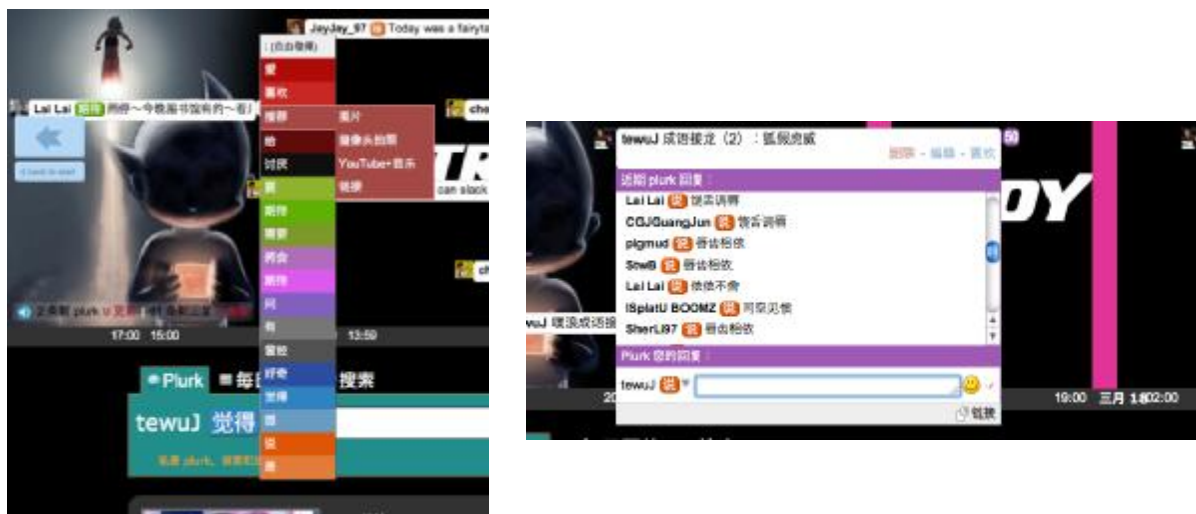
学生可以通过部落格学习, 教师也可以利用这个平台来学习, 进行教学反思。学生可以向老师建议学习的策略, 共同商榷学习的方向, 制定学习的目标。



图像 3 部落格实例

4. 探究当中的“嘿浪”天地

科中目前正在以“嘿浪”(PLURK)进行教学上的尝试。在这之前, 教师征询了学生如何利用嘿浪来学习华文看法。他们列举了具有创意性的活动, 如迷你辩论、主题接龙(如成语接龙)或作文续写。



图像 4 噗浪实例

在目前的实验阶段，教师选择噗浪中的特定的关键词语如“爱”、“期待”、“觉得”等等（见上图），让学生根据这些动词来发表个人的一些想法。教师也让学生“自由发挥”，针对特定主题，选定某个动词，阐述个人的看法，发表评论。其他同学更可以对某同学的感言有所反馈，进行交流。如此一来，学生能够理解同学们的各个观点，扩展个人的视野。

此外，师生也进行了于 30 分钟内“隔空”（即在各自的住宅内）完成“噗浪成语接龙”的实验性活动。〔注：师生约定于晚上 9 点整进入“噗浪挑战网”〕

学习策略主要是检测这批二语学生是否具备调动语文知识的能力，并且能够依据成语的最后一个汉字续接正确的成语（如图所示）。这个活动对学习者的最大挑战是不知应该续接哪个同学的回应。由于是线上的即时工具，大家都有可能在同一个点线输入自己的答案，以致有些同学根本无法顺利地参与其中，败兴而终。

针对这项活动的后续修订，让每个学习者都能积极参与活动的设计是把每位学生编上序号，在一定的时限内，按序号依次续接给定的成语。如此一来，即没有漏网之鱼又可以调动每位参与者高度学习的积极性。

5. 结论

在这开学后的八周，教师充分利用科中优渥的科技学习环境，同时针对教学目标，善加选择妥当的 Web2.0 线上工具，培育学生创意思维(Critical Thinking)、协作创造(Collaboration)以及有效沟通(Communication)的学习能力。从而实践“无线学习、学习无限”的教学理念和学习机制。值得一提的是，经历这一段短暂的学习历程，我们深信，要让科技教学策略具备前瞻性，课程设计者始终才是让 Web2.0 学习文化璀璨生辉的灵魂。

共創平台系統對於中小學課程之運用

The Application of Primary and secondary school curriculum on system of co-creative platform

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【摘要】 本篇論文的主旨是利用 wiki 系統的共同創作行為與 S2A(Script to Animation)系統共創劇本的特性運用在中小學教學，主要目的是藉由主動學習讓孩童們更進一步的了解課程，近來學者們則提出開放式的學習，而這個方式是由學習者自己創造出來的一個活潑且雙向的學習環境，將知識分享給其他人，並且其他學習者也根據自己的經驗，加入不同的見解和看法，最後所有學習者個別貢獻的知識將可整合在一起，達成群體的共識。S2A 系統的特性相當符合開放學習的精神：多人線上修改、編輯網站的內容、透過討論來合作學習等功能，每一個使用者都可以自由的在 S2A 平台上貢獻自己的知識。

【關鍵字】 合作學習、知識匯集、共創文本、遠距離教學

Abstract: The purpose of this study is to apply the features of wiki's collaborative creation and S2A(Script to Animation) in elementary and middle schools' education. The main goal is to let students have further understanding of curriculums from active learning. Recently, scholars suggest open learning; it's to enable learners to create their own active and multi-purpose learning environment, letting them to share knowledge with others. Others can also provide opinions according to their own experiences. In the end, all learners' contributions of knowledge can be integrated to a common view. Feature of S2A fits in with the spirit of open learning: largely anonymous users can make changes to websites' contents at the same time; every user can freely contribute one's knowledge in the S2A platform.

Keywords: Cooperate Learnig , Knowledge Management, Distance Learning, E-Learning

1.前言：

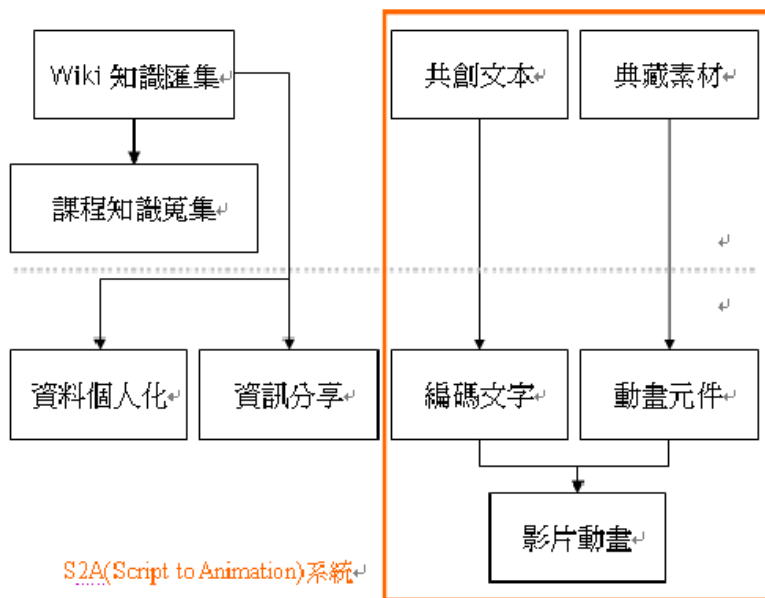
此平台 S2A(Script to Animation)是在強調提高網路合作學習效用，在 wiki 知識匯集之後，結合典藏的素材透過 S2A 的編碼文字、動畫元件等功能，最後把文字跟圖像結合成影片動畫，過程當中讓學習者來收集所需要的資料圖庫，經由課程教學活動的設計、發展網路合作學習支援系統實驗雛形，了解學習者不同個人特質、學習風格與電腦自我效能的差異性，藉由互動、主動式的方式加強學習者的印象與興趣。

共創平台的學習方式亦屬於合作學習的一環，合作學習中學習者之學習行為會受到個人因素及環境因素的影響。從個人因素而言，必須探討學習者不同的個人特質並提供適性學習的教學。從環境因素而言，網路輔助教學的重要課題在於網路教學輔助系統的功能與機制，

以及能夠創造因材施教、良好互動與合作學習的教學設計，並針對不同群組學習目標，提供不同的情境學習，或是運用虛構的學習情境，滿足課程的特殊需求（[林建名，2003](#)）。

2. 共創平台 S2A(Script to Animation)介紹

本共享平台目前包含了三大部分，分別是 Wiki 知識匯集、共創文本和典藏素材，整體架構圖如下：



2.1. Wiki 知識匯集

利用 wiki 的概念方式進行知識的收集整理，包含了三個項目，分別是知識蒐集、資料個人化、資訊分享。

2.2. 資料個人化

建立共創資料上傳系統讓學習者能夠在此進行資料匯集的共同創作，功能主要分為兩大部分：「共創資料集」及「查詢資料」。

共創資料集部分，由學習者共同規劃新的資料集內容。以故事接龍的創作方式為例，學習者登錄帳號與密碼之後，即來到新增資料集的首頁。在輸入第一章內容之後，點選送出按鈕，即完成新資料集的第一章內容（見圖一）。

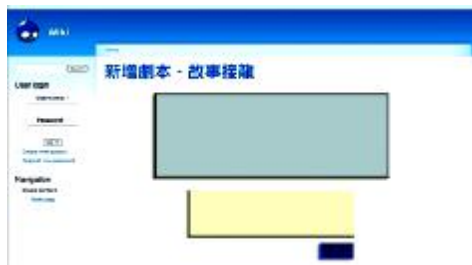


圖 1 新增文本介面

在查詢資料的功能下，使用者可藉由輸入關鍵字，或是資料更新時間（見圖二），就可以找到符合該搜尋字串的相關資料集。此功能在於提供使用者在選擇資料集瀏覽上，更快速及更有效率的方式。



圖 2 查詢文本介面



圖 3 已撰寫文本介面

2.3. S2A(Script to Animaion)系統

因此，本研究希望建置一套根據文字劇本與圖像來產生影片動畫的系統(S2A)，讓學習者在使用的時候有更好的互動效果，構想流程如圖五所示，本系統分為五部份，分別為共創劇本、典藏素材、編碼文字、動畫元件、影片動畫，以下進行說明：

2.3.1. 共創文本

學習者可於網路上進行資料集的共同創作，預期結果將能收集相當多元豐富的文本內容，以供後續發展。

2.3.2. 典藏素材

根據各課程所需，由學習者去收集圖像元件進行典藏動作，包含影像、聲音和影片圖像等等。

2.3.3. 編碼文字

以學習者在共創平台上的集思廣益為基礎，發展相關的編碼文字規則。經過編碼規則後的資料集可以成為動畫運算的腳本。

2.3.4. 動畫元件

將原有的典藏素材進行美工製作，參照編碼規則以及未來運算動畫的限制來製作成各式各樣的動畫元件，包含場景、圖像、動作和背景音效等等。

2.3.5. 影片動畫

使用具有程式語言開發能力的多媒體整合平台(例如 Adobe Flash)，撰寫運算動畫的程式，以編碼文字為準則，與資料庫內的動畫元件結合運算出影片動畫。

3. 共創平台 S2A 教學應用策略

共創平台透過互動式系統進行教學使教學流程更為活潑，而使用 S2A 系統教學更有助於學童對各概念的學習效果以及讓學生培養主動學習的能力，學習者把課程所需的圖像元件，結合依課程所需而找到的文本資料透過 S2A 來呈現，加強學童的成就感與深度的了解，以達到良好的學習效果，由於參與課程中學習者本身需要清楚的知道需要的上課素材，學生對於課堂上有任何的問題，會更專注的思考，並與老師討論，主要目的就是學生適時引導討論，藉由討論來代替課堂上的沉默讓小朋友逐漸習慣參與課程的編制，以達到互動式的合作學習。在教程編制上，因為S2A跟舊有共創系統最大不同的地方就是它的，合作性跟主動性，從個人合作學習行為對學習成效影響反應出學習者假如對共創平台系統使用程度與課程投入程度愈高，則使用合作學習成效會愈好，因此若在教學活動中設計引發學習者參與互動的意願，

將是增進合作學習成效的重要關鍵。此系統的發展不僅止單一課程應用，還可擴展更多的領域應用，包括了解歷史文物、民俗文化、大自然動植物等等。

而老師在設計合作學習的操作策略時，必須秉持著讓此操作策略能提昇學習者的學習效果為考量。參與合作學習中，學習者必須學習兩件事：（1）是和學業有關的任務工作；（2）是參與群組學習的人際技巧和團體技巧，合稱小組工作(Johnson、1994)。

OR-Bach 和 Van Joolingen（2004）在網路塑模系統支援合作問題解決的研究中，提出輔導者支持性的介入合作學習，目的是在提高：（1）個人和群組的互動；（2）內容導向和溝通導向的互動。由上述文獻結果分析，網路合作學習的主要目的有學習合作互動技巧與促進知識學習成效。

最後S2A集思廣益，在學習者把文本資料跟圖像都收集好後合成動畫影片，不僅提高學習者的成就感與記憶力且提供一個有效的教學資源交換功能，讓使用者不只是能夠自我學習，還能透過互動學習的方式來閱讀其他人的學習作品，達到教學相長的功效，實現學習社群的理想。

3.1. S2A教學模式的推演

根據第三章第一點教學應用策略的文獻發現，並沒有任何一種教學模式能完全適用於所有的教學與學習形式，但是每個教學模式卻有其獨特的觀點與功用。而綜合網路教學模式和S2A的共創特性，我們可以了解到現今國小的課程使用S2A平台因該注意下列幾項：

3.1.1. 強調主動式學習

施惠（民 82）認為現今的科學學習強調主動探討的學習方式，同樣的網路教學特性也強調學習者主動探索的重要性。因此在國小課程的網路教學方法中，探索式的教學方式也是重要的學習方式。

3.1.2. 加強情境模擬學習

科學教育漸漸強調情意的學習，因此教學如能融入情境的的學習，將使學習活動更加完備。網路超媒體的特性可以提供多媒體的界面，呈現多樣的學習環境，而教材運用故事與角色扮演發展，不僅提昇學習動機且可與生活經驗相結合。

3.1.3. 注重互動討論

近年來網路興起的社群概念，特別強調這種社會互動方式，藉以凝聚學習者的向心力。網路不僅提供遠端豐富的學習資源，且提供學生與學生、教師與學生互動討論的空間與園地，使專業學問可以交流。在網路教學模式的推演時，需考慮網路此項重要特性。



圖 4 操作介面

4.使用 S2A 共創平台之限制

雖然網路合作學習具有其優點。但也是有其本身的限制所在，此平台強調的是運用由學習者收集到的圖檔和文字檔作結合成為一個故事接龍型態的教學模式，所有的圖檔文字的正確

性都有待群組討論後經由指導者核閱才可以為下一個學習者使用，換句話說，如果沒有良好的事前訓練與適時的策略幫助，還是不能促使學習者群組成員間達到有效的互動，會使合作學習成效大打折扣。。因此，教學者有責任發揮教學專業，配合科技發展，事前考量學習者不同的學習行為，設計有效的策略來提升學習者進行網路合作學習的效果。

5. 結論

分工合作是學生進化學習方式的重要動力，相對於過去礙於舊式平台技術的限制，很難做到徹底的協同創作。現在此平台已經把這項基礎給建設起來，於是學生可以利用S2A系統來進行共同創作、協力完成課程，不管在收集資料或是共同創作中的討論，對於學習者都有顯著的成效。

過去舊有的共創學習系統都太過於制式化，缺乏主動性與合作學習的功效，今天學習環境的改變，網路教學與傳統教學的應用大不相同，教學資訊的互相將會傳遞將更頻繁，讓學習者主動去涉取相關的資源、再透過群組式討論已經編成未來教學趨勢，因為無時無刻每個人將扮演不同的角色，不再是單一的學習者或教學者的角色，相信共創平台在未來的教學會越來越普遍，而如何讓學習者有效率主動學習將會成為一個重要的議題。

參考文獻

- 林建名(2003)。 [網路合作學習成效之探索性研究](#)。資訊管理學系研究所碩士論文。嘉義縣：南華大學。
- 蔡宜坦（2004）。以Wiki 輔助網頁語法教學之研究。中興大學資訊科學研究所碩士論文，未出版，台中市。
- 駱仁山、王再國（2007）。自由軟體鑄造場專案開發平台之發展。中央研究院資訊科學研究所。
- 黃政傑、林佩璇（1996）。合作學習。台北市：五南。
- 童宜慧、張基成（1999）。網路化學習歷程檔案系統。第八屆國際電腦輔助教學研討會論文集。
- 台中市：逢甲大學。
- 施惠（1993）。國民小學自然科教師在職研習-探究式教學活動設計之研究。國立新竹師院科學教育中心。教育部中小學科學教育計畫編號 18。

註記分享平台實施網路合作學習應用研究—以 Diigo 為例

The Applications of Note-sharing Tools for Web-based Cooperative Learning –

Using Diigo as an Example

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【摘要】註記分享在數位學習中可應用於學校及推廣教育。本文利用 Diigo 平台，在學校教育以小學「修辭格教學」實施網路合作學習，挑選北縣某國小六年級一班進行教學，最後藉由「高年級學童學習動機量表」觀察學童學習動機改變情形。推廣教育則以「李天祿珍貴文物與影音資料數位館」提出結合數位典藏網站之應用策略。結果顯示，小六學童對於此教學方式感到新奇有趣，搭配小組合作與競爭方式能讓活動更顯熱絡，對其學習動機亦多呈現正向積極的態度。而在推廣教育上面也可透過建置註記分享教育網提升數位學習教學品質，達到數位典藏與教學相輔相成之效。

【關鍵字】Diigo、網路註記分享、網路合作學習、修辭格教學、數位典藏

Abstract : The applications of note-sharing for e-learning can be used in school and lifelong education. This paper used Diigo as a web-based cooperative learning platform for both occasions. In one hand, a class of 6th grader was selected for initial tryout, and a learning motivation evaluation form was given to observe the motivational changes. On the other hand, "Li Tien-lu Digital Archives Website" was applied for lifelong learning sector and a creative learning strategy was adopted. Results indicated that for school learning, students showed interest in this new e-learning strategy, and classroom atmosphere was vivid. For lifelong education, it also exhibited the capabilities of improving and enhancing the quality of pedagogical applications of digital archiving materials.

Keywords: Diigo, web-based note sharing, web-based cooperative learning, rhetorical teaching, digital archives

1.前言

合作註釋工具（collaborative annotation tools）為社會型書籤概念所延伸出的功能，使用者可以直接在所瀏覽的網站上劃重點及添加標註。李瑩、黎加厚（2007）指出合作註釋工具所提供的一系列功能使整個網路變成一個可寫、可整理、可交互的媒介。近年來，越來越多的 Web2.0 平台提供合作註釋之註記分享服務，並且適用於網路合作學習當中。

註記分享平台在數位學習上可應用於學校教育及推廣教育兩大區塊，本文擬分別於此兩大區塊發展一套示範教學策略。在學校教育方面，本文擬導入「網路合作學習」之方式，結合註記分享工具（Diigo）來實施「修辭格教學」，以國小教科書出現較多、學生最感興趣的「譬喻修辭」進行教學，對象為台北縣某國小六年級一個班，盼此策略能增進高年級學童之學習動機，不再視修辭學習為畏途。而在推廣學習方面，則擬以參與台灣國科會計畫之

「李天祿珍貴文物與影音資料數位典藏計畫」，從數位典藏網站學習的角度，探討合作註釋工具結合數位典藏內容學習的應用潛力與作法，以期提供給數位學習建置者創新的思考方向，提昇數位學習教學品質。

2.網路合作學習、註記分享工具與 Diigo

2.1.網路合作學習

王智玄（2000）對網路合作學習下的定義為「學習者在網路上使用各種網路工具透過合作的方式來學習，運用群組討論的方式，形成一學習社群」。Susman(1998)指出於網路環境之下以問題解決為中心之合作學習，對於增進學生學習成效、團隊互動和學習意願皆有明顯的助益。周士堯（2006）亦指出觀察教師認為網路合作學習情境，可以突破傳統教室教學限制，藉由跨區域的討論，加廣學生多元視野，更能深化全球教育中情意培養及技能學習。網路合作學習可以對學習內容產生深入瞭解，提昇學習動機（許湧坤，2003；王凱平，2003）。綜合學者觀點，網路合作學習應用層面相當廣泛，相當值得推廣，其對於學習動機增強亦有實徵研究支持，因此，本研究擬引入此策略於修辭格教學與成人推廣學習，期能提升學習動機。

2.2.註記分享工具

註記分享工具的概念起源於社會型網路書籤。自 2003 年 del.icio.us 網站開啟網路書籤服務之先河後，簡單易用的線上書籤與即時註記功能也逐漸普及。本研究選擇同時擁有網路書籤以及合作註釋功能的註記分享平台，進行評估與特色比較，分別為：Diigo、Reframe it、Google Sidewiki 以及 Webnotes 四個註記分享平台，評估如下：

表 1 四種註記分享平台評估表

系統	Diigo	Reframe it	Google Sidewiki	Webnotes
標記註解	提供不同顏色的標記功能，並可在文字旁新增便條註解	選取重點至邊界的討論區塊發表評論	選取重點至邊界的討論區塊發表評論	提供不同顏色的標記功能，並可在文字旁新增便條註解
網頁擷取	有	無	無	有
發佈分享	可透過 Blog、Facebook 及 Twitter 等社群網站進行分享，並支援 RSS 與 Widget 功能	可透過 Blog、Facebook 及 Twitter 等社群網站進行分享，並支援 RSS 與 Widget 功能	可透過 Blog、Facebook 及 Twitter 等社群網站進行發佈分享	可透過 Email 以及 Twitter 進行發佈分享
搜尋功能	透過 Tags 及 Lists 進行條件搜尋	利用朋友評論、群組評論與關鍵字搜尋	可透過 Tags 以及關鍵字進行搜尋	透過文件夾以及 Tags 的方式搜尋
群組功能	可自行建立群組或加入群組討論分享	可自行建立群組或加入群組討論分享	無，僅提供個人書籤記錄使用	無，僅提供個人書籤記錄使用
其他特色	提供 Educator Accounts 讓教師可以建立班級群組	可不另外申請帳號，透過其他 OpenID 使用	提供近 60 個發佈分享網站，其中包含如 Diigo 等書籤網站	除了網站書籤外，提供 PDF 檔資料匯入

經過評估後，發現 Google Sidewiki 以及 Webnotes 沒有建立社群之功能，對於網路合作學習時可能較為受限。而 Diigo 不僅可以在社群裡面分享書籤，也可以發表主題討論，用途更為廣泛，所以決定選擇 Diigo 作為本研究應用策略之建置系統。

2.3. Diigo

Diigo 為「Digest of Internet Information, Groups and Other stuff」之簡稱，其創始人來自中國，曾經任教於加州大學柏克萊分校的任偉博士，Diigo 於 2006 年由美國 CNET 網站評選十大受歡迎研究工具中排第四名。Diigo 官網開宗明義即強調「Diigo 是一個功能強大的研究工具和知識分享的社群網站」，並提供 Diigo Toolbar 瀏覽器工具列下載，只要加入 Diigo 會員即可與全世界 Diigo 使用者藉由網頁分享你的觀點及評論他人言語，真正達到 web2.0 的精神。研究者欲藉由 Diigo 兩大特點：Highlight 及 Sticky Note，將教學教材電子化後放到網頁上，讓學生分組討論後，將結果直接註記於網頁上並分享之，讓各小組可以觀摩其他組想法並給予回饋，達成知識分享、資源交流和學業進步之目的。

由於 Diigo 是一非常嶄新及具前瞻性的註記分享工具，因此相關實證研究較缺乏，下表 2 整理學者應用 Diigo 於教學上之實徵研究：

表 2 學者應用 Diigo 於教學上之實徵研究

學者	題目	研究結論或心得概述
Diigo 應用於教學的幾點思考		
李瑩、黎加厚（2007）	Diigo 在教學中的應用初探	<ol style="list-style-type: none"> 1. 輔助教師準備教學內容，促進專業發展 2. 轉化教學形式，豐富教學內容 3. 為師生提供便捷的交流平台 4. 提高學生獨立思考、自主學習的能力
湯躍明、吳靜松、李紅安（2007）	Diigo 在研究生學習中的應用探究	Diigo 提供一個具互動與交流性的平台，可有效促進研究生之個人知識管理、豐富學習、提升學習效率、學習更主動及提升個人的表達能力
Hargadon(2007)	Best of Social Bookmarking	Diigo 是功能強大之社會性書籤，它能让使用者直接於網頁上高亮選取並註記留言，並分享給其他用戶，這對於教育應用非常有幫助，此方式有效幫助教師評估學生作業。

資料來源：研究者歸納整理

由上列學者研究得知，Diigo 的確不失為一強大之研究工具，其應用於實際教學之可行性也很高，教師若能活用 Diigo 之各項功能，搭合作學習之技巧，應可強化學生學習動機及學習成效，讓此新型態 web2.0 概念之工具發揮功效。

3. 利用註記分享工具於修辭格教學與其應用策略

修辭格教學即將修辭格技巧融入教學的一種方式（陳麗雲，2006）。杜淑貞（1986）認為教師於國語科讀書教學時，適時增加修辭的欣賞與指導，引導學生學習修辭。而關於國小修辭格教學，陳麗雲（2006）認為「國小修辭格教學，要教會學生識別修辭格，畫清各類修辭格之間的界限，並且瞭解各個修辭格的性能與效用」。本研究選定國小語文教科書常出現，學生較熟悉之「譬喻」進行教學，將上課教材放至 Google docs 上並發佈之，讓學生分組使用 Diigo 註記分享，最後配合本研究之修辭格教學，編製了「高年級學童學習動機量表」，作為觀察學生教學後學習動機改變情形，教學流程如下：

1. 參考修辭相關書籍並擬好教材與試題，將教材全部放到 Google docs 上，並發佈之（讓所有人都可以瀏覽，但不能編輯）。

2. 註冊 Diigo 帳號並向 Diigo 管理員申請開通 Teacher Console 功能，以便開通分組學生帳號及設定密碼。
3. 教學前規劃好分組合作學習方式、註記答題技巧注意事項及計分規則，並於教學活動進行前講解規則及進行方式。
4. 與班級導師敲定好實施時間，預借好電腦教室，並確保電腦穩定與網路順暢。
5. 將學生依上學期國語科兩次段考之平均成績高低，採 S 型異質分組方式，每組 5-6 人，分成 6 組，一組一個 Diigo 帳號。
6. 為使學生熟悉 Diigo 註記之技巧，宜事先準備一篇文章讓學生練習。
7. 教師依評分標準針對每題答題加以註記評分，並將結果填寫於「評分表」。
8. 活動實施後，請每位同學填寫「高年級學童學習動機量表」，並統計填寫情形。
9. 活動最後針對評分結果給予各組適當之獎勵。

教學活動網址：http://docs.google.com/View?id=d28sqz5_1cvppfxdr

而在實地教學應用過程中，有以下注意事項：

1. 教材準備、評分標準、流程掌控、分組原則、組員打字速度等環節都很重要。
2. 教師事先的「評分標準講解、註記示範答題」非常重要，對於國小生來說，「愈明確之規則與做法」有所遵循是很重要的。
3. 分組註記活動實施時，教師應隨時走訪各組，關心小組合作學習概況，不要有組員無所事事，避免搭便車之情形。

4. 利用註記分享工具於數位典藏學習與其應用策略

Fuchs 等人（2004）認為，數位典藏支援教導與學習的部份不僅僅只是在於其分享、保存以及組織的典藏內容，更可以讓人們匯集不同的觀點與想法，提供優質的學習環境。數位典藏所建置的數位內容，是建立數位學習的最佳元件，將數位典藏與數位學習進行整合與連結，可以成為數位學習的新場域（陳志銘、陳佳琪，2008）。「李天祿珍貴文物與影音資料數位典藏計畫」透過數位化技術保留珍貴的台灣布袋戲文物資產，對於台灣傳統藝術知識的散步與特有民俗內涵的傳承扮演著重要的角色，在傳統文化教學上可利用該網站開放近用的影音、文物與詮釋資料豐富教學內容。其利用 Diigo 進行數位教育整合構思之應用策略如下：

1. 建立「李天祿與傳統布袋戲知識」共享社群：利用 Diigo 的社群（Group）功能，建立「李天祿與傳統布袋戲知識」共享社群，讓學習成員們可以在裡面分享所看到的相關網站，並在底下發表評論、心得，或發表主題（Topic）進行討論。若教育者本身為網站建構者，可以利用 Diigo 所提供之“Group Widgets”將資訊嵌入在網站當中，讓學習者可以在網站中就看到所社員分享的網頁與討論之議題，更可讓造訪此網站的人擁有管道得知 Diigo 社群並加入參與，達到合作共創分享知識的目的。如圖 1 所示。
2. 利用 Diigo 合作註記功能建構「Diigo 李天祿數位典藏學習網」：Diigo 之合作註記功能讓使用者可以直接在網頁上面畫重點、進行註解。教育者可以透過此項功能在網站上面直接建構「Diigo 李天祿數位典藏學習網」。此學習網並不限於網站建構者才得以架構，將註解功能設定為只限群組閱讀，只有加入學習網群組之社員們才可以看到註解的內容。如圖 2 所示。



圖 1 在左側欄位嵌入 Diigo Group Widget 圖 2 利用 Diigo 在網站與群組成員註記討論

3. 結合部落格或社群網站增加社群價值：Diigo 提供在 Facebook、Twitter 及 Blog 共同發佈之功能，三者皆是現今廣為網友使用之 Web2.0 系統，透過共同發佈可匯集更多有興趣的網友創建與分享知識，達到 Web2.0 共享平台推廣教育之目的。

5. 結論與建議

本研究導入 Diigo 應用於國小修辭格教學為一創新之策略，此網路合作學習策略不管是從學生填寫之「高年級學童學習動機量表」或過程中研究者觀察小組互動情況，學生的參與度、互動討論情形及學習動機都蠻正向積極的，可作為資訊融入教學策略之參考。另外運用 Diigo 作為數位典藏之成人推廣學習平台，利用內容豐富的現成網站直接進行註記，教育者可不另多耗費成本額外架設教育網，就可以看到群組成員們運用 Diigo 所提供的分享內容。教育者可以在上面對於較艱深的名詞或需額外補充資料的段落進行補充。

Diigo 不僅可以免費使用網路群組與書籤功能，其介面也十分親和易用，符合 Web2.0 時代無技術門檻之應用。希望透過本研究的探討，對於網路合作學習可以加入新的元素，達到 Web2.0 知識串聯之效。建議後續研究可廣泛應用於各領域，並加入不同背景變項，期盼能貢獻更多實徵研究，增進網路學習者之學習成就。

參考文獻

- 王凱平（2003）。網路合作學習對護專學生化學學習成效之影響研究。靜宜大學應用化學研究所博士論文，未出版。
- 王智玄（2000）。新的學習策略-網路合作式學習之探討。資訊與教育雜誌，78，42-50。
- 杜淑貞（1986）。國小作文教學探究。台北：台灣學生書局。
- 李瑩、黎加厚（2007）。Diigo 在教學中的應用初探。遠程教育雜誌。16-20。
- 周士堯（2006）。以兩岸跨校網路合作學習輔助高中地理科全球教育教學。國立台灣師範大學地理學系在職進修碩士班碩士論文。
- 許湧坤（2003）。網路合作學習模式應用於程式設計課程之研究，銘傳大學資訊管理學系碩士在職專班碩士論文。
- 陳志銘、陳佳琪（2008）。數位典藏支援數位學習現況與發展。臺灣圖書館管理季刊。4(2)，9-23。
- 陳麗雲（2006）。國小高年級修辭格創思教學之研究。國立臺北教育大學語文教育學系碩士論文，未出版。
- 湯躍明、吳靜松、李紅安(2007)。Diigo 在研究生學習中的應用探究。中國電化教育，2007 年第 11 期。
- Hargadon, S. (2007). Best of Social Bookmarking. *School Library Journal*, 53(12), 20-20.

- Keller, J. M. (1987). Development and use of the ARCS model of motivational design. *Journal of Instructional Development*, 10(3), 2-10.
- M. Fuchs, C. M., C. Nieder'ee, M. Hemmje. (2004). Digital libraries in knowledgemanagement: an e-learning case study. *International Journal of Digital Libraries*, 4, 32.
- Susman, E. B. (1998). Cooperative Learning: A review of factors that increase the effectiveness of cooperative computer-based instruction. *Journal of Educational Computing Research*. 18(4), 303-322.

微型部落格網路平台置於中小學國語文教育課程內容之應用-以 Plurk 為例

The Use of Micro-blogging for Primary and High School Chinese Curriculum – Using “Plurk” as an Example.

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【摘要】部落格的近年越來越以人為中心發展，微型部落格(micro-blogging)，是新型態的個人創作及群體互動服務，諸如 Twitter、Plurk...等等都是屬於這類的服務，因此也逐漸成為大眾廣泛使用的網路平台。本文則是利用 Plurk 為教學平台，將中小學的國語文課程導入，運用 Plurk 的特性，加上文字、照片和影像的多元授課方式，達到互動式教學與合作學習的目的，也增加中小學生對於學習國語文的興趣，培養其國語文的能力，使學生的邏輯思考更加廣泛且具學習成效。

【關鍵字】微型部落格、合作學習

Abstract: Recent years, development of blogs is more user-centered. Micro-blogging, a new type of individually creative work and group interactive service, such as Twitter and Plurk, have become widely used network platforms. In this article, we take Plurk as an example, importing Chinese curriculum in primary and secondary school on this platform. Using the characteristics of Plurk, along with multiple data forms--texts, pictures, and videos--achieves the goal of interactive teaching and Collaboration learning. Meanwhile, it increases students' interest in Chinese learning and improves their language ability. Hence, they will be thinking more logically and broadly.

Keywords: Micro-blogging, Collaboration Learning

1. 前言：

部落格(Blog)的發展隨著網路技術的進步而逐漸成熟，與 web 2.0 概念的結合，使部落格形成雙向互動、分享的平台之一。舉凡政府部門、各大企業、各級學校以及相關營利事業機關，紛紛設置部落格來拉近大眾或消費者的距離。近年來，傳統部落格的型態有所轉變，所謂的微型部落格(micro-blogging)也逐漸發展成型。其與傳統部落格的差別莫過於更即時性、便利性，將日常生活的大小瑣事，透過微部落格，完整且迅速的分享與參與。就此特性，微型部落格也就成為網路互動教學的平台，老師藉由此平台上傳教學大綱、教材、線上測驗考題、標註事項、建構出虛擬教室來達到師生互動及相互討論學習的效果。

本文則是利用微型部落格 Plurk 為教學平台，將中小學的國語文課程導入，運用 Plurk 的特性，達到互動式教學的目的，也增加中小學生對於學習國語文的興趣，培養其國語文的能力。藉由多元化的教學方式，使學生的邏輯思考可以更加廣泛且更具學習成效。

2. 微型部落格介紹

微型部落格(micro-blogging、microlog)，其與一般部落格最大的不同在於它有字數上得限制，通常限定在 140 個字以內，藉此改變使用者對於事件的描述方式。每當自己在部落格中有新的更新時，自訂的朋友圈即可更新狀態，取得使用者的最新部落格訊息。隨其發展，

這些訊息可以被很多方式傳送，包括簡訊、即時訊息軟體、電子郵件、MP3 或網頁。一些微型部落格也可以發佈多媒體，如圖片或影音剪輯。

3. 國際間著名微型部落格介紹與比較

目前國際間規模最大且具代表性的微型部落格是 Twitter，Twitter 因為從 2008 年美國大陸航空一架飛機在丹佛出事，一個在該飛機上的乘客利用 Twitter 留下紀錄，而開始陸續的被報導，加上美國總統 Barack Obama 在競選時也有用 twitter 而成名，許多名人、歌手也都開始加入 twitter 的行列，而也有公司和社群團體利用 twitter 打廣告宣傳。但 Twitter 目前所提供的介面語言只有英文和日文，所以其主要的使用者來自英語系國家及日本地區。當然，在台灣的接受度就因為英文程度而限制了使用者的數量。

另一個熱門的微型部落格為 Plurk，中文名為噗浪。由於其提供超過 25 種語言的介面版本，所以在非英語系國家較 Twitter 為流行，因此台灣 Plurk 的使用者也較多。然而，Plurk 的最大的特色在於使用可拖曳及互動的時間軸(Time-line)來呈現使用者當下的心情語錄，讓自己和朋友在時間軸上面留言，也可以分享圖片和連結網址影片和好友的文章。再者，時間軸的視覺表現，使用者可以一目了然的了解訊息事件發佈的時間順序，使訊息事件以堆疊方式呈現，使用者方便透過時間點來了解最新發布的訊息。而 Plurk 最有趣且具創意的功能在於 karma 值，其是指使用者對於噗浪的熟練度，若要提高自我的 karma 值，則使用者必須發表適量的文章以及保持活動。此外，在 Plurk 中的一些功能需具備一定的 karma 值，才允許開放使用，例如：表情符號。Karma 值的機制，類似遊戲中的累積經驗值，因此探究使用者的心理，較能促使用者累積 karma 值。這是 Plurk 較為吸引人的特色之一。

表 1 為微型部落格 Twitter 和 Plurk 的整理比較，依據兩種不同類型的微型部落格，整理成表格。

表 1. 微型部落格 Twitter 和 Plurk 的整理比較與特色

	Twitter	Plurk
成立時間	2006 年 3 月成立於舊金山	2008 年 5 月 12 日
語言	英文、日文	二十餘種語言版本
字數限制	140 個英文字(70 個中文字)	中文、英文皆為 140 個字
特色	<ul style="list-style-type: none"> Ø Twitter 圍繞著追隨者 (Follower) 這個概念。當你打算去跟隨 (Follow) 一個 Twitter 使用者的時候，那個使用者所發布的訊息就會按照時間順序全部出現在你的 Twitter 首頁上。 Ø 用戶可透過 Twitter 網站、即時通訊、SMS、RSS、電郵或 Twitter 用戶端軟體獲得文字更新。 	<ul style="list-style-type: none"> Ø 可以在一條時間軸上顯示自己和好友的所有訊息，每一位會員都可以單獨評論別人的 Plurk 內容。 Ø Karma 值系統，以令會員更加投入網站上的動。 Ø 搜尋關鍵字，可以讓噗浪客知道「這個話題還有誰在討論」，鎖定特殊討論話題。除此之外，還能夠儲存鎖定常用的關鍵字，保持對某話題的追蹤。 Ø 能生成訊息中的關鍵字所產生的趨勢時間圖表。這個圖表能概估該關鍵字在所有使用者發出的訊息中所出現的頻率次數。

4. 網路合作學習的介紹

合作學習是一種透過與小組成員社會互動的相互學習活動之下，發展出許多促進小組合作及化解衝突的學習策略，使成員在不斷地溝通協調的學習過程產生相互依存的關係，彼

此擁有共同的目標而一起建構知識、促進認知發展的過程（Zurita & Nussbaum, 2004）然而，網路教學較傳統教學具有非同步、多方向、個別化、自動記錄的優勢（田耐青、洪明洲，1998）。故目前的教學趨勢已經慢慢轉向成網路虛擬社群的教學模式。網路打破了地域上的隔閡，縮短了彼此間的距離，因此形成多種傳播方式以及內容型態的特性，為學校教育創造許多的可能。

許多研究發現，透過網路合作學習的方式可增進學生概念、提升學生的後設認知、高層次認知技能、提出更多的問題解決策略（林建仲、鄭宗文，2001），進而培養創造思考、主動探索的能力、提高學習動機及增廣學習範圍（林建仲、鄭宗文，2001）。再者，學生經由親自操作的學習有助於建構及內化構念，將觀測所得的資料做有意義的圖表呈現，在互動中獲得肯定與經驗分享，有利於高層次技能的養成（許瑛珖、吳慧珍，2002）。建置一個虛擬的學習平台，使得學生有更多元化的想法可以即時分享與討論，加深學生對於課程教學內容的印象，使其更能了解內容的涵意。

5. 國語文教育課程置於 Plurk 的應用

本文主要的構想為運用 Plurk 建置一個虛擬的教學平台，將 Plurk 的即時性及時間軸 (Time-line) 的特色，將其運用在中小學的國語文教學上。以下將會列舉幾個實例來說明此構想概念。

實例一

文字上的應用：老師在 Plurk 上先導引發表一首詩詞的名字或是關於此詩的其他資訊，然後要求學生透過網路虛擬教學平台，進行詩的接龍或是補充。希望透過公開的學習，使學生能夠嘗試觀察和發表自我的看法。使一個看似普通的詩詞，也可以有不一樣的學習方式及成效。



圖 1. 老師透過 Plurk 平台導引主題



圖 2.學生透過 Plurk 平台參與主題的討論與分享

實例二

圖片/影像上的應用：依據實例一的延伸思考，老師可以透過網路平台的多元性，加入不同元素的題材，如圖片/影像的導引，讓學生在國語文學習過程中，可以有不同的邏輯思考方向，想出不同的創意發想，達到刺激思考及記憶學習的功用。



圖 3.老師透過 Plurk 平台發表圖片引導學生思考



圖 4.學生透過 Plurk 平台發表由圖片所感受到的內容

上述兩個實例，分別列舉出文字及圖像利用微型部落格 Plurk 的教學構思，在第一個實例中，結合了文字接龍、共創平台以及 Web 2.0 互動、分享概念，應用於中小學之教學中，可以激發出不一樣的上課模式和內容。並配合老師所要求的時間內，在時間軸(Time-line)上做一個明顯的界定區分，以便於管理。在第二個實例中，加入圖片或是影響，不但可以增加學生上課的興趣，還可以朝向多元教學內容的授課方式，刺激學生思考，達到教學目的。

6. 教師角色定位與家長認同度的建立

老師在網路平台中是一的領導者的角色，必須有效控制學生的討論秩序與相關約束，才能使得此學習平台能夠發揮最大效應。然而傳統的教學模式中的人際關係主要是「師生關係」，而網路平台教學後的人際關係擴充至「親、師、生」的三角關係。故此教學案例，必須透過教師的專業知識結合與學生的互動模式，也可邀請家長一同在 Plurk 教學平台上教學相長，不但增強合作學習的目的，也構築了親師之間的良好關係。相信經由家長的親身參與，可以建立彼此的認同度，最後讓學生能夠在專業的教師教學與家長的共同監督參與下，能夠也更好的學習成效。

7. 結論

微型部落格是一個即時性且異步性的網路平台，將國語文教學內容結合置虛擬的網路學校中，增加的不只有教學內容的豐富度，最重要的是學生的分享與參與。使學生在其中找到樂趣，快樂學習才是真正的學習基礎，也才能夠順水推舟的達到教學目的。(黃繡媛，1997)認為網路提供更寬廣的自我學習空間，能創造跨越教室的學習環境，進行虛擬情境的野外實查，以及跨班、跨校、跨國的問題討論，可促進以學生為主體的學習，並落實互動式與多元化的教學。本文提供了利用 Plurk 微型部落格平台作為主軸的教學模式，結合 Web 2.0 與網路合作學習的概念，創造出不同於傳統教育方式的教學內容和平台使用。藉此提供中小學國語文教育的參考。

參考文獻

- Zurita, G., & Nussbaum, M. (2004). A constructivist mobile learning environment supported by a wireless handheld network. *Journal of Computer Assisted Learning*, 20, 235-243.
- 田耐青、洪明洲 (1998)。電腦中介與合作學習。台北師範學院學報。11，1-22。
- 林建仲、鄭宗文 (2001)。合作式學習與問題解決—培養以問題解決為中心的網路合作學習。資訊與教育雜誌。85，55-62。
- 許瑛珧、吳慧珍 (2002)。網路合作學習與科學過程技能的學習。科學教育。254，16-27。
- 黃繡媛 (1997)。網際網路在歷史教學上的應用。高中歷史教學與研究。4，242-255。
- Twitter. (2010)。In *Wikipedia, the free encyclopedia*。檢索日期：2010 年 3 月 1 日。取自：
<http://zh.wikipedia.org/zh-tw/Twitter>
- 微網誌(2010)。In *Wikipedia, the free encyclopedia*。檢索日期：2010 年 3 月 1 日。取自：
<http://zh.wikipedia.org/zh-tw/%E5%BE%AE%E5%8D%9A%E5%AE%A2>
- Plurk(2010)。In *Wikipedia, the free encyclopedia*。檢索日期：2010 年 3 月 1 日。取自：
<http://zh.wikipedia.org/zh-tw/Plurk>

A Study of Information Presentation Effects on Cognitive Load and Learning Performance through Embodied Interactive Video Game (EIVG) in Science Learning

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Abstract: *There is a growing need and trend for video games which promote physical activity and mental stimulation for children, adult, and older people as well. From the perspectives of learning, this study aims to understand the effects of prior knowledge, information presentation speed (fast or middle) and information presentation modules (series or parallel) on cognitive load and learning performance based on the platform of embodied interactive video games (EIVG). The Quasi-experimental design was adopted as the major method of this study. There were 107 6th grade students as the subjects for this study by random cluster sampling. Based on self-report measurement, there was no significant difference on cognitive load among the groups, and the average cognitive load was 2.99 on the 5-point scale. As far as the learning performance, there was significant difference on posttest between the groups in terms of different prior knowledge and speed. Moreover, each group made a little progress on the second and third play. This study drew the conclusion that learning on the embodied interactive video game was effective and without much cognitive load.*

Keywords: embodied video game, information presentation, cognitive load

1. Purpose

Learning a foreign language is always a difficult task comparing with learning one's native language. Native Language learning is acquired through everyday immersion since birth while learning a second language often requires more formal instructions. It is difficult for a native speaker to distinguish what part of their thinking is language and what part is thought because they already internalize their native language. However, it is unlikely for a person learning a second language to think and internalize in the second language until they are completely fluent with that particular language. To communicate using a second language, often people have to translate their thoughts before verbalizing it. The translation and hesitation is what sometimes cause the delay in response.

Language transfer is a common phenomenon in the language learning. Language transfer is the effect of one language on the learning of another. (Longman Dictionary of Language Teaching & Applied Linguistics, 1992). In the process of the foreign language learning, learners will unconsciously bring the pronunciation, lexical, grammatical structures, and thoughts of the native tongue into the target language. However, for Chinese learners learning English pronouns, negative language transfer would often occur due to the fact that Chinese is a language without masculine and feminine. When using a second language, it is more likely to apply the same rules for the native language unless the second language has become second nature. It is for this reason different pronoun (subject, object, and possessive pronouns) are used in this study.

In Taiwan, due to the high school and college entrance examinations, the approach to teaching English as a second language stresses skill orientation and rote memorization. Yao (1999) states that the listening and speaking instruction is absent in Taiwan's high school education, which leads to limited abilities of students' auditory and verbal skills. The

situation lasts to colleges and universities, and students are misled to believe that more English vocabulary and grammar they can recognize, the better their English proficiency will be. In this study, one of the purposes is to examine through what structure the participants will improve their pronoun usage ability better.

2. Methodology

2.1 Participants

Due to the content of the games, the subjects for this study were 107 6th grade students, which included 60 boys and 47 girls, by random cluster sampling. According to pretest, they were homogeneous in prior knowledge concerning toxic plants.

2.2. The Research Design

The Quasi-experimental design was adopted as the major method of this study (see *Table 1*). We separated these students into four groups randomly; two control groups and two experimental groups. All groups took pretest (to understand the level of prior knowledge) and posttest (to understand the learning performance and perceived cognitive load). The experimental groups watched the scenario for prior knowledge enrichment. The learning contents were about toxic plants. There were two kinds of information presentation modules, one was to categorize the plants into toxic plants and non-toxic plants in series (M2), the other was a multiple choice to select one correct answer from four items (M7). Participants played three times on each module. Furthermore, there were at least two levels of speed to present information and each group only took one speed. In the embodied interactive video game environment, the subjects may move their hands, heads or any parts of the body to perform the select action through the webcam. The performances data for the video games were automatically recorded on the system for further analyses.

Table 1. Quasi-experimental design

GROUP	Level of Game's Speed	Scenario for prior knowledge
1	Fast (about 10~12 questions/ minute)	Provided
2	Mid (about 7~8 questions / minute)	Provided
3	Fast	Not provided
4	Mid	Not provided

3. Findings

This study aims to understand the perceived cognitive load, and the effects of prior knowledge, information presentation module and speed on cognitive load and learning performance. The findings were as follows:

3.1. Perceived Cognitive Load

The average cognitive load was 2.99 on the 5-point scale. And there was no significant difference among the groups. That means different prior knowledge, different speed and modules of information presentation on EVIG didn't make difference on cognitive load. In another words, interaction with EVIG which was free from devices may contribute to level the cognitive load in learning.

3.2. Learning Performance

3.2.1. The effect of prior knowledge

As far as learning performance on posttest, according to ANOVA analysis and Scheffe' post hoc test, we found that group 1 and group 2 were better than group 3 and group 4. That means there was significant effect of prior knowledge on learning performance. Moreover, in the toxic plant recognition part from the posttest, group 1 and 2 also performed better than group 3 and 4, and group 4 was better than group 3 (see *Table 2*).

Table 2. ANOVA on posttest

	Group	N	Mean	SD	F	Scheffe'
posttest	1	28	43.71	10.07	22.004	1>3、4 2>3、4
	2	28	43.57	5.51		
	3	23	30.61	7.13		
	4	27	33.33	5.95		
posttest recognition	1	28	23.82	3.90	48.740	1>3、4 2>3、4 4>3
	2	28	23.54	2.08		
	3	24	15.71	2.65		
	4	27	18.56	2.56		

Furthermore, this study found the groups without scenario provided had greater improvement than the groups with scenario provided (see *Table 3*). For this situation, we made inference that prior knowledge (scenario providing) sure would enhance participants' accuracy rate, but which also interrupted with the recognition of the content, thus might reduce their space for improvement. Moreover, the participants in non-scenario groups were using trial and error to learn about toxic plants, and there was a clear improvement between each play. Therefore, we thought that trial and error approach was useful in this educational game.

Table 3. T-Test on accuracy improvement

	Scenario Provided (Group 1 & 2)	Non Scenario Provided (Group 3 & 4)	df	t	p
M22 - M21 Accuracy	-2.38	5.70	89	-2.089	.040*
M23 - M21 Accuracy	-3.18	9.66	104	-3.242	.002**
M23 - M22 Accuracy	-.80	4.58	104	-1.528	.130
M72 - M71 Accuracy	2.71	1.75	105	.207	.837
M73 - M71 Accuracy	-.07	17.65	101	-3.333	.001**
M73 - M72 Accuracy	-3.94	17.88	101	-4.347	.000***

* $p < .05$, ** $p < .01$, *** $p < .001$ i.e M21 = 1st play in Module 2 game

3.2.2. The effect of information presentation speed

In this study, group 3 and group 4 were non-scenario groups. It shown that group 4 was better than group 3 in their posttest for toxic plant recognition ($t(1,49) = -3.90, p < .001$). Their difference was in their speed of information presentation. Group 3 was in fast speed and group 4 was in middle speed. From this data, we found that under the situation of no prior knowledge (non-scenario provided), the slower speed of information presentation can help learner to build their cognition of the learning content. In other words, in a period of time the lower amount of information presentation can help students to get better learning result.

Table 4. T-test on learning performance in terms of information presentation speed

	Group 3	Group 4	df	<i>t</i>	<i>p</i>
Posttest	30.61	33.33	48	-1.47	.147
posttest recognition	15.71	18.56	49	-3.90	.000***

 $p < .001$

3.2.2. The effect of information presentation module

In Table 5 below, the mean of accuracy rate of module 2 was much higher than module 7. Therefore, the module which had lower cognitive load would have higher accuracy rate.

Table 5. Module 2 and Module 7's accuracy and mean of improvement

	M2 Accuracy	M7 Accuracy	M2 Mean of Improvement	M7 Mean of Improvement
Mean	70.66	40.26	1.92	5.57
Mode	75.33	21.00	.00	.00
SD	14.28	20.61	14.17	18.84
Min	39.67	.00	-42.00	-40.00
Max	97.67	93.33	50.00	50.00

3.3. Technology acceptance

3.3.1. The relationship between technology acceptance and cognitive load

According to Pearson Correlation, we found there was a low correlation between technology acceptance and cognitive load. Higher technology acceptance led to higher cognitive load. Technology acceptance was developed from two main factors: perceived usefulness and perceived ease of use. The subjects' feeling of technology acceptance might come from the part of ease of use, which is dependent on the user interface. However, cognitive load measuring included the contents of the games. Therefore, subjects might have less knowledge of toxic plant to lead to high cognitive load, although they knew how to play the game in a short time.

3.2.2. The relationship between technology acceptance and learning performance

There is a relationship between average accuracy of module 2 and technology acceptance ($p=.016$). Students who had higher technology acceptance also had better performance in Module 2. Moreover, students who had higher technology acceptance might pay more attention in plants recognizing in the games, and which led to higher cognitive load. In other hands, students who had lower technology acceptance were not only need to remember the content but also need to pay much attention in the playing method, which might disperse their perception of cognitive load.

4. Discussion

According to this experimental study, we found there was no significant difference on cognitive load in terms of different prior knowledge, information presentation speed and module. In another words, interaction with EVIG which was free from devices may contribute to level the cognitive load in learning. As far as learning performance on posttest, we found there was significant effect of prior knowledge on learning performance. Furthermore, this study found the

groups without scenario provided had greater improvement than the groups with scenario provided. Regarding trial and error approach was useful on EVIG. , we found that under the situation of no prior knowledge, the slower speed of information presentation can help learner to build their cognition of the learning content. In other words, in a period of time the lower amount of information presentation can help students to get better learning result. This study drew the conclusion that learning on the embodied interactive video game was effective and without much cognitive load.

References

- Kalyuga, S., & Sweller, J. (2005). Rapid dynamic assessment of expertise to improve the efficiency of adaptive e-learning. *Educational Technology, Research & Development*, 53, 83–93.
- Schwan, S., & Riempp, R. (2004). The cognitive benefits of interactive videos: learning to tie nautical knots. *Learning and Instruction*, 14(3), 293-305.
- Seufert, T. (2003). Supporting coherence formation in learning from multiple representations. *Learning and Instruction*, 13 (2), 227–237.
- Seufert, T., Janen, I. & Brünken, R. (2007). The impact of intrinsic cognitive load on the effectiveness of graphical help for coherence formation. *Computers in Human Behavior*, 23(3), 1055-1071.
- Sweller, J., van Merriënboer, J.J.G., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10 (3), 251–296.
- Swicka, A. (2008). Dynamics of cognitive load theory: A model-based approach. *Computers in Human Behavior*, 24(3), 1041-1066.

網絡教育遊戲中教師角色的反思：鷹架理論在『農場狂想曲』的實踐與應用

Reflection on the Role of Teachers in the Educational Online Games:

The Application and Practice of Scaffolding in “FARMTASIA”

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【摘要】 將學教與遊戲結合以提高學生的學習興趣及效能已有很多相關的研究，但在網絡環境的E世代中如何讓學生通過網絡遊戲(Online Game)以提高學生的解難及協作能力實在是現今教育界值得探討的課題，特別是如何利用網絡環境作為學習場景的優勢及老師如何支援學生在網絡遊戲有意義地學習實在值得探討。本文會以由香港中文大學資訊科技教育促進中心開發的網絡遊戲(Online Game)『農場狂想曲』“Farmtasia”為本，探討教育遊戲中教師的角色，如何將鷹架理論在『農場狂想曲』的實踐與應用。

【關鍵詞】 網絡教育遊戲 鷹架理論

***Abstract:** The integration of learning and teaching with GAME to improve student interest in learning and performance has been published in a lot of related research, in the E-generation network environment, how to make a good use of online games (Online Game) to improve students problem-solving and collaboration skill is education issues worth to exploring, especially how to take the advantages of using Internet as a learning environment, the role of teachers and how to support students to learn meaningfully in the network game. Farmtasia is an online educational game designed by The Centre for the Advancement of Information Technology in Education, The Chinese University of Hong Kong. This paper focuses on exploring the role of teachers in educational games, and how to integrate Theory of Scaffolding into the game “Farmtasia”.*

1. 前言

1.1. 鷹架教學

鷹架教學理論源自蘇俄心理學家 Lev Vygotsky 的學習理論。Vygotsky 認為人類的認知發展過程是需經過「內化」或「行動的遷移」，將社會意義及經驗轉換成個人內在的意義(Vygotsky, 1962)。Vygotsky 將認知發展分為實際的發展層次(Real level of development)以及潛在的發展層次(Potential level of development)，前者是指個體能夠獨立解決問題的能力，後者則是需要他人(老師、同儕中較優秀者)引導或支援下才能解決問題的能力。這兩個層次間的，Vygotsky 將兩者之間的差距稱為「可潛在發展區(zone of proximal development 簡稱 ZPD)」。

鷹架(Scaffolding)由 Wood 等在 1976 年提出，強調學習者內在心理能力的成長，有賴教學者或能力較強的同儕協助，這種協助應建立在學習者當時的認知能力的特質上。在可潛在發展區獲得外界所給予的協助以支援其學習，就稱為鷹架，能對發展具有促進作用的功效。

Debra (1992) 認為鷹架教學擁有六項要素：教師的支持、學習責任轉移到學生身上、師生對話非評估性的合作、保持適當水準的教學、學生選擇與參與團體發展。

1.2. 教育遊戲

遊戲是孩子的天性，對於孩子，任何事情（包括學習）都可能是遊戲。“遊戲是一種自願的活動或消遣，是在某一固定的時空內進行的，其規則是遊戲者自願接受的，但是又有絕對的約束力，遊戲以自身為目的而又伴有一種緊張、愉快的情感以及對它‘不同於日常生活’的意識。”（Huizinga 著，成窮譯，1998，頁 34-35）。

將遊戲用於教育中，能為學生創造富有吸引力的學習環境（Malone，1981；Lee & Lee，2001；瞿坤，顧清紅，2000），使得學習更有趣，並可以使學生在“做”中“學”（Thiagarajan，1989；Kirriemuir & McFarlane，2004），從而提高學生解決問題的能力、協作學習能力和其他學習能力（Whitebread，1997；Bruckman，1998）。

1.3. 農場狂想曲 *FARMTASIA*

考慮到資訊科技教育應用存在的問題以及網路遊戲潛在的教育應用價值，為了充分發揮網路的深層功能，並真正導致學習範式的轉變，香港中文大學資訊科技教育促進中心李芳樂教授和李浩文教授提出了虛擬互動學生為本學習環境(VISOLE: Virtual Interactive Student-Oriented Learning Environment)的學習模式。所謂 VISOLE，它是一種讓學生在互動式遊戲化虛擬環境中自主學習知識的學習模式。

這種學習模式大致分為三部份：

- 1 學生在教師的幫助和引導下利用 VISOLE 提供的教學材料以及其他網路教學資源自主學習相關知識；
- 2 學生以“公民”的身份加入到 VISOLE 創設的遊戲化虛擬世界中，並在其中發現問題、分析問題、解決問題，藉以學習相關的學科知識，並培養解決問題的能力和協作學習能力等高階能力；
- 3 學生在教師的引導下對學習過程進行反思和總結，通過這些反思和總結，從而達到真正掌握知識並提高能力的目的，並能夠將虛擬環境中的知識和實際中的知識聯繫起來。

在 VISOLE 學習模式的框架下，香港中文大學資訊科技教育促進中心開發《農場狂想曲》教育遊戲中，學生可以在其中創建一個農場，通過對農場的經營和管理，來綜合學習地理、農業、環境、經濟、政府、社會等學科知識，並培養解決問題、協作學習、資訊科技等相關能力。

農場狂想曲已發展到第二代，兩代都是以網絡環境進行建構學習為本，學生以 RPG (Role-playing Game) 角色扮演模式進行遊戲，以農夫身份經營農莊以賺取最大的收穫及信譽度，同學能夠綜合學習及應用地理、經濟、科技及生物等知識考驗其決策能力。

1.4.1. 農場狂想曲(一) *FARMTASIA I* (2006 年)

《農場狂想曲 1》通常的玩法是將玩家分成四人一組，用八天（或十六天）的時間完成八個回合的賽事。在每個回合的賽事中，玩家們扮演農場主人的角色，在遊戲期間必須妥善安排人手來完成農地，果園及畜牧的工作。為提高遊戲的真實性與難度，玩家亦需要留意每天的天氣狀況，以及突如其來的天災，玩家亦可以在眾多小遊戲中獲得不同的獎勵。四位玩家的競爭目標，就是為自己的農場賺取最多的金錢與聲望。在遊戲結束時，系統會因應玩家過去八個回合的表現，分別得到不同的遊戲結局。

1.4.2. 農場狂想曲(二) *FARMTASIA II* (2009 年)

《農場狂想曲 2》是一套網上遊戲化學習系統，在「農場狂想曲 2」的虛擬世界中，每位同學扮演農場主人的角色，完成耕種、畜牧和買賣的任務。在這過程中，同學能夠綜合學習及應用地理、經濟、科技及生物等知識。遊戲中的電腦角色會安排不同的任務給同學。他們也會作為指導者帶領同學學習耕種和畜牧的基本知識。農作物收取得成後，可到市場出售來賺取金錢和等級。同學更可以到市場購買肥料、飼料等用品及工具。

當同學賺取足夠的金錢和等級後，他們可以興建更多的設施來擴展農場，例如牛奶工場、罐頭廠、貨倉、天文臺及水塔等等。同學亦可以雇用農場小幫手協助管理農場。同學更可到遊戲中世界各地其他地方設立農場。為提高遊戲的真實性，植物和動物會受不同地方的氣候影響，同學需要想辦法解決天氣帶來的問題。

2. 《農場狂想曲》與鷹架理論的實施

《農場狂想曲》與一般網絡遊戲的顯著分別，就是肯定教師在支援學生進行高階學習的角色，以鷹架理論為本去為學生建構知識、技能與價值觀，針對其可潛在發展區作深層拓展。現先比較兩代遊戲的異同，再就遊戲的設計如何讓教師為學生進行鷹架學教作探討。

表格 1 兩代《農場狂想曲》比較

	農場狂想曲(一) FARMTASIA I (2006 年)	農場狂想曲(二) FARMTASIA II (2009 年)
系統每局參與人數	4 人	無限
遊戲比賽活動日數	16 日	5 星期
鷹架教學支援策略	實際課堂 由老師傳授相關知識	系統內網絡知者 給予相關學科知識
學習協作者	老師 組內同學	遊戲討論區內網民
反思策略	課堂反思 BLOG 網誌	課堂反思 BLOG 網誌
學習成果	情景難題	情景難題

2.1. 系統參與人數－學習協作者：

在農場狂想曲(一)中系統規限每局參與人數為四人，系統同時間可以容許很多組同時進行遊戲，但組別間是沒有任何聯繫及互動溝通。同學的協作伙伴只限於同組的同學。在農場狂想曲(二)中系統對參與人數沒有任何規限，可支援無限學生同時於平台上進行互動學習，個體與個體之間相互互動，成員之間環環相扣，一個個體的行為亦會影響其他個體的環境系數，而系統內的環境系數變化亦會影響遊戲中每個個體。這情況就比較貼近現實世界的「情境學習」(Authentic Learning)。

「情境學習」由 Brown, Collins, & Dugid(1988)提出，但之前 Schon(1987)對專門行業執業人員學習模式的研究、Suchman(1987)觀察人們操作影印機之人機互動現象、以及 Lave(1984, 1987)對傳統技藝學徒學習歷程的俗名誌研究，已蘊含了情境學習的概念。Schon(1987)指出，許多專門行業的知識、技能、行規或術語，無法完全用文字或語言作整全的紀錄詳述。若要獲得該專業技能，唯有進入專業情境，成為一名學徒，親自觀察和參與，

才能懂得其中竅門。Schon 提出了「在行動中求知」(Knowing in action)及「在行動中反省」(Reflection in action)的學習概念，即是情境學習理論的重要內涵之一。Suchman (1987) 觀察操作使用影印機的過程中發現，大部分人並非先閱讀完使用者手冊後再操作機器，而是在使用過程中遇到困難時，再查閱說明書或直接請教有經驗的人。所以 Suchman 提出了「情境行動」(Situating action)的觀點，強調知識若脫離使用情境，則學習就變成玩抽象符號的遊戲。知識中許多抽象概念及規則必須透過實際的體驗來領悟，由實際行動中才能理解其真正的含意。Lave 等人對學習和日常活動的俗名誌研究發現，一些從事專門行業的老百姓(如屠夫、助產士、裁縫師、操舵手等)，雖然只是從一個小小的學徒做起，並未像專家一樣接受完整的教育或正式的訓練，但面對專業上各種複雜的情景問題，仍然有令人滿意的表現，甚至更懂得一些訣竅，知道如何直接利用環境資源去解決未曾遇見的問題 (Lave, & Wenger, 1991)。

由此可知，不同的學者均主張情境學習是學習者與環境互動的產物，且本質上受活動與文化脈絡的影響 (Brow, Collins, & Dugid, 1989)。

Vygotsky 讓我們瞭解到「學習社群」的重要意義。互動的對象可以是老師，也可以是同儕同學。透過溝通與協作中形成學習支架，才能讓學生在貼近現實世界的環境中作有意義的解難式任務為本學習。在農場狂想曲(一)中學習的協作者主要是老師及同組同學，但在農場狂想曲(二)中同學則以遊戲論壇為本，同學會將問題及自己玩遊戲的心得在遊戲論壇中分享，故此使用知識論壇對於學生的經驗累積與轉化甚有成效。

2.2. 遊戲比賽活動日數：

在農場狂想曲(一)中遊戲是以十六日限，同學在期間接受到教師的知識傳授及建構，行動的反思與歸納，並在遊戲中作不同的決策以賺取最大的回報及信譽度。將整個遊戲限制在十六日完成能夠將學生的學習興趣及競爭性提高，同學要在短時間中作行為決策、反思歸納、鷹架提升等高階學習，面對不同的模擬現實世界的困難作最佳反應及決策，使其學習熱忱得以維持。鷹架理論在「垂直」與「水平」兩個層次中實踐，一方面教師提供相關遊戲的知識以支援學生解決遊戲中面對的困難，另一方面教師亦為同學在遊戲中的決策作回饋，使同學在之後的決策有更佳表現。在農場狂想曲(二)中遊戲加長到五星期三十五日為限，最重要是由於鷹架是需要學生內化及沉典，將之理解並應用在其行為，時間太短對能力弱的學生是未能建構完成。其次是農場狂想曲(二)的遊戲設計比較貼近現實世界，學生在遊戲中所面對的困難無論數量及難度均需要時間去思考，以作最佳決定去解決難題。當然帶來的問題就是要維持學生的學習熱誠及投入就變得困難。

2.3. 鷹架教學支援策略：

在農場狂想曲(一)中鷹架教學主要是在實際課堂中出現，大學提供一本知識手冊給予學校教師以作知識傳授，使學生能夠懂得面對遊戲中的困難與問題。內容是有關經濟、科技、生產系統、自然環境、生物、政府、自然災害及環境問題的課題。學校會安排約總共六小時的課節讓學生學會相關知識。在農場狂想曲(二)中則安排一個虛擬角色公主，在遊戲中的情景困難地區附近出現，讓同學面對相關困難時能夠向知者提出問題，並即時學習相關知識去解難。這原意是希望學生能夠按學習的需要找尋相關的資源解難並作出鷹架教學。但問題是對於一些學習動機及能力較弱的學生，由於沒有老師的指導及監測，面對問題可能是亂作決定更甚是抱放棄態度。故此鷹架教學的部份仍應在課堂出現，但配以系統的知者作支援，或可對學生提供更佳的學教成效。

2.4. 反思策略及方法：

在農場狂想曲(一)中同學的反思主要在與教師面見時出現，系統中有一錄影機功能能將學生的學習行為作錄影，以方便教師與學生在檢討時作分析及反思，使同學在遊戲中表現越來越好。另外同學亦會就每階段的表現作反思歸納，將之文字化後寫在網絡日誌中以方便老師及同組成員作回饋，作為學生於遊戲中的學習紀錄檔。在農場狂想曲(二)中亦有相關學教活動，但由於參與人數甚多，要紀錄學生的學習表現以推敲其決策因素實不容易。但即使有農場狂想曲(一)的錄影機功能，要教師為每一學生的學習行為作視像觀察並抽取出有價值作檢討的部份，這工作實在是不能負荷。故此若系統中能夠將學生的重要決策才紀錄下來，以方便老師為學生作反思及鷹架教學，這才是實際課堂的所需。

2.5. 學習成果的展示：

完成遊戲後同學會面對另一情景難題，當中的困難與深度和廣度均是與遊戲中所面對的困難相近。期望學生能將在遊戲中所學的綜合內化，並在全新的情景中應用及實施。這種能力的轉移亦是鷹架理論的價值所在。在農場狂想曲(一)中的情景難題：「同學需要寫信給一農夫林伯，分享你在這遊戲中的得著，並為林伯提供意見怎妥善去經營農場。」；在農場狂想曲(二)中的情景難題：「假設你是一位農民，請根據在「農場狂想曲2」的經驗，及其他參考資料，策劃一個農場發展計劃，使農場能夠在環境、經濟及社會方面長期維持生產。」。

由情景難題來看，農場狂想曲(二)题目的深度和廣度明顯比農場狂想曲(一)為高。農場狂想曲(二)是期望學生能歸納出可持續發展的概念，並要求同學歸納在遊戲中所學去策劃一個農場發展計劃，使農場能夠在環境、經濟及社會方面長期維持生產。這種能力的拓展是需要教師作出有效的鷹架才能讓學生完成這任務。否則在零碎的學習片段中同學未必能夠反思出其學習決策行為背後的原因。教師需將之整理、綜合、反思、評鑑讓同學將之內化，在往後的類近情景作出更佳決定。

3. 農場狂想曲鷹架教學的改善

農場狂想曲(二)的鷹架比起農場狂想曲(一)的鷹架教學明顯分別，是由老師主導傳授知識使學生能夠面對遊戲中的情景難題，進化為由學生主導在遊戲中探究問題並通過網絡知者或網絡社群去支援其解難及學習。知識得以通過網絡社群作整合及提升，學生面對困難時亦能在網絡群體中獲取支援以助解難。這方式是近似現在學生在一般網絡遊戲的玩法，但學生能否在網絡社群中學到適切知識，這很取決於網絡社群的素質。故安排網絡知者在遊戲中適當情節中出現，給予學生學習支援，這安排會比較合乎教育需要。在網絡中按著自己的遊戲進度學到相關知識，這種以學生為本的學習模式使學生的學習興趣得以提升。

4. 總結：

教育與網絡遊戲的結合實在是有其教育意義，特別是針對網絡環境的優化及網絡遊戲的普及，網絡遊戲與教育配合能夠掌握到學生的學習興趣及脈搏。但現今相關的教育研究仍不多，特別是針對教育網絡遊戲的設計特質、如何與課程結合、如何配合鷹架理論的實踐及教師角色等仍有很大空間有待探究。期望有更多網絡教育遊戲開發，讓學生在網絡環境中配以教師的鷹架支援其更有意義地學習。

附加資料：

農場狂想曲(一)：<http://webquest.bmf.edu.hk/visole/>

農場狂想曲(二)：<http://webquest.bmf.edu.hk/farmtasia2/>

參考文獻

- 徐新逸(民 82)。錨式情境教學教材設計、發展與應用之研究(I)。國科會科教處結案報告 (NSC82-0111-S-032-001)。
- 徐新逸(民 84)。錨式情境教學教材設計、發展與應用之研究(II)。國科會科教處結案報告 (NSC84-2511-S-032-001)。
- 尚俊傑、莊紹勇、李芳樂、李浩文 (2008)。個案研究方法在教育遊戲研究中的應用。《現代教育技術》。
- 尚俊傑、莊紹勇、李芳樂、李浩文 (2008)。遊戲化學習行為特徵之個案研究及其對教育遊戲設計的啟示《China Educational Technology》2，65-71。
- 周玉霞 李芳樂 李浩文 尚俊傑 (2008)。玩還是學：學習村莊中學生的知、情、意、行。中國遠程教育,1,57-61。
- 尚俊杰，莊紹勇，李芳樂，李浩文 (2007)。VISOLE 的動機策略及其成效。全球華人計算機教育應用學報。5(1&2)。72-84。
- 瞿坤、顧清紅 (2000) 教育 MUD/MOO--獨具魅力的網絡化學習環境。電化教育，81，35-39
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-41.
- Bruckman, A. (1998). Community support for constructionist learning. *Computer Supported Cooperative Work*. 7, 47-86.
- Collins, A., Brown, J., & Newman, S. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning and instruction: Essays in honor of Robert Glaser* (pp. 453-493). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Debra, J.P., (1992) The negotiation of meaning and the transfer of responsibility for learning through teacher scaffolding and student self-scaffolding of instruction, University of Texas at Austin, *Dissertation. Discourse event*. Dissertation: University of Cincinnati.
- Huizinga 著. 成窮. 譯. (1998) .人：遊戲者. 貴陽：貴州人民出版社.
- Kirriemuir, J. & McFarlane, A. (2004). Literature Review in Games and Learning. *Bristol: Nesta Futurelab series*, report 8.
- Lee, J. H. M. & Lee, F. L. (2001). Virtual interactive student-oriented learning environment (VISOLE): Extending the frontier of web-based learning. *The scholarship of teaching and learning organized by University Grant Council*, Hong Kong.
- Malone, TW (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 4: 333-369.
- Schon, Donald. (1987). Educating the Reflective Practitioner. *San Francisco: Jossey-Bass*.
- Suchman, L. A. (1987). Plans and situated actions: The problem of human-machine communications. *Cambridge, UK*
- Thiagarajan, S. (1989). EG HUNT: a game for teaching concepts. *Educational Technology*, 29(2), 48-51.
- Vygotsky, L.S. (1962). Thought and Language. *Cambridge, MA: MIT Press*.
- Whitebread, D (1997). Developing children's problem-solving: the educational uses of adventure

games, in: McFarlane, A (ed) *Information Technology and Authentic Learning*. London: Routledge, 13-37.

Wood, D. J., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychiatry and Psychology*, 17(2), 89-100.

Examining Technology Acceptance in a Competitive Educational Game: A Case Study of “NEXT”

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Abstract: *The purpose of the current study was to examine levels of technology acceptance among 20 elementary teachers and to evaluate the differences in rating the acceptance of the online game “Next”. The online game system functioned as an educational instrument and the current study served as a reference for the future research which may evaluate the effectiveness of the instrument. The results suggested that the instrument was generally accepted by the teachers and there was no significant difference in rating the variables of technology acceptance regarding the instrument, including perceived ease of use, perceived usefulness, attitude, usage intentions and concentration.*

Keywords: next, online game system

1. Introduction

When it comes to evaluation of the usability of an information system, there are three aspects to be concerned: system, user and the interaction between them. The scale of evaluation may range from user interface design (color, font or layout) to the adoption of an innovative technology. In the field of human computer interaction (HCI), researchers have accumulated many results by measuring users’ satisfaction or their acceptance levels toward technology. Both approaches contribute a lot to the system development although they have not been considered to be combined most of the time (Barbara & Peter, 2005). In the first approach, experts usually examine all factors involved in the system and information design explicitly, but its actual usage cannot be guaranteed. We must realize that if people are willing to use a system, they must be driven by intrinsic or extrinsic motivations. However researches concerning intrinsic motivations are not adequate. Technology acceptance model (TAM) as a result can be applied here. In TAM, perceived usefulness and perceived ease of use are two factors that influence user attitude. Moreover, perceived ease of use has direct impact to perceived usefulness, and perceived usefulness has extra effect to user intentions (Davis et al. 1989). But just like we discussed earlier about user satisfaction, studies of TAM has its insufficiency. They consider all system design features as a single construct, and just take several features into consideration (Barbara & Peter, 2005). In this study, the authors will try to figure out the connection among technology acceptance variables, such as user belief, attitude toward the system, usage intention, et cetera.

2. Methods

2.1. Game design

The game “Next” is designed according to a famous poker game “Heart Attack” in Taiwan. When playing the game by poker cards, the cards are dealt to each player equally. There may be 2 to 4 people at the same time. The number is spoken from 1 to 13 while players take turns to toss cards. When the number pronounced is the same with the card tossed, players have to press the tossed card by hand. The slowest player has to collect all cards on the table. The

player who firstly runs out of the cards in hand is the winner. The game “Next” is an online game set on the server. Game rules are arranged in consideration of the traditional poker game “Heart Attack”. However, instead of number, content of cards is replaced by subject matters such as poetry, alphabet, a periodic table of elements, et cetera. As the game is played online, the voice of players is replaced by the cues appearing on the left side on the screen. The number of cards is determined according to content of cards. Similar as substantial poker cards, there are four suits, including spades, hearts, diamonds and clubs. As a consequence content of a card has four corresponding suits.

Participants and procedures

Data were collected from 20 teachers currently employed in Jin Hua elementary school. There were 10 teachers in each group. In the first stage, the teachers were invited to a meeting in the National Taiwan Normal University to attend demonstration of the game “Next”. After understanding the rules of the game, they started to play by themselves. 20 minutes later, questionnaires regarding technology acceptance were distributed. The hermeneutic research method was applied in this study (Hong et al., 2009).

Measures

There were 36 items included in the whole scale. Participants were measured with a three-point Likert scale containing 36 items, which were drawn from Liu, Liao, & Pratt (2009) measure of TAM. In our study, eleven items were developed to measure ease of use. Seven items were generated to measure perceived usefulness. Eight items were developed to measure attitude toward the online game. Five items were developed to assess usage intention and another five items were used to evaluate user concentration when playing the game.

The three-point Likert-type response scale included 1 (*disagree*), 2 (*neutral*), and 3 (*agree*). Mean scores were calculated. A higher score indicated higher extent of each category. Internal consistency reliability was measured with Cronbach's alpha. The values of Cronbach's alpha in perceived ease of use, perceived usefulness, attitude, usage intentions and concentration subscales were .89, .90, .93, .93 and .87 respectively. Table 1 showed the descriptive values and internal consistency reliability for each subscales. Cronbach's alpha, which measured internal consistency of the scale, showed that internal reliability of the measure was .97.

Table 1. The descriptive values and internal consistency reliability for each subscales.

	Mean	Variance	SD	N of items	Cronbach's Alpha
1.Ease of use scale	26.30	29.06	5.39	11	0.889
2.Perceived usefulness scale	17.85	15.82	3.98	7	0.900
3.Attitude scale	19.20	25.01	5.00	8	0.932
4.Usage intention scale	13.35	6.66	2.58	5	0.926
5.Concentration scale	13.40	4.25	2.06	5	0.866

3. Results

As regards to the first section of the procedure, means of perceived ease of use, perceived usefulness, attitude, usage intentions and concentration scores were 2.39, 2.55, 2.40, 2.67 and 2.68 respectively. Generally speaking, the sample scored higher in usage intention and concentration, and scored relatively lower in perceived ease of use and attitude. Internet frequencies had no significant effects on the five categories respectively.

Correlation coefficients were first analyzed to examine the correlation among variables. The Pearson correlation coefficients of different variables obtained were listed in Table 2. All these coefficients were found to be significant.

Table 2. Pearson correlation coefficients.

Ease of use	Perceived usefulness	Attitude	Usage intention	Concentration
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Ease of use	1.000				
Perceived usefulness	0.633**	1.000			
Attitude	0.788**	0.851**	1.000		
Usage intention	0.612**	0.831**	0.851**	1.000	
Concentration	0.599**	0.823**	0.808**	0.872**	1.000**

**p<0.01

With regards to the differences of rating the acceptance of the online game, a hermeneutic approach was conducted. The hermeneutic string of phenomenology specifically deals with the problem of making the implicit more explicit. The purpose of hermeneutics is to bring “into nearness that which tends to be obscure”(van Manen,1990). Therefore, the hermeneutic approach can evaluate the awareness of game users without them thinking about it. The hermeneutic approach helps participants interpret their consciousness of contemplating students’ behaviors and then build the dimensions (Schwandt, 1994).

It was found that the two groups of teachers showed significant similarity in their respective evaluation results. Altogether, 31 items out of 36 shared the same rating by both groups. The status of judgment among the two groups was shown in table 3.

The corresponding proportion (PC) is $31/36 = 0.781$.

The expected corresponding proportion (EPC) is 0.365 (Table 4).

$$k = (PC - EPCT) / (1 - EPCT) = (0.861 - 0.365) / (1 - 0.365) = 0.781.$$

With k analysis a k value greater than 0.70 denotes a significant level. Since $0.781 > 0.70$ the k value indicates that the hypothesis that there is no difference in weighting for the importance of factors influencing technology acceptance between two groups was supported. Therefore, the results of k analysis indicate that those factors of high importance should be taken into consideration and generalized in evolutionary game design.

Table 3. The analysis of corresponding proportion.

A	Agree	Neutral	Disagree	Total
B				
Agree	14	2	1	17
Neutral	1	11	0	12
Disagree	0	1	6	7
Total	15	14	7	36

Table 4. The analysis of expected corresponding proportion.

Code	Marginal frequencies	EPC
Agree	$(17/36) \times (15/36)$	0.197
Neutral	$(12/36) \times (14/36)$	0.130
Disagree	$(7/36) \times (7/36)$	0.038
Total		0.365

4. Discussion

According to the results above, the online game “Next” is generally accepted by the elementary teachers as an educational instrument, which is considered a form of technology in educational use. The variables examined are positively related with each other. Furthermore, when evaluating the differences of expert opinion on user interaction with the instrument, the authors have found high similarity within the two groups. It means the opinions of the two groups are mainly similar regarding the instrument.

For the researchers and the educators the effectiveness of an educational instrument is often the main concern of issues. Future research may examine learning outcomes of the online game system “Next” when taking the results of

the current study into concern. In addition, highly correlations between variables make it appropriate to proceed to the future research. However, it has to be of concern that a causal relationship cannot be inferred in this study.

References

- Barbara H. W., & Peter, A. T. (2005). A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research*, 16(1), 85-102.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Hong, J., Huang, M., Lu, C., Cheng, C., Lee, Y., & Lin, C. (2009). Interactive learning environments: Playfulness-based design in educational games: a perspective on an evolutionary contest game. London: Routledge.
- Liu, S., Liao, H., & Pratt, J. A. (2009). Impact of media richness and flow on e-learning technology acceptance. *Computer and Education*, 52, 599-607.
- Lucas, H. C. (1978). Empirical Evidence for a Descriptive Model of Implementation. *MIS Quarterly*, 2, 27-41.
- Melone, N. P. (1990). A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research. *Management Science*, 36 (1), 76-91
- Schwandt, T. A. (1994). Constructivist, interpretivist approaches to human inquiry. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*. London: Sage.
- Van Manen, M. (1990). *Research in lived experience: Human science for an action sensitive pedagogy*. Albany, NY: State University of New York Press.

Reducing Speeded Process Errors in Practicing English Pronoun with Embodied Interactive Video Game

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Abstract: *This study investigated whether Chinese students who learn English as second language would improve on their usage and fluency of pronoun by using interactive pronoun video games. It is mainly focus on the three part of speech of pronoun: subject (he, she, they, it, we), object (him, her, it, them, us) and possessive pronoun (his, her, its, their, our). Participants were randomly placed in one of the two groups (picture group and auditory group) for this experiment. Both part of the experiment were given on a timed based to hope to observe the reducing of error during speeded process. The result showed that both picture and auditory group benefit from the interactive pronoun video game on their English pronoun skill.*

Keywords: interactive video game, English pronoun, Game-based Learning

1. Introduction

Learning a foreign language is always a difficult task comparing with learning one's native language. Native Language learning is acquired through everyday immersion since birth while learning a second language often requires more formal instructions. It is difficult for a native speaker to distinguish what part of their thinking is language and what part is thought because they already internalize their native language. However, it is unlikely for a person learning a second language to think and internalize in the second language until they are completely fluent with that particular language. To communicate using a second language, often people have to translate their thoughts before verbalizing it. The translation and hesitation is what sometimes cause the delay in response.

Language transfer is a common phenomenon in the language learning. Language transfer is the effect of one language on the learning of another. (Longman Dictionary of Language Teaching & Applied Linguistics, 1992). In the process of the foreign language learning, learners will unconsciously bring the pronunciation, lexical, grammatical structures, and thoughts of the native tongue into the target language. However, for Chinese learners learning English pronouns, negative language transfer would often occur due to the fact that Chinese is a language without masculine and feminine. When using a second language, it is more likely to apply the same rules for the native language unless the second language has become second nature. It is for this reason different pronoun (subject, object, and possessive pronouns) are used in this study.

In Taiwan, due to the high school and college entrance examinations, the approach to teaching English as a second language stresses skill orientation and rote memorization. Yao (1999) states that the listening and speaking instruction is absent in Taiwan's high school education, which leads to limited abilities of students' auditory and verbal skills. The situation lasts to colleges and universities, and students are misled to believe that more English vocabulary and grammar they can recognize, the better their English proficiency will be. In this study, one of the purposes is to exam through what structure the participants will improve their pronoun usage ability better.

2. Theoretical Framework

The brain provides two types of memory system: declarative and procedural memory. Declarative memory is responsible for conscious recall of facts and events while procedural memory involves the learning of a variety of motor

skills and cognitive skills (Macedonia 2005). If a person wants to speak in real time, it is impossible to apply all rules on a conscious level. Thus, it is necessary to transform declarative knowledge into procedural memory in order to speak the particular language in real time. “Automatisation may be seen as the process of converting declarative knowledge into procedural, and bringing with it all the advantages of the procedural and eliminating all the disadvantages of the declarative” (Johnson 1996).

Information can be learn and turned into long-term memory through repeating practice. Through repetition priming an individual will learn to response to a certain stimulus when presented (Homer & Henson 2009). The respond time decreases as the stimulus-response (S-R) learning take effect. The attempt to strengthen the S-R association through repetition priming and speeded process anticipate the result of faster and more accurate response on English pronoun. During the game, in order to allow participants to make the connection between the stimuli (sentence) to the correct response (pronoun), the problem will not change to the next until the correct response was chosen.

3. Research Questions

One presents visual sentences as questions, and another presents auditory sentences instead. The prediction is that the students playing the visual structure of the game will show more improvement after playing the game. Therefore, the research questions are: (1) Will the students improve more by playing the one that present the sentence visually or will they learn better through listening, which is a weaker part when strengthen might contribute to the improvement of English learning as a whole. (2) Students will strengthen and improve the usage of English pronoun through repetitive play and reduce speeded process error.

4. Research Method

4.1. Participants

A sample of 48 adults who speak Chinese as their first language were tested on their English pronoun by using internet web-based game system and sets of oral performed tests. The participants included 17 male and 31 female. The participants ranged in age from 18 to 34. They had a wide range of English experience all with the basic knowledge of English pronouns.

4.2. Game Design

Through the webcam placed on the screen, the player waves or moves in front of the camera, and the interaction between human and computer software hence has been formed when the webcam captures the movement of the player. There are many modules on the platform, and this study adopts the module while the respondents have to choose one correct answer out of 4 answer cards. One is so called “Picture group”. The other is “Auditory group”, participants have to wave at the correct answer that appears in the middle of the screen after hearing the question. They have got to choose the correct pronoun representing the picture they see or the pronoun they heard. The answer cards bear different kinds of pronouns, so that the examiners can see if the participants truly understand the usage of the terms.

4.3. Oral Test Design

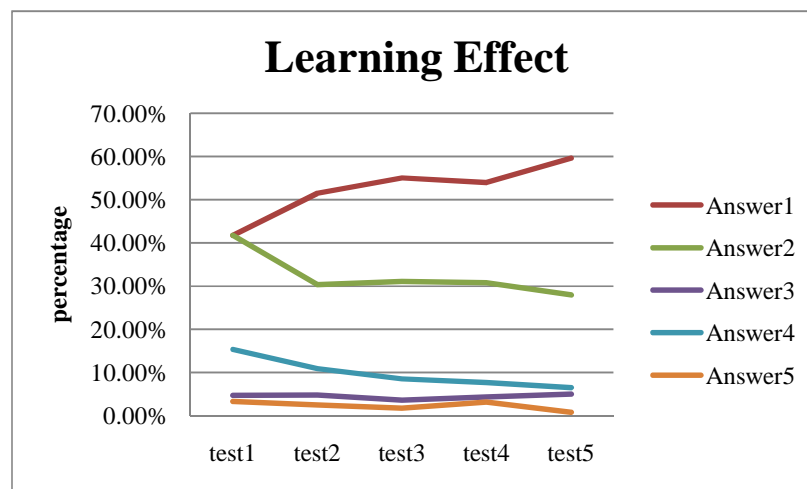
Oral test includes a total of 60 problems allowing 11 seconds for each problem. Participants need to provide their answer before the screen turned grey, or else their answer would be invalid. The recorder would then press the corresponding answer number on the keyboard before the next problem appears. The answer numbers are labelled as following: 1 = correct response, 2 = delay response, 3 = correction in response, 4 = wrong response, 5 = no response. Recorders need to listen to participants’ response, check the response with the answer sheet, determine whether the

response (correct, delay, correction, wrong, no answer) and press the corresponding number on the number key on the keyboard.

5. Result

Data were analyzed by a $5 \times 3 \times 2$ mixed ANOVA, with the within-subject factors test (test1, 2, 3, 4, and 5) and part of speech (subject, object, and possessive pronoun) and the between-subject factor group (picture group and auditory group). The dependent variables are the percentage of answer number 1, 2, 3, 4, and 5. Scheffe post hoc was performed for the analysis to compare scores of all participants on oral test of 1 through 5 against the five possible answer numbers (1 = correct, 2 = delay, 3 = correction, 4 = wrong, 5 = no response) and part of speech within pronouns.

Figure 1. Learning effect: comparing test 1~5 with answer number 1~5



As shown in Figure 1 above, three-way ANOVA shows that the main effect of the independent variable “test” is significant with the answer number 1 data, $F(4,184)=12.597$, $MSE=0.617$, $p<0.001$. As for answer number 1, correct response, there is significance when comparing test 1 ($M = 41.74\%$) vs. 2 ($M = 51.49\%$), 1 vs. 3 ($M = 55.07\%$), 1 vs. 4 ($M = 53.99\%$), 1 vs. 5 ($M = 59.65\%$) and 2 vs.5. It illustrate that there’s a significant increase in reply of answer number 1 on test 2~5 compare with test 1. There is also a significant increase of answer number 1 on test 5 compare with test 2. As for answer number 2, there is no significance when compared between the tests.

Likewise, in the answer number 4 data, three-way ANOVA shows that the main effect of independent variable test is significant, $F(4,184)=27.842$, $MSE=0.179$, $p<0.001$. As for answer number 4, wrong response, there is significance when comparing test 1 ($M = 15.35\%$) vs. 2 ($M = 10.90\%$), 1 vs. 3 ($M = 8.51\%$), 1 vs. 4 ($M = 7.67\%$), 1 vs. 5 ($M = 6.53\%$) and 2 vs.5. It illustrate that there’s a significant decrease in reply of answer number 4 on test 2~5 compare with test 1. There is also a significant decrease of answer number 4 on test 5 compare with test 2. In the answer number 5 data, three-way ANOVA shows that the main effect of independent variable test is significant, $F(4,184)=6.496$, $MSE=0.017$, $p<0.001$. As for answer number 5, no response, there is significance when comparing test 1 ($M = 3.33\%$) vs. 5 ($M = 0.83\%$). It illustrate that there’s a significant decrease in reply of answer number 5 on test 5 compare with test 1. (Fig. 1)

In Figure 2, the answer number 1 data analysed with the three-way ANOVA show that the main effect of independent variable pronoun is significant, $F(2,92)=327.223$, $MSE=8.978$, $p<0.001$. When making comparison on part of speech of pronouns with answer number 1, there is significance between subject ($M = 74.94\%$) vs. object ($M = 42.50\%$) and subject vs. possession pronoun ($M = 39.73\%$). Significance was not found between object and possessive pronoun on answer number 1. It shows that subjects are more likely to receive a correct response comparing with

objects and possession pronouns. However, there's no significant difference on correct response between objects and possessive pronoun.

In the answer number 2 data, three-way ANOVA shows that the main effect of independent variable pronoun is significant, $F(2,92)=100.058$, $MSE=2.801$, $p<0.001$. When making comparison on part of speech of pronouns with answer number 2, there is significance between subject ($M = 19.23\%$) vs. object ($M = 32.79\%$), subject vs. possession pronoun ($M = 41.02\%$) and object vs. possessive pronoun. It shows that subjects are less likely to receive a delay response comparing with objects and possession pronouns. Objects are less likely to receive a delay response comparing with possessive pronouns.

In the answer number 3 data, three-way ANOVA shows that the main effect of independent variable pronoun is significant, $F(2,92)=33.091$, $MSE=0.102$, $p<0.001$. When making comparison on part of speech of pronouns with answer number 3, there is significance between subject ($M = 2.08\%$) vs. object ($M = 5.65\%$) and subject vs. possession pronoun ($M = 5.73\%$). Significance was not found between object and possessive pronoun. It shows that subjects are less likely to receive a delay response comparing with objects and possession pronouns.

In the answer number 4 data, three-way ANOVA shows that the main effect of independent variable pronoun is significant, $F(2,92)=74.853$, $MSE=0.948$, $p<0.001$. When making comparison on part of speech of pronouns with answer number 4, there is significance between subject ($M = 3.31\%$) vs. object ($M = 15.85\%$), subject vs. possession pronoun ($M = 10.21\%$) and object vs. possessive pronoun. It shows that subjects are less likely to receive a wrong response comparing with objects and possession pronouns. Objects are less likely to receive a wrong response comparing with possessive pronouns.

In the answer number 5 data, three-way ANOVA shows that the main effect of independent variable pronoun is significant, $F(2,92)=21.905$, $MSE=0.065$, $p<0.001$. When making comparison on part of speech of pronouns with answer number 5, there is significance between subject ($M = 0.44\%$) vs. object ($M = 3.21\%$) and subject vs. possession pronoun ($M = 3.31\%$). It shows that subjects are less likely to receive a wrong response comparing with objects and possession pronouns. Objects are less likely to receive a wrong response comparing with possessive pronouns. There is no significant difference between the picture group and the auditory group. (Fig. 2)

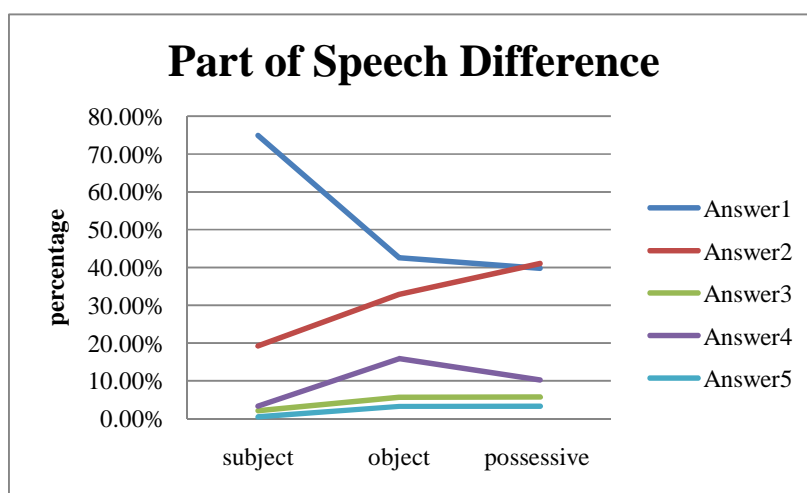


Figure 2. Part of speech difference: compare answer number 1~5 with each part of speech (subject, object, possessive pronoun)

6. Discussion

In term of cognitive growth, repetitive practice through the game system when tested using oral test is prove to decrease learner's error rate, delay reaction, correction rate and improve correct rate. Participants from both picture and auditory group have shown improvement on their English pronoun skill after participated in the experiment 4 times (game + oral test). Out of the three types of pronouns, participants response better to subject pronoun in comparison with object and possessive pronouns. However, the auditory group did not show significant in improvement over the picture group as expected in the hypothesis. Participants in the auditory group did not benefit more from playing the game in areas that they lack practice in. The amount of improvement for both groups is unable to calculate without the comparison of a control group. Thus, it would be most valuable to extend the study to include an extra control group to compare the result with existing data. Nevertheless, the repeated practicing using the interactive pronoun video game reduce speeded processing error, increase correct rate in term improves on oral language pronoun usage.

References

- Horner A., & Henson R. (2009). Bindings between stimuli and multiple response codes dominate long-lag repetition priming in speeded classification tasks. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35, 757-779.
- Johnson, K. (1996). Language teaching and skill learning. Oxford: Oxford University Press.
- Macedonia, M. (2005) Games and foreign language teaching. *Support for Learning*, 20, 135-140
- Richards, J.C., Schmidt, R. (1992) Longman Dictionary of Language Teaching & Applied Linguistics (2nd ed.). Essex: Harlow
- Yao, Z. H. (1999). The study of the reading approach and EFL teaching strategies. *Humanities and Social Sciences Newsletter Quarterly*, 10, 14-31.

Science Argumentation in Blended Learning in the Wright Brothers Situated Cases

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Abstract: *Inquiry-based science classrooms place emphasis on the role of the student in negotiating understanding (Crawford, 2005; Polman, 2000). The question that guides the analysis presented herein is how students' experience with the learning of science can further their participation in the practice of science. To this end, we designed a game-like situation that is beneficial to learning; using their knowledge of science, students interact through argumentation during problem-solving. By focusing on the interactions between students, we designed a blended learning platform that proposes three major problems for K 5 and K 6 students to solve: aircraft cannot take off, aircraft are being blown away, and aircraft are crashing during landing. The results of this study indicate that students are more active science learners when they engage in argumentation about science.*

Keywords: The Wright Brother, aviation, Game-based Learning

1. Introduction

Dialogic argumentation has long been of broad interest to learning psychologists, particularly those who regard social collaboration as central to cognitive development (Moshman, 2005; Rhodes, & Gelman, 2008). According to Piagetian tradition, cognitive conflicts lead children to seek equilibrium. Such conflicts may result from pairing students with different opinions or expertise (Azmitia & Perlmutter, 1989; Ellis, Klahr, & Siegler, 1993). Learning is the result of certain social settings that force the elaboration and justification of various positions (Rogoff, 1998, p. 408). Consequently, grouping people with different opinions together to solve a problem furnishes them with opportunities for learning.

Clark and Sampson (2006) highlight argumentative discourse may offer students opportunities to engage the scientific idea development and to appreciate the discussing skills. With the technology enhance implementation, the scenarios blend face-to-face and Web-supported learning such that the strengths of both settings can be leveraged and exploited. In this way, blended-learning has contributed to providing increased room for self-directed, meaningful interaction in class and richer learning experiences (Derntl & Motschnig-Pitrik, 2005). Thus, a game-like situation is designed for students in this study, for the purpose of enabling students to learn scientific knowledge through argumentation and discussion during the problem-solving process.

2. Literature Review

Argumentation has its roots in ancient times, and is associated with Aristotle who is interested in the study of thinking. An argument may be good because it presents the most evidence and persuades the listener to solve a problem; all these outcomes may be considered as equally valid and arguments that achieve them equally well (Hagler & Brem, 2008).

2.1. Denotation of scientific argumentation

The publication of Toulmin's book "The uses of argumentation" (1958) is a pivotal work in the history of argumentation. Argumentation is described as "the art of inquiry through critical discussion" (van Eemeren et al., 1996, p.9). Driver et al. (2000) propose that group settings provide an ideal environment to allow students to practice the skills of argumentation (p. 292). From a pragmatic perspective, argumentation can only be judged based on some

specific goal and in consideration of the tools and resources available. As for peer interaction, prior knowledge cannot be considered in isolation, but as what Andriessen, Baker, and Suthers (2003) have called confronting cognitions.

2.2. Dialogic Learning and Thinking

From Piaget's (1985) viewpoint, egocentrism is pivotally defined as the tendency of children's logic and thought to perceive, understand and interpret the world in terms of the self. When directed thought develops, it will be significantly affected by one's experience and logic as social interactions take place. Further, language serves the purposes of explaining, reasoning, questioning, thinking and developing knowledge (Mercer, 2000; Wegerif, Mercer, & Dawes, 1999). Specifically, the concept of dialogic learning also evolved from the investigation and observation of how people learn, both outside and inside, and is deemed a potential instruction strategy, and it also spurs students to process information beyond the level of knowledge telling (Bereiter & Scardamalia, 1987).

2.3. Blended learning

Blended learning is defined as the "effective integration of various learning techniques, technologies, and delivery modalities to meet specific communication, knowledge sharing, and informational needs" (Finn & Bucci, 2004, p. 2). This can take place either as part of a learner-led discussion or one facilitated by an e-learning moderator able to support and direct learners (Anderson, 2004). Whitelock and Jelfs (2003) suggest that blended learning should integrate and combine traditional learning methods with e-learning approaches. For this reason, blended learning needs to make use of a variety of media as part of an e-learning environment whilst simultaneously exploiting additional educational avenues such as inquiry-based learning (Kubicek, 2005).

3. Research Questions

Frijters, Dam, and Rijlaarsdam (2008) suggested that dialogues can be classified into the following stages based on the contents of the conversation:

Stage I: Are the participants really discussing the same content?

Stage II: Analyzing five levels of argument skills:

- 1) Being able to share personal opinions with fellow students?
- 2) Being able to form one's own opinion in a dialogue, utilizing the input of fellow students?
- 3) Being able to contribute in a dialogue to the formation of opinions of fellow students (co-construction of opinions (standards and values)) and to contribute to clarification of fellow students' opinions (standards and values)?
- 4) Being able to validate/appraise one's own opinion from the perspective of justice and respect? and,
- 5) Being able to validate/appraise the opinions of others from the perspective of justice and respect?

Stage III: Being able to investigate and to discuss based on situations?

4. Research Design

4.1. The game of *The Wright Brother*

The digital situated game used in this study was "The Wrights," a computer software focus on aviation issues, which includes three learning situations. The first was to help a plane take off, the second was how to keep a plane steady in winds from all sides, and the last was to make a safe landing. Each situation comprised three or four categories of options, including aircraft material, airfoil width, wind direction, location of tires, etc.. In addition, the game allows players to share experiences in a web forum. Participants can create virtual dialogue to increase learning experiences.

Two classes of K5 to K6 students were the targets of this study. While playing, students immediately were able to receive feedback and responses from the website; if the attempt was not successful, players were allowed to search their initial choices and then challenge the same question again by trying out other solutions. This active engagement and empowerment is an example of constructive learning (Dettori, Giannetti, Paiva, & Vaz, 2006).

4.2. Data Collection

To analyze the learning outcomes through dialogues, data were collected by videotaping the planning of the course, its implementation, and the process of analysis as a whole. During the experiment, students were required to play the “Wrights” game twice. In the first attempt, they were instructed to play with no guidelines or instruction. After they finished the game for the first time, they were gathered to share their experiences. Teachers helped them organize questions and led them in group discussions. After 30 minutes of group activities, the students were asked to play the game again. Then, data resources included video and filed note through the entire process.

5. Research Findings

Amaral, Mendez, and Garrison (2002), and Amaral and Klentchy (2005) suggested that an explicit focus on science classroom discourse, in particular an academic language, is needed to prepare students to talk like scientists. The results are consisted to the study of Brickell, Ferry, and Harper (2002), scientific argumentation in the Wrights Brother game. Students created scientific dialogues while playing the game. According to the transcripts, the most frequent matter mentioned was the comparison of materials. Some students took the weight into consideration in order to achieve the individual mission. For example, students selected paper to make aircraft, and added stones to stabilize planes. Other arguments made by students included changing the direction of the wind and the use of tools such as chains to fix airplanes on the ground. One of the teams even searched on the Internet for the Bernoulli principle or supportive information to solve the problem. According to students’ discussion, issues related to physical models were solutions relevant to practical considerations, such as increasing the weight, changing different materials, and using tools.

Prior knowledge and current resources can also have a significant effect on the types of argument that people produce, intentionally or unintentionally (Brickell, Ferry, & Harper, 2002). In comparison with Piaget’s theory of child development, fifth or sixth graders should be able to perform abstract thinking, but students in this study did not demonstrate their capability in this aspect. The reason might be related to the aviation topic, which is not covered in elementary education curricula. Another fact discovered in this aspect is that students barely deepened their scientific conversations. Even though some students could conduct scientific dialogues, they did not further elaborate into argumentation. They use common sense to select an option, instead of arguing their application of scientific knowledge with others. The results are consisted to the studies of Brem and Rips (2000), and Dawson and Venville (2009), they indicated that people are capable of producing structurally sound arguments in adaptation of strategies considered structurally weak in the absence of knowledge, and judged arguments lacking in knowledge more favorably when the debaters had insufficient information to go on.

6. Conclusions

According to this study, students worked together during the technology-enhanced leaning time and seemed to learn scientific knowledge with fun and interest. In comparison with traditional in-class lectures, learning the Wrights situated cases provided another alternative for scientific learning. This study echoes the fact that the scientific argumentation for fifth or sixth graders is concrete. Although the level of students’ cognitive development may be ready for abstract thinking, they are stuck in practical thinking when encountering unfamiliar issues in science. This finding indirectly places an emphasis on the importance of the teacher’s role. Some students felt anxious about the difficulties and were marginalized when the difficulties remained. Hence, improved reliability and playfulness of situated cases are critical factors for students to succeed. With the correct subjective content and decent interface design, the students will immerse themselves in scientific knowledge exploration. Otherwise, students will not take it seriously as learning, so the purpose of the game design will not be served.

References

- Amaral, O. M., & Klentchy, M. (2005, March). Effective classroom practices: English learner development strategies in science. Paper presented at the National Science Education Leadership Association (NSELA) Professional Development Institutes, Dallas, TX.
- Amaral, O. M., Mendez, G., & Garrison, L. (2002). Academic language development: A key element of science instruction. *The CSP Connection*, 2(3), 1–4.
- Anderson, T. (2004). Toward a theory of online learning. In: T. Anderson and F. Elloumi, (Eds.), *Theory and practice of online learning* (pp. 3–31.), Athabasca University, Athabasca, AB.
http://cde.athabascau.ca/online_book/pdf/TPOL_book.pdf (accessed 08.11.09).
- Azmitia, M., & Perlmutter, M. (1989). Social influences on children's cognition: state of the art and future directions. In H. Reese (Ed.), *Advances in child development and behavior*, (vol. 22, pp.89-144). Orlando, FL: Academic Press.
- Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Erlbaum.
- Brem, S. K., & Rips, L. J. (2000). Explanation and evidence in informal argument. *Cognitive Science*, 24(4), 573–604.
- Brickell, G., Ferry, B., & Harper, B. (2002). Developing informal reasoning skills in ill-structured environment: A case study into problem-solving strategies. Retrieved from
<http://www.ascilite.org.au/conferences/auckland02/proceedings/papers/094.pdf>
- Clark, D., & Sampson, V. (2006). Personally-seeded discussions to scaffold online argumentation. *International Journal of Science Education*, 29(3), 253-277.
- Crawford, T. (2005). What counts as knowing: Constructing a communicative repertoire for student demonstration of knowledge in science. *Journal of Research in Science Teaching*, 42 (2), 139–165.
- Dawson, V., & Venville, G. J. (2009). 'High-school Students' Informal Reasoning and Argumentation about Biotechnology: An indicator of scientific literacy?', *International Journal of Science Education*, 31(11), 1421 — 1445.
- Derntl, M., & Motschnig-Pitrik, R. (2005). The role of structure, patterns, and people in blended learning. *Internet and Higher Education* 8(2), 111–130.
- Dettori, G., Giannetti, T., Paiva, A., & Vaz, A. (2006). Technology-mediated narrative environments for learning. Rotterdam/Taipei: Sense.
- Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312.
- Ellis, S., Klahr, D., & Siegler, R. (1993). The birth, life, and sometimes death of good ideas in collaborative problem-solving. Paper presented at the meeting of the American Educational Research Association. New Orleans.
- Finn, A., & Bucci, M. (2004). A case study approach to blended learning.
http://www.conferzone.com/resource/wp/CaseStudy_BlendedLearning.pdf (accessed 08.11.09).
- Frijters, S. F., Dam, G. T., & Rijlaarsdam, G. (2008). Effects of dialogic learning on value-loaded critical thinking. *Learning and Instruction*, 18, 66-82.
- Hagler, D. A., & Brem, S. K. (2008). Reaching agreement: The structure & pragmatics of critical care nurses' informal argument. *Contemporary Educational Psychology*, 33, 403–424.
- Kubicek, J.P. (2005). Inquiry-based learning, the nature of science, and computer technology: New possibilities in science education. *Canadian Journal of Learning and Technology*, 31(1), 51-58.
- Mercer, N. (2000). *Words and minds: How we use language to think together*. London: Routledge.
- Moshman, D. (2005). *Adolescent psychological development: Rationality, morality, and identity* (2nd ed.). Mahwah, NJ: Erlbaum.
- Piaget, J. (1985). *The equilibration of cognitive structures*. Chicago: University of Chicago Press.

- Polman, J. (2000). *Designing project-based science: Connecting learners through guided inquiry*. New York: Teachers College.
- Rhodes. M., & Gelman, S. A. (2008). Categories influence predictions about individual consistency. *Child Development*, 79(5), 1270-1287.
- Rogoff, B. (1998). Cognition as a collaborative process. In W. Damon (Ed.), *Handbook of child psychology*, (vol.2, pp. 679-744). London:Wiley.
- Twigg, C.A., 2003. New models for online learning improving learning and reducing costs, EDUCAUSE review, September/October 23–36. <<http://www.educause.edu/ir/library/pdf/erm0352.pdf>> (accessed 08.11.09).
- Van Eemeren, F. H., Grootendorst, R., Jackson, S., & Jacobs, S. (1996). Argumentation. In T. A. van Dijk (ed.), *Discourse studies: A multidisciplinary introduction*. London: Sage.
- Vygotsky, L.S. (1986). *Thought and Language* (8th printing). Cambridge, MA: The MIT Press.

Visuospatial Sketchpad is More Effective in Learning Chinese Intonation through EIVG

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Abstract: *The current study was conducted to test the premise that embodied interactive video game intervention can assist foreign students with the difficulty in distinguishing Chinese intonation with remediating exercises. We divide subjects into three groups, the reading, listening and control group, and ask them to do a pre- and post- test, along with playing embodied interactive video games. We find that every group has made progress in their knowledge of Chinese intonation, and among them the reading group outperforms the other two. The results are discussed with the learning efficacy in dual channel and other variables that may influence subjects' performance.*

Keywords: Phonological Loop, Visuospatial Sketchpad, Embodied Interactive Video Game, Tolerance Level of Pronunciation Errors, Chinese Intonation

1. Introduction

Tone recognition is helpful for developing automatic prosodic labeling system for Chinese speech. It offers a method to discriminate homophone words. Second, automatic detection of intonation structure such as prosodic phrase boundaries, focus, stress locations, etc. is attracting more and more attention recently (Hirose & Iwano, 1999). Therefore study on tone recognition is the first and unavoidable step in incorporating intonation information processing into Chinese spoken dialogue systems (Zang & Hirose, 2004). Tone recognition is crucial to set up game-based language learning systems for foreigners to learn Chinese. Pronouncing lexical tones is rather difficult for people of non-tonal languages (Zang & Hirose, 2004), where pitch tones usually express different stress or intonation patterns instead of differentiation of lexical meanings. Tone recognizer may offer a diagnosis of the learner's pronunciation, and show the learner the way to correct his (her) pitch features.

In order to help people with tonal problems, we develop embodied interactive video games to help us complete the task. However, tone may vary with the context in Chinese, we believe that it'll be better we give them phrases to practice, instead of single words. All subjects are required to complete the experiment by doing a pre- and post- test, along with eight games. After analyzing the data, we find that all subjects are improved with their Chinese intonation, even the control group, and among them, the reading group outperforms the other two.

2. Methodology

2.1. Participants

The sample population of this study is foreign students who learn Chinese in the National Taiwan Normal University. All of them have basic Chinese communication skills, especially in listening and reading. 41 people participate at beginning, but in the end only 29 complete the experiment. Based on Baddeley's (2003) working memory theory, we assign our subjects into three group, reading (visuo-spatial sketchpad), listening (phonological loop) and the control by the sequence they come. No matter which group they are in, they are required to complete a pre- and post-test, and games.

2.2. The Experimental System

The pre- and post-tests are taken in the form of multiple choice; subjects have to choose the correct answer out of four, and write them down in the given column. The source of our questions is drawn from the beginner's part in the 8000 phrase chart designed by the Steering Committee for the Test of Proficiency-Hanyu.

As for the games, instead of re-purposing from the generic games, we've developed a whole new platform that provides self-editing function (Burgos, Tattersall, & Koper, 2007). This platform is open resource, which means that everyone can approach it and edit lessons there. In Canada, scientists have done a research on how self-editing platform helps students to learn, and find it can help students to write more logical sentences (Owston et al., 2009). We edit our games on that platform and assign subjects of different groups 48 games, but the time in total is the same. Both the reading and the listening groups will play three rounds of all the tonal combination of the two-word phrases, while the control practices all English pronouns.

2.3. Instrument Development

The pre- and post- tests each consist of 100 questions, 50 listening and 50 reading questions. All subjects are required to do the same pre- and post-test before and after the game.

Our embodied interactive video games employ webcam to do the job, which is quite different from other mouse-based educational games. When the reading group login, they'll see the given phrase and they have to wave the correct answer card out of four through the webcam. If they the answer is right, they'll get 10 points, if wrong, 5 points will be taken. The listening group and the control group will play the same embodied interactive video games, but the content of the game is different.

2.4. Research Procedures

The listening, reading and control group have to follow the instructions we give them, to operate in their computers at home, and play the assigned 6 games each day.

3. Result

This study attempts to find out which channel is more helpful to foreign students, when they bend on learning Chinese intonation. The duration of data collection lasts for two weeks.

3.1. Pre- and Post-Test

By analyzing statistically, we learn that regardless of which group they are, they perform better in the post-test. In the first test, the average total score is 78.80 (SD=19.773), and the correct answer rate is 78.8%. The average score of reading test is 37.62 (SD= 10.902), and the average score of listening test is 41.18 (SD= 10.270). Their correct answer rate is 75.24% and 82.36%. In the second test, the average total score is 87.00 (SD=12.127), and the correct answer rate is 87.0%. The average score of reading test is 42.34 (SD= 5.972), and the average score of listening test is 44.66 (SD= 7.001). Their correct answer rate is 84.68% and 89.32%. (Table doesn't show.)

Because our sample's number is too small, we applied nonparametric statistics the Wilcoxon Sign-Rank Test to the pre- and post-test. It is significant in the pre- and the post-test. The results are showed in Table 1. An average improved score of word section is 2.48 (SD= 3.269, $Z=-3.602$, $p<0.001$). The other average improved score for voice section is 1.41 (SD= 3.035, $Z=-2.241$, $p<0.025$).

We use another nonparametric tool, the Kruskal Wallis Test. Table 2 shows that the reading, listening and control group doesn't have reached statistical significance. On the reading test, the p value is 0.394. It is 0.460 on the voice test.

Table 1. Correlation between the pre- and post- test

	Mean \pm St. Dev.	Z	p value
Posttest-R – Pretest-R	2.48 \pm 3.269	-3.602	<0.001

Posttest-L - Pretest-L	1.41 ± 3.053	-2.241	0.025
Posttest-T - Pretest-T	3.9 ± 3.509	-4.172	<0.001

Table 2. Three groups' performance in reading and listening tests

		N=29	n	p value
Reading	reading	improved	12	0.394
		Not improved	3	
	listening	improved	6	
		Not improved	5	
	control	improved	2	
		Not improved	1	
Listening	reading	improved	9	0.460
		Not improved	6	
	listening	improved	8	
		Not improved	3	
	control	improved	1	
		Not improved	2	

3.2. The Embodied Interactive Video Game

After practicing the embodied interactive video games for eight days, we observe that all subjects make progress after they are getting more familiar with the platform. We get a very good curve on this analysis of the variable on Table 3. Compared with the first and the second game, we find their score is rising, which is 14.33 (SD=35.423, Z=2.004, p=0.045) and it has reached significant in the Wilcoxon Sing-Rank Test. The average score in the third game and the first game is 27.67 (SD=52.441, Z=2.072, p=0.038), while the average score in the sixth game and the first game is 36.93 (SD=47.738, Z=2.095, p=0.036), while the average score in the eighth game and the first game is 49.30 (SD=40.730, Z=0.911, p=.362).

Game1-8 contain all of the combinations of four tones in two-word phrases. Game 1, 3, 5, 7 include the combination of the first and second tones with the other five tones, the neutral tone is included, for example “mother” in Chinese is “mā ma” (the first tone with a neutral tone), while the game 2,4,6,8 include the combination of the third and the fourth tones with the other five tones, such as receiving education in Chinese is “shàng kè”(the fourth tone with a fourth tone). But here we need to explain why we don't include the phrase begins with the neutral tone, because it's rarely seen. This table shows that after playing the embodied interactive video games day by day, subjects' scores have gradually climbing in the combination of five tones.

Table 3. Correlation of eight days' practices in our platform

	Mean ± St. Dev.	Z	p value
game2 - game1	14.33 ± 35.423	2.004	.045
game3 - game1	27.67 ± 52.441	2.072	.038
game4 - game1	24.80 ± 57.240	1.184	.236
game5 - game1	27.12 ± 39.973	1.127	.260
game6 - game1	36.93 ± 47.738	2.095	.036
game7 - game1	41.53 ± 77.098	.023	.982
game8 - game1	49.30 ± 40.730	.911	.362

3.3. Analysis of other relevant variables

In the study, we also analyzed some variables that may have the relationship with game scores or test scores, for example, their gender, nationality, language, the duration of their learning Chinese, and if they have language exchange partners. We use the Linear Regression and Spearman Rank-Order Correlation to analyze our data, but we don't observe any trace of the moderate or high relationship with their scores in games and tests.

4. Discussion

Before the experiment, we assume that people who are assigned to different groups will perform better in that part of the test, for example people in the listening group will outperform the reading group in listening test. However, the result shows that every group has made improvement in both reading and listening test, even the control one.

All subjects' cores in the reading test are going from 37.62 (SD= 10.902) to 42.34 (SD= 5.972). On the other hand, the averaged scores in listening test also climb from 41.18 (SD= 10.270) to 44.66 (SD= 7.001). But due to lack of sampling, we don't think that the result of the control group can be taken into account.

Besides, the reading outperforms the other two. As to what leads to this result, we offer two explanations. First, when people learn Chinese intonation, their eyes and ears are involved at the same time, even though we intentionally demand them to use one sensation only when playing games. Second, the result may be caused by limited sampling.

5. Conclusion

According to our research, we find that our embodied interactive video games are helpful to those who want to learn Chinese intonation, because they all make progress in the post-test. Moreover, we find people who learn through the visuospatial sketchpad channel outperform those learn through the phonological loop in our study.

References

- Baddeley, A. (2003). Working memory and language: An overview. *Journal of Communication Disorders*, 36, 189–208.
- Burgos, D., Tattersall, C., & Koper, R. (2007). Re-purposing existing generic games and simulations for e-learning. *Computers in Human Behavior* 23, 2656-2667.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q*, 13(3), 319–339.
- Hirose, K., & Iwano, K. (1999). Detecting prosodic word boundaries using statistical models of moraic transition and its use for continuous speech recognition. In: ICASSP99
- Huata, D. A. (2002). *Reading Race: How every child can learn to read*. New Zealand, [Huia Publishers](#).
- Owston, R., Wideman, H., Ronda, N. S., & Brown C. (2009). Computer game development as a literacy activity. *Computers & Education*, 53, 977–989.
- Sanchez-Franco, M. J. (2010). WebCT – The quasimoderating effect of perceived affective quality on an extending Technology Acceptance Model. *Computers & Education*, 54 (1), 37-46,
- Zhang, J., & Hirose, K. (2004). Tone nucleus modeling for Chinese lexical tone recognition. *Speech Communication*, 42 (3), 447-466.
- 葉軍，2002。〈容錯度與口語語音測試〉。毛世楨主編，《對外漢語語音教學測試研究》。北京：中國社會科學出版。

科學發明故事之互動式多路徑情節設計研究

A study on interactive multi-path scenarios design for scientific invention storytelling

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【摘要】數位科技的高度發展，讓民眾對於科技成果與新知已有多種管道可以吸收與理解。科技發明者不斷突破困境與反覆嘗試，其研發成果應用於民眾生活，除享受科技所帶來的便利，亦可認識發明過程以提昇民眾對科技內容的理解與素養。以互動遊戲型式進行學習，許多研究者指出能強化學習者的動機與興趣，亦能輔助學習成效。本研究旨在探討以多路徑情節設計，將科學知識形成、科學探索方式、科技發明過程以多媒體內容提供學習者豐富與生動的認識，以引發學習者對科學發明故事之探索動機與學習興趣。

【關鍵詞】多路徑情節、科學發明故事、互動遊戲

Abstract: The high developments of digital technology, leads to the public already have varieties of channels that can absorb and understand to inventions and new knowledge. The technology inventor is breaking through the predicaments with trying repeatedly, and the achievement to apply to public life. We not only enjoy the facility that technology brings, but also can understand development of technological inventions in order to promote the public understanding of technological content and literacy. Many researchers point out those studies of interactive model with game-based learning, which can strengthen learner's motivation and enjoyment, as well as assist in the result of learning. This study will develop interactive game-based multi-path scenario design of scientific invention storytelling for understanding scientific knowledge formations, scientific exploring methods, the developments of technological inventions, and implement that to offer abundant and fascinate comprehensions to learners. Research hopes to provide multimedia content rich understanding of learners to stimulate learners to exploration motives for the scientific invention storytelling.

Keywords: multi-path scenario, scientific invention storytelling, interactive game

1. 前言

科技發明對國家社會之持續進步自然有正面的依附關係，人類文明的「新知識(New Idea)」發展背景與促成，可從當時社會、經濟與文化發展的演變，進而理解創新概念的初始靈感、深度探索與研究發現之過程。民眾對創新概念的關注建立在對生活的改變、與對未來的期望，而創新概念之研發過程：「投入多少心力」、「遭遇困境」、「嘗試錯誤」、「不斷學習與啟發」等，往往可以引導民眾理解研發過程之背景、刺激民眾多元的思考方向。「故事」可以啟發人對事物的理解與想像，幾乎每個人都愛聽故事，故事的互動特性不僅在視覺方面進行，在心理知覺方面亦多有沈浸與著迷的情境，置身於故事情節中，除了帶來樂趣也與故事中訴說、詮釋的景物有著不同程度的糾葛關係。

數位故事(Digital Storytelling)的發展，在許多製作電影、動畫技術日益成熟下，故事情節引導觀者無窮盡想像，同時賦予強化故事情境的視覺影音效果。Freidus & Hlubinka (2002)提及 7 種訴說引人入勝的數位故事方式：(1) 訴說觀點(Point of View)、(2) 引起注目的問題(Dramatic Question)、(3) 情緒性內容(Emotional Content)、(4) 訴說口語與旁白(Voice)、(5) 聲

音與音效(Soundtrack)、(6) 直覺性簡潔用詞(Economy)、(7) 節奏與步調(Pacing)。生動地表現一個數位故事在訴說與敘事技巧固然重要，而動聽的故事情節也是左右觀者沈浸於想像空間的重要因素。

坊間許多關於科技發明的故事書籍多半以線性結構(Linear)訴說科學的發明過程。書本上以生動、擬真的插圖，描繪發明/發現者的深度探索歷程，且以文字描述進而引導學童理解創新概念的發展脈絡，與啟發學童對創新概念的延伸想像。以「多路徑(Multi-path)型式」發展數位故事，呈現型式更為多元的影像與動畫故事，學童在觀看兼具視覺、聲光效果的動畫時，在預先設計的腳本下，對科技發明的整體過程能有基本理解，在多路徑腳本發展下，其探索科學概念能引發豐富的學習樂趣(Betz, 1996)。

本研究旨在探討以多路徑情節設計，將科學知識形成、科學探索方式、科技發明過程以多媒體內容提供學習者豐富與生動的認識，以引發學習者對科學發明故事之探索動機與學習興趣。研究目的可說明如下：

- (1) 將科學知識形成、科學探索方式與科技發明過程以多媒體型式製成數位故事。
- (2) 發展多路徑數位故事以引發學習者的探索與喜好。
- (3) 以互動遊戲式之多路徑數位故事設計，將科技研究內容傳達給學習者，增進對科技發明故事的認知。

2. 多路徑情節之設計模式與概念分析

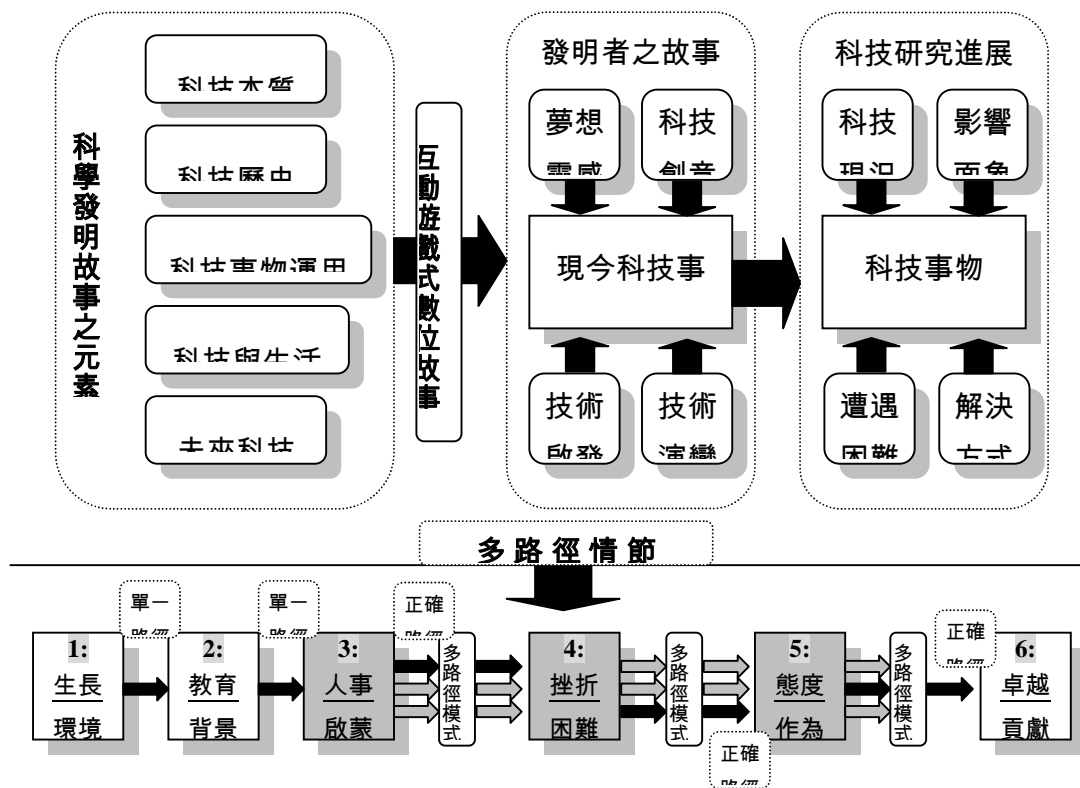


圖1 科學發明故事之多路徑情節設計思考面向

本研究針對重要的科技事物發明先行以蒐集與整理科技發明背景資料、發明者生平與當時社會文化的發展狀況，作為撰寫數位故事的腳本主軸，並尋找故事發展的可能分歧點，以多路徑型式規劃故事分支，分支腳本可能是科學知識的形成過程、科學事物發明的啟發靈感、科學探究的方式、以及探究過程中的其他可能性。分支腳本最終將引導至過去/現在的科學

發展，對現在/未來民眾的生活改變，對國家與社會的文化經濟影響，以及可能的衍生應用與成效，最後以互動遊戲的探索方法為故事呈現方式。

以愛迪生(Thomas Alva Edison)發明電燈為示範說明多路徑情節設計概念：不屈不撓的精神做了 1600 多次耐熱材料和 600 多種植物纖維的實驗，才製造出第一個炭絲燈泡，可以一次燃燒 45 個鐘頭。後來更在這發明基礎上不斷改良製造方法，為了推廣電燈的使用，研究出並聯電路、保險絲、絕緣物質、銅線網路等電器系統的各種附加設備；又製造了電壓穩定的發電機和經濟配電的三線掣，這些偉大的貢獻，已大大改善了人類的生活。

多路徑情節設計中，以動畫呈現愛迪生生長背景，另以互動遊戲闡述電燈研發過程，象徵愛迪生嘗試各種不同材質進行試驗，以強化學童對電燈內部構造、電流運作致使產生光能的科技發明有更深的認識。在此架構下，先行蒐集科技事物運作的歷史背景，包含相關發明者的啟發與貢獻：如科技夢想、靈感與創意源頭、探索研究與試驗、發明具體雛型與應用演變。再者，瞭解科技事物現況與未來趨勢，如瞭解飛行器的最新科技中，改變了什麼與創造了什麼？對未來可以期待些什麼？因此，科學發明故事之多路徑情節設計之思考面向如圖1所示，其科學發明故事之元素包含科技本質、科技歷史、科技事物運用、科技與生活、以及未來科技的趨勢，而發明者之故事著重在科技靈感之起源、科技創意運作以及生活之運用，科技研究進展則以所遭遇困難、解決方式、影響面向為主軸，作為科學發明故事的多路徑結構。

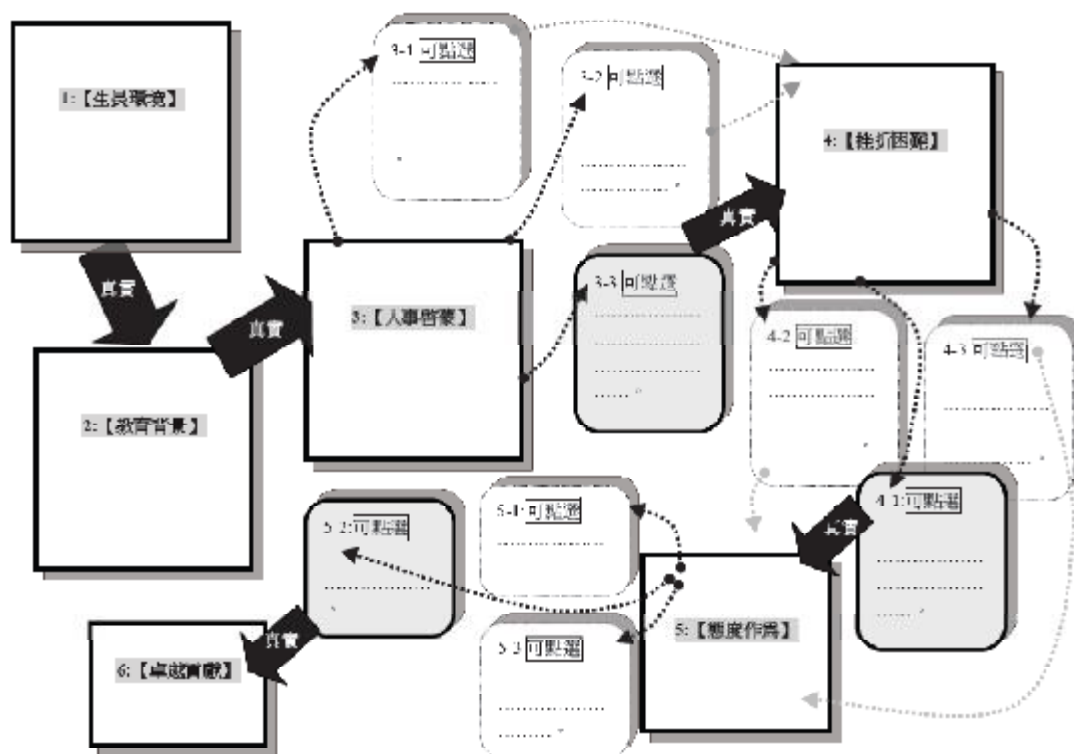


圖2 多路徑故事之探索與互動概念

多路徑情節以科學發明者為敘述主軸，分為(1) 生長環境：即描述科學家的生活與成長環境，以輔助瞭解科學家未來人格與意志養成的背景因素。(2) 教育背景：即描述科學家的求學與求知過程，以瞭解科學發明背後所具備知識的基礎能力。(3) 人事啟蒙：即描述科學家面臨科學發明前，何人何事的引導與影響而造就科學家的際遇與傳奇。(4) 挫折困難：科學發明過程並非十分順遂，所面臨的挫折與艱苦如何洗鍊科學家的堅定意志。(5) 態度作為：

面對挫敗時，當下如何形成態度觀念、行為意識以解決問題、構思決策。(6) 卓越貢獻：形成科學發明後，對社會、國家與世界的未來影響。其中生長環境、教育背景以真實故事作為單一路徑情節設計，讓學習者以概括性方式認識科學家產生發明前的背景環境，而人事啟蒙、挫折困難、態度作為則以真實故事為構思來源，進行其他可能的情節(路徑)的想像、以形成故事的分岔路徑，在故事發展前後合乎邏輯與饒富想像下，提供學習者探索多路徑科學發明故事之互動環境(如圖2)。最後的卓越貢獻，僅有唯一正確且真實的路徑發展，讓科學家完成科學發明，並瞭解對世界的未來影響。

科學事物的生活應用，其相關事物種類繁多，以人類一天生活應用的事物為例，可思考延伸至相關的科技發展，可分「食」：如基因科技食品（細胞、基因等科學）等、「衣」：應用化學（材料、物理等科學）等、「住」：電能發展（電子、資訊等科學）等、「行」：交通運輸（物理、通訊、機電等科學）、「育」：醫學（疾病、基因等）、「樂」：通訊、網路、科技媒體之發展等。細部來說，如以「電話」為科技事物運用之舉例，涵蓋的數位故事即便包含：貝爾發明電話之靈感、研發過程與歷史演變，至今的通訊科技（馬可尼發明無線電科技）、資訊科技、網路科技至未來的生活願景等。「汽車」之科技事物，則涵蓋瓦特發明蒸氣機之過程、電能與機械的發展、通訊科技發展與時尚工業的發展等。

3. 科學發明故事之多路徑情節設計

依據上述多路徑情節設計模式、互動探索之分析，本研究初步以七位科學發明家進行實作，多路徑成果、互動分析詳見展示網頁(<http://can.elt.nhcue.edu.tw/Can/S-I-Story/index.html>)，科學發明家的多路徑情節設計與探索方式則分別精簡探討如後。

3.1. 發現「遺傳定律」的孟德爾(*Gregor Mendel, 1822-1884*)之多路徑情節

多路徑結構採以網頁之超鏈結為互動探索，過程中以撲克牌之配對結果來決定是否繼續往下發展的依據。其人事啟蒙階段以孟德爾是否獲得修道院的推派與教授的賞識至維也納大學進修、挫折困難階段主以碗豆、其他生物等之遺傳驗證卻無法獲得學術界的重視、態度作為則以實驗失敗與遭受他人抨擊等為情節發展的分岔點，進行多路徑情節設計。採以超鏈結探索多路徑情節，需配以路徑地圖(Map of path)概念讓學習者瞭解目前情節發展階段。

3.2. 發現「電」的富蘭克林(*Benjamin Franklin, 1706-1790*)之多路徑情節

多路徑結構以拍攝電影為主要互動環境，學習者化身導演角色可決定影劇的拍攝過程。並以影片倒帶概念來返回路徑分岔點，人事啟蒙階段以父親的態度為主要分歧、繼承家業或開設印刷業成為對電概念的研究開端，挫折困難則以哥哥的妒忌與爭執、實驗失敗為發展路徑，態度作為則以是否堅持與奮戰不懈為情節發展的分歧點，以進行多路徑情節設計。

3.3. 發明「飛行船」的齊柏林(*Ferdinand Graf von Zeppelin, 1838-1917*)之多路徑情節

多路徑結構以觀看電視進行頻道選擇的動作來呈現，每一頻道對應單一路徑支節，頻道選擇即決定情節發展。人事啟蒙以南北戰爭後是否參與探險隊研發熱汽球為分歧點，挫折困難以飛船實驗失敗結果之事件為轉折，態度作為則以面對全國民眾的期待與鼓勵為主進行設計。頻道選擇即多路徑選擇，易於輔佐學習者返回上一層分歧路徑，重新思維新的發展。

3.4. 發明「望遠鏡」的伽利略(*Galileo Galilei, 1564-1642*)之多路徑情節

多路徑結構以望遠鏡觀察星象、星象排列為呈現概念，不同路徑會有相異的星象排列，每種情節路徑呈現出唯一星體排列，使特定排列易於引導學習者抉擇路徑發展。其人事啟蒙

階段以是否察覺荷蘭光學家的初步發現與開展先機，挫折困難則以教會保守派的質疑與撻伐為阻撓，而態度作為則以專注著作、創立科學教派為觀點進行多路徑情節設計。

3.5.發現「X光」的倫琴(Wilhelm Konrad Röntgen, 1845-1923)之多路徑情節

多路徑結構以迷宮形式為呈現概念，迷宮內不同轉折通道象徵相異的情節路徑；當路徑發展錯誤時，通道即封閉無法前進，且迷宮中唯一通道對應正確的情節發展，兼具明顯與適用的直覺。人事啟蒙以倫琴於蘇黎世理工學院畢業後的路途抉擇為開端，挫折困難則以缺少文憑而錯失應有的研究工作，而態度作為以堅持實驗工作的意志、秉持追根究底的精神來進行多路徑之情節設計。

3.7.發現「無線電」的馬可尼(Guglielmo Marconi, 1874-1937)之多路徑情節

多路徑結構以網格概念呈現，其中以 3X3 格子表現各支節，網格可強化多路徑的結構型式，尤其能觀察情節發展的縱向關聯與各分歧枝節的橫向差異。人事啟蒙以馬可尼小時候的家庭教師之教育影響而開始分歧，挫折困難以未能通過海軍學校的入學檢定資格為發展，態度作為最後以對義大利郵政局捐贈的態度，所導致的後續影響來構思多路徑之情節發展。

3.8.發明「電話」的貝爾(Alexander Graham Bell, 1847-1922)之多路徑情節

多路徑結構以線性連結、3D 場景來呈現各支節，並於轉折處提示可能的發展路徑。人事啟蒙以對德國作家赫姆霍茲所寫「音的感覺」著作的感受，挫折困難以與桑德士的爭執、研究資金來源為情節分歧，態度作為則以亨利的激勵重拾研究的熱情與堅持，作為路徑發展的構思。線性連結較無法輔助學習者探索多路徑的結構發展，需輔以類似超鏈結的路徑地圖進行情節抉擇，提供地圖讓學習者探索路徑同時也瞭解路徑脈絡。

4. 結語

本研究透過科學發明故事的多路徑情節設計，撰寫互動程式、製作動畫與介面設計，引導學習者探索故事中科技發展的過程與發明者的態度改變，以增進對發明者歷史背景、科技內容的理解與認識、循序提昇對科技的素養。探索過程時，當學習者發現在分歧路徑呈現著無法完成(或繼續)的故事結局時，介面應適時反應、回饋學習者返回上一個路徑分歧點的方法，引導重新決定未曾經歷的支節發展。而當探索過程保持在正確情節路徑時，發明家終能完成科學發明/發現使命，體認科技事物對國家、乃至於世界的貢獻與未來影響。

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參考文獻

- 保羅·伊斯瑞/著(2004)。《解剖發明家：愛迪生傳》。台北：希代出版社。
- Betz, J. (1996), Increase Learning in an Interactive Multidisciplinary Environment. *Journal of Educational Technology Systems*, Vol. 24, No. 2, pp. 195-205.
- Freidus, N. & Hlubinka, M. (2002), Digital storytelling for reflective practice in communities of learners. *ACM SIGGROUP Bulletin*, Vol. 23, No. 2, pp. 24-26.

Design and Implementation of Personal Museum-based on O3D

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Abstract: *This paper describes an integrated method of designing and implementing an indoor virtual environment interactively for cultural heritage exhibiton based on our immersion educational learning system by using O3D(Open web standard for 3D graphics). By using the 3D museum construction tool offered by our system, users can create their personal museums to exhibit their collections interactively with their own style and subject, such as according to decade. And users can also set their constructed personal museum open to others to view, learn information or do business inside, which can not only help users organize and store their collections expediently, but also dramatically inspire users' interests and self-determination while processing traditional culture heritage sources.*

Keywords: 3D virutal museum, interactive design, O3D

1. Introduction

In recent years, more and more digital museums are developed based on virtual reality, human-computer interaction and network as well as other computer technologies, to realize precious cultural resources sharing and protection. In order to resolve the problem that the digital resources of these museums are isolated, heterogeneous, geographically distributed and difficult to be shared effectively, the archaeological Digital Museum of Shandong University [1] has been constructed to allow users to retrieve the rich cultural resources including graphics, pictures, audio, video, text, 3D models and many other kinds of media information according to individual requirement. How to organize and present these rich resources logically and conveniently and to improve the usability of cultural heritage resources is a key issue that needs to be considered when building a digital museum.

One feature of the virtual museum is its use in E-learning [2]. Studies show that people, especially children, learn better when they are immersed in their learning environment. Therefore, immersion can enhance the museum's educational role. VRML (Virtual Reality Modeling Language) is widely used to create 3-dimensional environments [3]. Recently, with the popularity of 3D games, the research into educational computer games was initiated, which provides a more flexible method for users to learn information and communicate with each others [4].

We have created an O3D-based virtual environment for learning cultural heritage which is combined with a game environment to provide a friendly atmosphere that makes learning more pleasant, where users can collect relics in this virtual world (see Figure 1). In order to organize and present these rich resources collected by users efficiently, we proposed a method to design 3D virtual exhibition hall interactively, where users can create their personal museums by clicking the road sign inside the virtual learning environment (Figure 1). By using the tool offered by our system as shown in Figure 2, users can build their personal museums by themselves using their knowledge with different design style. Users are free to decide the layout of their museum and design by a special subject, such as the exhibition hall of jade articles. Our system is quite easy for the user to learn and only needs a short time to construct a virtual personal museum.

The remainder of this paper is organized as follows: Section 2 describes the design method of the system. Section 3 outlines the key techniques to implement the whole system. In the end, some concluding remarks and future work are given in Section 4.

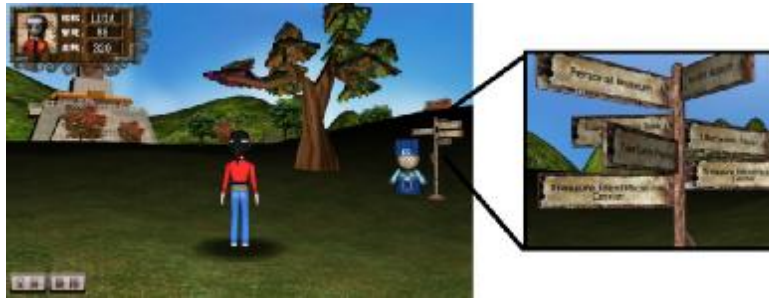


Figure 1. Virtual environment for cultural heritage learning



Figure 2. Interface of our personal museum designing system

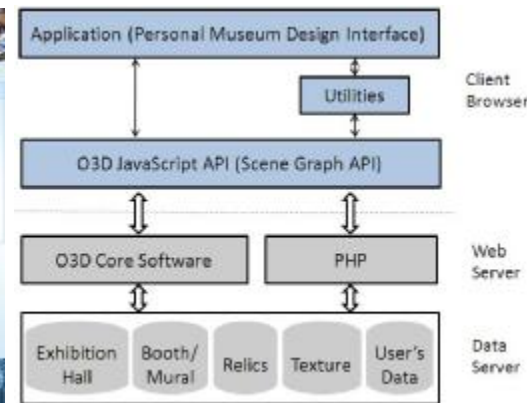


Figure 3. System architecture

2. System Design

In our system, we provide a virtual museum construction tool to help users construct their personal museum interactively. With the wide availability of online social and educational websites, there have been numerous attempts to add a third dimension to the Web over the years. A new project from Google, O3D, aims to create interactive 3D graphics applications that run in a web browser window or in a XUL desktop application [5]. We chose O3D to implement our system.

Figure 3 shows the architecture of our system, the client O3D is running as a browser plug-in in the client's computer, which also provides a rendering engine. At the web server side, we use database of mySQL to store information of the exhibition hall, cultural relics and users. Our system uses a tree structure to manage culture relics. First of all, relics are classified according to different subjects. According to the results of classification, different cultural relics are put in different databases. And PHP is used to complete database connection and updating. In the interface designing, the interface of trigger-style navigation menu is relative to the tree structure of the database. This means that all the resources of organization show hierarchical characteristics. Thus it can reduce the database access, increase the reliability of the system and improve the speed of access.

Below is the main flow of our museum design system, as illustrated in Figure 4. Details about the main steps will be presented in Section 3.

- 1) Firstly, players should build the outline and wall for the museum. Then they can mark off some rooms in the museum.

- 2) After that, users will put some exhibition booths in the appropriate positions.
- 3) Then players put collections on the exhibition booths. In this process, players can decide which exhibition booth they will be located on. Players can also adjust the collection's position, size, direction and so on.
- 4) In the end, players can publish and watch the effect of the personal museum in different view sights.

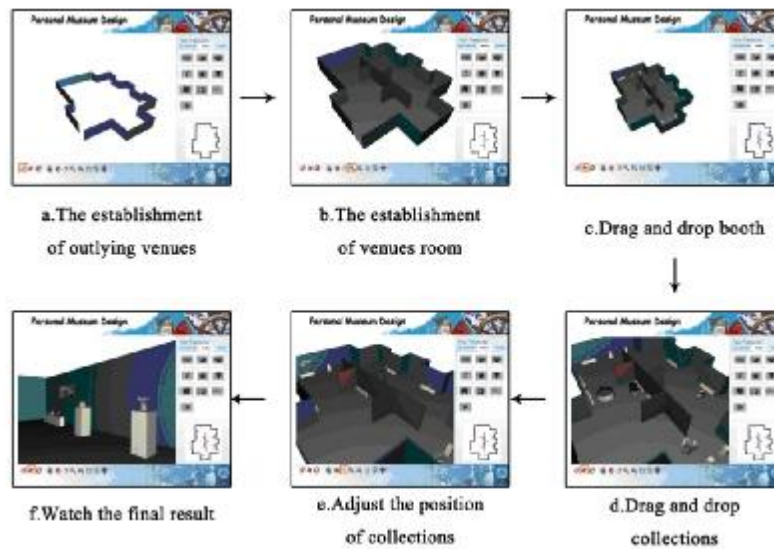


Figure 4. Flow chart of personal museum designing system

3. System implementation

3.1. Empty exhibition hall creation

The first step to build players' personal museums is to build the empty exhibition hall, including the wall construction and exhibition booths setting. One key step for users to create a personal museum is to design the outside part. It is realized by clicking the O3D window with your mouse to decide the starting point for a wall. The problem we need to solve is how to transform a one-dimensional line to a three-dimensional one. When using the mouse to click O3D screen window, a ray from the point is created on the plane of the camera (Figure 5). O3D provides a function to get the coordinates of the intersection of the ray and the three-dimensional ground plane. Clicking the window twice, we can determine a segment with a starting point. Then find the segments which have the same vertical distance to this line. These segments help to decide the coordinates of the other six points. Using other O3D functions can create and display the three-dimensional walls created. When setting exhibition booths, we use a parameter restriction method to make the positioning more convenient. Such as, if the user drags the booth near the wall, our system will locate the booth along the wall automatically.

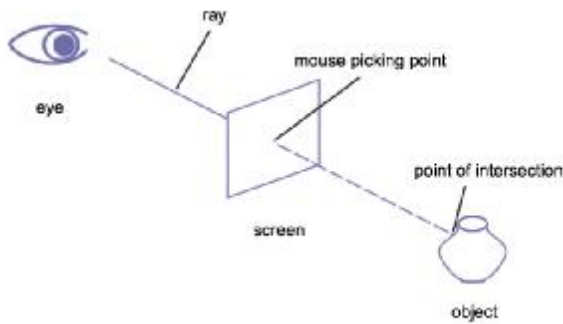


Figure 5. 3D object fetching

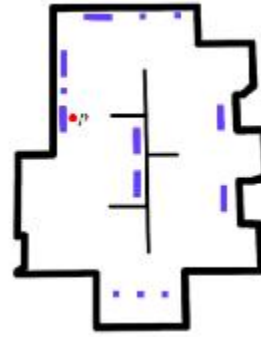


Figure 6. Collections' positioning

3.2. Positioning Collections

Users may appoint each collection's position in the 3D scene interactively by dragging it from the browsing tree to a point p in the scene's 2D map, as shown in Figure 6. If p is inside the outline of the 2D map, we should find the nearest platform inside the scene to point p and set the collection to the platform roughly. The platform information is stored in the edges' data structures of the 2D outlines. We should find the nearest edge to point p from the edges of the 2D outline first. After that, do distance testing between point p and platforms along this edge. We also supply tools for users to do small adjustments for a collection in the 3D scene adaptively in three views (top view, front view and side view).

3.3. Roaming and user test

After building the personal museum, users can have a global view of their personal museum. Users can control and modify the location of view through the mouse or keyboard, as shown in Figure 7. Pressing the up button and down button, viewpoint is moved toward up and down. Pressing the right button and left button, viewpoint is moved toward the right and left.

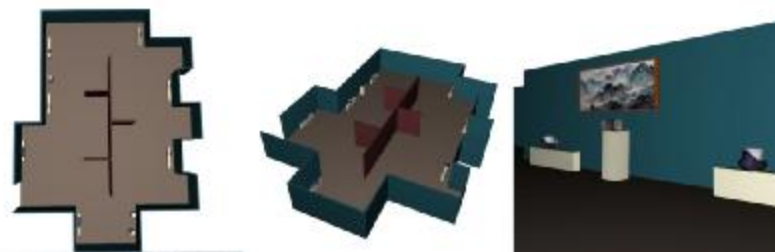


Figure 7. Different View sides: Top view, side view, zoom-in view

While doing view point setting, the O3D camera has a function named “*update*”. When viewpoint or target is changed, the location of camera is also changed. We enter the roaming mode by selecting a tool in the tool box. At the beginning of the roaming, the location of eye and target are setted up initially. And the updating of eye and target is implemented in the function of “*onRender*”.

After users set their personal museum open to others, many players can roam inside and can interact with the items on display, such as rotating the model, check the introduction of the model, or interact with other users. Figure 8 gives an example of roaming inside a published personal museum. We also do some simple tests for 32 users (Figure 9). More than 90% of them think the system is useful and attractive. More than 96% users prefer to choose this system as

learning environments than traditional text education. But about 15% users think the interface and interaction method should be improved.



Figure 8. Roaming inside a published personal museum



Figure 9. User test

4. Conclusion

In this project, we are building a tool for players to design their personal museums to exhibit their collections interactively with their own style and subject. And users can also set their constructed personal museum open to others to view, learn information or do business inside, which can not only help users organize and store their collections expediently, but also dramatically inspire users' interests and self-determination while processing traditional culture heritage sources. There are still some things that can be improved in the future. We need to build a more friendly interface and make the interaction more convenient. And the cultural heritage should be more abundant. In addition, a highly perceptive user evaluation should be done for primary and secondary school students.

5. Acknowledgement

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Reference

- [1] Hui Xiang, Xiangxu Meng and Chenglei Yang.(2003). Design and Implementation of Digital Archaeology Museum of Shandong University, Journal of System Simulation [J], 15(3): 319-321.
- [2] J. Ibanez, R. Aylett, R. Ruiz-Rodarte.(2003) Storytelling in virtual environments from a virtual guide perspective. Virtual Reality, Springer, London, 7 (1): 30-42.
- [3] Nentwig, L. LeMO.(1999) A virtual exhibition of 20th century German history, Computer Networks, 31(21): 2237-2244.
- [4] McFarlane A., Sparrowhawk A. Heald Y.(2002). Report on the educational use of games. TEEM: Cambridge.
- [5] <http://code.google.com/apis/o3d/>

A Comparison of Online Discussion Learning Behavioral Patterns in Collaborative Virtual Learning: Peer-Assessment Strategy and Problem-Solving Strategy

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Abstract: Exploring the online discussion behavioral patterns for teacher/learner community in collaborative virtual learning context with different interactive learning strategies via empirical observations may provides important further references for community managers or system developers. In this paper, we summarize a series of our findings of three studies and make a comparison of the online discussion behavioral patterns of two interactive strategies: peer-assessment and problem solving, then discuss the features and limitations in collaborative virtual learning context. The comparison and discussions may provide some important references for community management and system development in e-Learning environments.

Keywords: collaborative virtual learning, behavioral pattern, online discussion, online community, sequential analysis, content analysis

1. Introduction

In a collaborative virtual learning context, the knowledge of teachers and learners is often shared via online discussion forums. Moreover, the strategies for online discussion activities have influence on the quality of discussions in online communities (Patricia & Dabbagh, 2005; Hewitt, 2003). Designing appropriate online discussion activities for teacher/learner communities has been one key issue of online learning and professional development, and exploring the process of online discussions for teacher/learner community in collaborative virtual learning with different interactive instructional strategies via empirical observations may provides important references for community managers or system developers.

In this poster paper, we summarize a series of our findings of three studies (Hou et al., 2007, 2008, 2009), In Study I (Hou et al., 2007), an online peer-assessment instructional discussion activity in actual teaching settings was conducted in order for us to observe the depth and behavioral pattern in students' knowledge sharing process. In Study II (Hou et al., 2008), we design an online problem solving instructional discussion activity and implemented it in an actual

teaching situation to observe the depth and behavioral pattern of learners' discussions, and Study III (Hou et al., 2009) explored the behavioral sequential pattern and content of an online teacher community's knowledge sharing discussion activity that integrates the problem solving. These studies all applied quantitative content analysis, original protocol analysis and lag sequence analysis (Bakeman & Gottman, 1997), which can infer the behavioral sequence transition diagram that shows the sequences that are statistically significant to explore the depth of knowledge construction and the pattern of discussion behavior among members of the communities. Since the studies applied the same methods and explored two interactive strategies: peer-assessment and problem solving in both learner and teacher communities, we then can make a review/comparison and discuss the features and limitations in depth in this paper. The comparison and discussions may provide important references for online community management for collaborative virtual learning.

2. Coding Schemes

The three studies applied the same coding schemes to analyze the social knowledge construction pattern (we used the Gunawardena, Lowe, and Anderson's (1997) Interaction Analysis Model (as shown on Table1)), for exploring problem-solving patterns (e.g., Study II and Study III), we design a coding scheme for problem solving discussion in Study II (Hou et al., 2008) (as shown on Table2).

Table 1 Coding scheme for knowledge construction (Gunawardena et al., 1997)

Code	Phase
C1	Sharing / comparing of information
C2	Discovery and exploration of dissonance or inconsistency among participants
C3	Negotiation of meaning/co-construction of knowledge
C4	Testing and modification of proposed synthesis or co-construction
C5	Agreement statement(s)/application of newly constructed meaning
C6	Others

Table 2 Coding scheme for problem solving discussion (Hou et al., 2008)

Code	Phase
P1	Propose, define, and clarify problem
P2	Provide solutions or information for possible answers
P3	Compare, discuss, and analyze
P4	Organize and form conclusions
P5	Others

3. Comparison and Discussions

We examine the key findings of the three studies. Table 3 compares the content analyses of all studies. It shows the interactive strategies used by each subject (learner or teacher communities) in the studies and the proportion of each behavior code in the study. Table 4 compares the sequential analyses of each study, and shows the behavior sequences that reached the level of significance.

Table 3 Comparison of content analysis of the three studies

Table 1. Comparison of content analysis of the three studies													
Study	Strategy	Subject	Percentages of codes (%)										
			C1	C2	C3	C4	C5	C6	P1	P2	P3	P4	P5
I	Peer assessment	Student	69.9	8.7	0.3	0	0	21.1	-	-	-	-	-
II	Problem Solving	Student	66.4	8.3	22.4	1.4	0	1.5	20.3	59.8	12.3	6.4	1.3
III	Problem Solving	Teacher	89.4	3.7	6.2	0	0	0.7	21.9	67.5	9.9	0	0.7

Table 4 Comparison of sequential analysis of the three studies

Study	Strategy	Subject	Significant Behavior Sequences	
			Knowledge construction	Problem solving
I	Peer assessment	Student	C1->C1, C6->C6	N/A
II	Problem Solving	Student	C1->C1, C3->C3, C4->C2	P1->P2, P2->P3, P2->P4, P4->P5
III	Problem Solving	Teacher	C1->C3, C2->C2, C6->C6	P1->P2, P2->P1, P2->P3, P5->P5

The samples in Studies I and II were all college students, and two different interactive strategies were used. We thus compare these two studies. The results reveal that the level of knowledge-construction in Study II showed much more C3 (22.4%) than that of Study I (C3: 0.3%). Almost no one in Study II deviated from the main topic, but this behavior was fairly common in Study I (off-topic messages i.e. C6, were near 1/5 of all messages). As for sequential behavioral patterns, if we compare Study II (C1->C1, C3->C3, C4->C2) with Study I (C1->C1, C6->C6), we see that Study II not only had better continuity in C1 and C3, but there were also extensive correlations (C4->C2) between each discussion code. For Study I, however, only C1 was continued, and off-topic discussions frequently continued (C6->C6). Generally speaking, problem-solving may have a more positive influence than peer-assessment in terms of facilitating knowledge-construction in our findings. Possible reasons for this may include the fact that peer assessment is a competitive interaction with mutual assessments and challenges. Problem-solving, however, is collaborative and involves cooperative interactions, solving each other's questions.

Since organizational climate is closely related to mutual knowledge-sharing (Bock et al., 2005), the climate is affected if students are asked to judge or review each other's works in a competitive context. This issue should be noticed when designing peer-assessment activities. Moreover, problem-solving was used in both Studies II and III, comparing the two shows that the learner community showed deeper level of knowledge-construction in C2, C3 and C4 phases than the teacher community did.

Due to the behavior of knowledge-sharing is related to the organizational characteristics (Bock et al., 2005; Yang & Chen, 2007). The differences may provide key references for teacher educators to in-depth understand the interaction figures and limitations of teachers and design more appropriate interactive activities for them.

4. Conclusion and Suggestions

The comparison in this paper may provide some references for community management and system development for collaborative virtual learning. We suggest that the comparison of content/sequences of different community/strategy may be valuable information for community guiders to design guide strategies to promote members' knowledge construction (e.g., integrate peer-assessment and problem-solving activities and post articles to guide/promote C3, C4, C5, and avoid C6, etc).

Moreover, system developer may also develop mind-tools (e.g., applying VL Intelligent Agents to automatically detect content, frequency and behaviors of learners' discussion and instantly promote feedbacks or reports for teachers or learners) for discussion environments in collaborative virtual learning environment to promote more C3, C4, C5 as well as the abovementioned sequences which benefit knowledge construction or problem solving process. (e.g., C1->C3, C3->C4, C4->C5, etc.)

Finally, due to the limitations of the samples, we focused more on the actual practice in higher education. However, this limits generalization of our research findings to other grade years or subjects. Future studies may conduct more empirical studies on different academic systems and domains in order to determine the similarities, differences, and other features of the involved behavioral patterns.

5. Acknowledgments

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6. References

- Bakeman, R., & Gottman, J. M. (1997). *Observing interaction: An introduction to sequential analysis* (2nd Ed.). UK, Cambridge University Press.
- Bock, G. W., Zmud, R. W., Kim, Y., & Lee, J. (2005). Behavioral intention formation knowledge sharing: Examining roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, 29(1), 87-111.
- Gunawardena, C., Lowe, C., & Anderson, T. (1997). Analysis of global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research*, 17(4), 397-431.
- Hewitt, J. (2003). How habitual online practices affect the development of asynchronous discussion threads. *Journal of Educational Computing Research*, 28(1), 31-45.
- Hou, H. T., Chang, K. E., & Sung, Y. T. (2007). An Analysis of Peer Assessment Online Discussions within a Course that uses Project-Based Learning. *Interactive Learning Environments*, 15(3), 237-251.
- Hou, H. T., Chang, K. E., & Sung, Y. T. (2008). Analysis of Problem-Solving Based Online Asynchronous Discussion Pattern. *Educational Technology & Society*, 11(1), 17-28.
- Hou, H. T., Sung, Y. T., & Chang, K. E. (2009). Exploring the behavioral patterns of an online knowledge sharing discussion activity among teachers with problem-solving strategy. *Teaching and Teacher Education*, 25, 1, 101-108.
- Patricia, K. G., & Dabbagh, N. (2005). How to structure online discussions for meaningful discourse: a case study. *British Journal of Educational Technology*, 36(1), 5-18.
- Yang, C., & Chen, L.C. (2007). Can organizational knowledge capabilities affect knowledge sharing behavior? *Journal of Information Science*, 33(1), 95-109.

3D Accelerometer Based Controller for Virtual Agent in VLE

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Abstract: *Virtual Agent is often used to improve the learning quality in Virtual Learning Environments (VLE), which enables interactions and encounters with other people and providing access to a wide range of resources. This paper proposed a remote controller embedded with a 3D accelerometer which is used for operating the virtual agent, which in this paper, is a 3D virtual human in the hand sign language teaching system. We design some basic gestures (raise up, left/right/up/down forward, etc), and employ the DTW algorithm for recognition, propose a system that process the algorithm and drive the virtual human in a VLE. At last, experiment is setup to show that a relative high recognition rate is performed the algorithm and in system.*

Keywords: 3D accelerometer, controller, virtual agent

1. Introduction

A more correct term for VLE may be a virtual environment for learning, rather than virtual learning environment. This removes any ambiguities and identifies that it is the environment which is virtual and not the learning. VLE can supplement face-to-face teaching methods, or totally replace these teaching methods in the case of distance learning or off-line class learning. Along with the growth of computing capabilities, more and more ITS (Intelligent Tutoring Systems) researchers have focused on providing tailored learning materials, instructions and instant interaction to suit individual learners or a group of learners by using intelligent agent technology (L. Aroyo, & P. Kommers, 1999) and (P. Brusilovsky, 2000). Intelligent agent technologies not only generate the artificial intelligence model of learning but also facilitate the interaction between the user and the systems. In some VLE, where the virtual agent is a virtual human, a facilitative interaction tool is necessary. Easy to use and cheap cost may be the basic requirement of the device.

In this paper, we introduce system which employing a remote controller, embedded with accelerometers, like Wii-Remote but much cheaper, to interact with the virtual human. The advantages of remote controller assisting interaction should be attributed to its appealing characteristics: wireless connection, simple operation, and human engineering shape. Moreover, the acceleration sensors equipped inside provide more useful information about motions of the user, thus it is possible to develop more intelligent functionalities based on it, like recognizing the user's gestures (Kallio, & Kela, 2006). We can capture the gestures using pattern recognition algorithms, and the whole interaction is very nature and: just wave the arm as usual--- the virtual can mock us exactly.

The rest of this paper is organized as follows. Related work is talked in section 2. In section 3, we addressed the controller and gesture recognition, including hardware, data collecting, data process and recognition algorithm. System architecture proposed is talked in section 5. And we argue some future work in the last section.

2. Related Work

Accelerometer-based gesture recognition has been discussed in many publications, most prominently in (Hofmann & Heyer & Hommel, 2004) and (Jiayang Liu, L. & Zhen Wang, 2009.). Accelerometers have also been used as an alternative modality for capturing motion information for recognizing ambulatory movements (Mathie & Coster, 2003). Most of gesture recognition algorithm is based on pattern recognition and machine learning . DTW (H. Sakoe, 1978)

may be the most straight one, and HMM is the most powerful tool(Zinnen, & Laerhoven, & Schiele, 20007) for this kind of problem, while other algorithms are also grate options, like Adaboost (Narayanan & Krishnan, & Colin, 2009). In this paper, we make controller device embedded with a 3D accelerometer, and employ the DTW algorithm for gesture recognition. The controller make the gesture based interaction easily to use without any extra training.

3. System Architecture

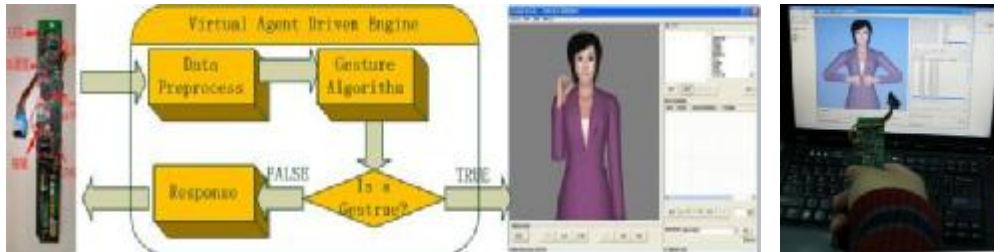


Figure 1. System Architecture of Using Controller for Virtual Agent

We illustrate the architecture of proposed system that interacts with the virtual human using our controller in Figure 1. Accelerometer signal will be sent to the system via Bluetooth, while we are doing some gesture. The virtual human driven engine then recognize the gesture after the data being preprocessed. Since there is still some possibility of recognition error, we design a module that response to the user, improve the system usability. The gesture that successfully recognized will be sent to the sign teaching system, which will drive the virtual human do the same gestures. The right part of Figure 1, shows the real operating scene using the controller.

4. Data preparation and Feature Extraction

4.1 Hardware Platform



Figure 2. Controller Hardware (left subfigure) and Data Collection Software (right subfigure)

An overview of the handle device is show in left part of Figure 1. It owns one 3-axis accelerometer. There are also few buttons, which we think the fewer the best, and a Bluetooth for communication with others. What's more, another advantage of the device is low power consumption and low material price. The left part of Figure 2 shows the software we used to collect data and make some preliminary analysis. We employ a web camera to help the labeling and segmentation of accelerometer signals. In Figure 2, we can find out that two gestures, raising up the arm and drawing circle, have different curve graph typically.

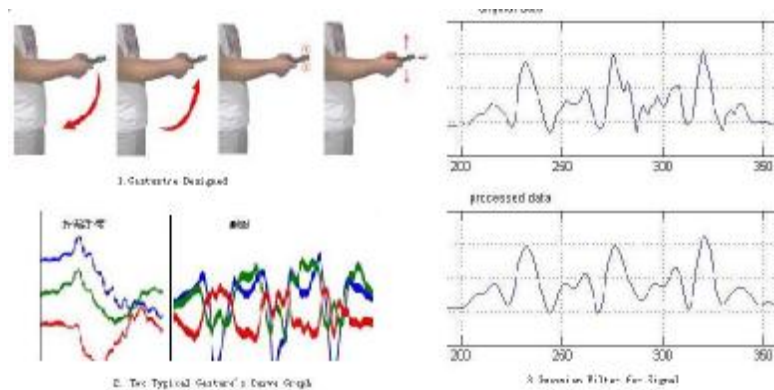


Figure 2. Gesture Design, Two typical gestures' curve graph and Gaussian Filter Smoothing

4.2 Filter Algorithm

Before we extract feature, a Gaussian Filter is used for all dimensions of the accelerometer to smooth the signal. The right sub graph in Figure 2 shows the smoothing result by filter. We can easily find out that, the high frequency part has been cut off from the original signal.

4.3 Feature Extraction

Feature extraction is the next step to process the signal data. Several features could be extracted from the accelerometer signals, for instance mean value, standard variant of each axis of the accelerometer, and correlation of each two axes. Here, for simple, we just consider the gesture recognition be similar to speech recognition, both of which are aiming to extract some pattern or recognize certain pattern from the series.

5. Control Gesture Recognition

5.1 Gesture Design

Gesture design is a critical work, and several factors need to be considered sophisticatedly and synthetically, while most works of gesture recognition focus on the algorithm --- the number of gesture needed and what they are, the operational function of the gesture and the transition between gestures. The left part of Figure 2, we illustrate four classes gestures according to virtual human control---raising up arm, putting down arm, up/down/left/right forward arm, drawing circle, which are supposed to be the most useful gestures for the virtual human agent.

5.2 Recognition Method

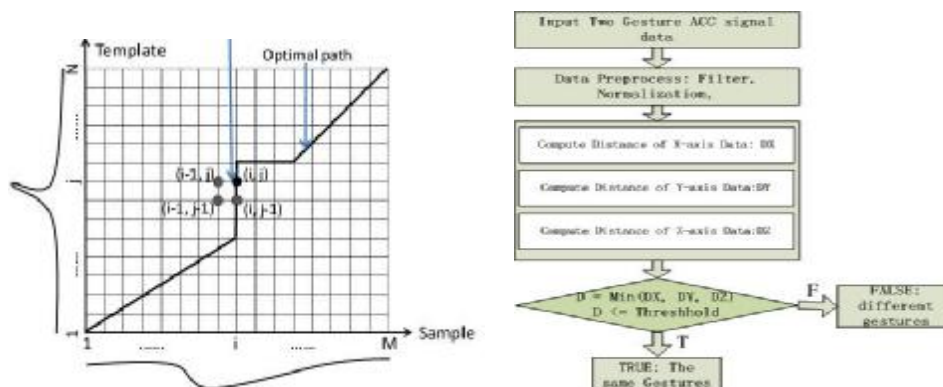


Figure 3. DTW(left) and Gesture Recognition Algorithm(right)

There are lots of algorithms can be used to recognize the gestures. In this paper, DTW (Dynamic Time Wrapper) is chosen for its simplicity and low computation cost. The minimal distance between two series, which indicating the similarity of them, can be compute using dynamic programming method. The left sub graph in Figure 3 illustrates the DTW algorithm that how to compute the minimal distance between series. And the right part one shows the steps that we take to recognize the gesture using DTW algorithm.

6. Experiment

We collect our experiment data by asking 10 people in our lab and do the gestures designed above 2 times at two different time of a day, which continued two weeks. The recognition rate is more 93%, which can found in Table 1.

<i>Gesture</i>	<i>Recognition Rate</i>
Rasing up arm	93.2%
Putting down arm	94.1%
Drawing circle	95.0%
Up forward	93.7%
Down forward	94.3%
Left forward	94.1%
Right forward	93.9%

Table 1. Gesture Recognition using DTW

7. Conclusion

In this paper, we take a virtual human as the virtual agent in a VLE scene, and propose a 3D accelerometer based controller to control the virtual human. Device hardware and recognition algorithm are all argued as well as the system architecture. Experiment shows that, most of the gestures have more than 92% recognition rate, which validate the feasibility of the system. In the future work, gesture auto-segmentation should be considered which may free the user from trigger the button when he wants to interacting by gesture.

References

- Martin Weller, M. (2007). *Virtual Learning Environments*. New York: Routledge.
- L. Aroyo, L., & P. Kommers, P. (1999). Intelligent agents for educational computer-aided systems, *Journal of Interactive Learning Research*, 10 (3/4), 235–242.
- P. Brusilovsky, P. (2000) Course sequencing techniques for large-scale web-based education, *Proceedings of Intelligent Tutoring Systems*, 525–535.
- Kallio, K. & S., & J. Kela (2006). User independent gesture interaction for small handheld devices. *International Journal of Pattern Recognition and Artificial Intelligence*, 20(4), 505-524.
- H. Sakoe, H.(1978). Dynamic programming algorithm optimization for spoken word recognition. *IEEE Transactions on Acoustics, Speech, and Signal Processing*, 26, 43–49.
- Jiayang Liu,L. & Zhen Wang W. (2009). uwave: Accelerometer-based personalized gesture recognition and its applications, *Pervasive Computing and Communication*, 1–9,9–13.
- Narayanan C., C. & Krishnan, K. & Colin Juillard C.(2009). Recognition of hand movements using wearable accelerometers. *Journal of Ambient Intelligence and Smart Environments*,143–155.
- Hofmann, H. & Heyer, H. & Hommel, H. (2004). Velocity Profile Based Recognition of Dynamic Gestures with Discrete Hidden Markov Models. *Proc. of the International Gesture Workshop on Gesture and Sign Language in Human-Computer Interaction*, 81–95.

- Mathie, M. & Coster, C. (2003). Detection of daily physical activities using a triaxial accelerometer, *Journal of Medical and Biological Engineering and Computing*, 41, 296–301.
- Zinnen, Z. & Laerhoven, L. & Schiele, B. (20007), Toward recognition of short and non-repetitive activities from wearable sensors, *In Lecture Notes in Computer Science, Ambient Intelligence*, 142–158.

Immersive Virtual Brush Simulation for Chinese Language Edutainment

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Abstract: *Brush Simulation is an innovative method to create convenient virtual environment for educational purpose. It aims to assist Chinese Language learners to enjoy practicing the artful style of Chinese writing and water painting brush work, without the burden of natural resource preparation (i.e. ink and paper). Recent research has shown that depending on the level of immersion and the quality of interaction / communication between user and the virtual augmented agents in edutainment system, powerful learning results in edutainment can be achieved. Unfortunately, users are often required to interact indirectly through special input devices (i.e. tablets) which are rather uncomfortable and different from its traditional way. And, thus, it often dramatically damages the overall user's immersive experience. In this paper we propose new design for the Input Layer of Virtual Brush Simulation model employing the optical-based tracking technology that gets rid of the cumbersome input tracking device, in order to provide user's higher immersive interaction in such edutainment system.*

Keywords: Chinese langue, Virtual brush simulation, optical-based tracking, immersive interaction, edutainment

1. Introduction

In recent years, many Virtual Brush Simulation models such as (Baxter, Scheib, Lin, & Manocha, 2005; Chu & Tai, 2004; Nelson & Tai, 2005; Strassmann, 1986) have been proposed targeting for a new possibility of practicing the traditional brush work on alternative digital media. For example, virtual brush used by modern painter artists has been suggested to be more convenient and economic for Arts work production, comparing to traditional practices. For Chinese language learners, through interactive educational games, virtual brush is also a good way to practice Chinese calligraphy and to learn the language at the same time. In Games and Cinematic industry, non-photorealistic painting style is more and more engaging to their consumers as special effects. Each of these applications requires an interactive simulation of virtual brush in real-time. However, the common problem in virtual brush simulation is that a user needs to constantly map his manipulation on the pointing device (i.e. tablet) to the monitor space where the actual footprint is generated. This often causes distraction to the interaction experience. Solving such input problem is very useful to provide natural interaction experience.

2. Related Work

Modern Virtual Brush Simulation System was initiated by Saito (Saito & Nakajima) and then later continued by other researchers (Plante, Cani, & Poulin, 2001; Wong & Ip, 2000; Xu, Tang, Lau, & Pan, 2002; Yeh, Lien, & Ouhyoung, 2002) to deal with the complexity of virtual brush simulation. In his simulation proposal, the process

consisted of three separated layers of interaction: Input layer, Brush Simulation layer and Ink Dispersion layer – Figure 1:

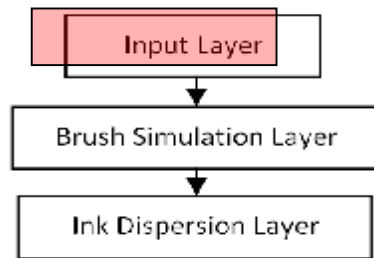


Figure 1. Modern Virtual Brush Simulation Model.

On top of the simulation model, input layer handles with the user manipulation data is usually generated by the input devices. Over the years, several input devices have been suggested, namely traditional 2D mouse, magnetic or ultra-sound pressure sensing tablet, haptic force feedback device and recently, Interactive tablet display (e.g. Wacom tablet series (Wacom Intuos, 2000)). However, such devices are in general not compatible with Chinese brush work practices due to its significant physical difference with traditional Chinese hairy brush, as illustrated in Figure 2.

On the other hand, optical tracking for virtual simulation (Rolland, Davis, & Baillot, 2001) has also gained more and more significant popularity for its capability of conducting flexible human-computer interaction on any working spaces such as wall, floor and even on the monitor itself. Optical-based tracking algorithms have been widely researched and has been proved to produce accurate tracking results in real-time, especially with the new parallel programming capability of GPUs (Chetverikov & Verestói, 1999; Sinha, Frahm, Pollefeys, & Genc, 2006; Tomasi & Kanade, 1991). In particular, SIFT (Heymann, Maller, Smolic, Froehlich, & Wiegand, 2007) is real-time color-based tracking algorithm which allows very stable tracking results without subjection to illumination variance and ad-hoc occlusion problem. This method has shown to be effective for tracking motion in general practice. In addition, 3D matching of points from multiple view points (stereoscopic) allows not just 2D planar tracking but points can be traced in 3D space (Stein, 1999). By specific installation of several markers, a full 6 Degrees of Freedom (DOFs) tracking can be achieved by using only two cameras.

3. New Input Layer Design

Inspired by current state of accuracy on optical tracking technologies, we introduce a new immersive and user-friendly setup for user input layer of the simulation system. This new setup aims to close the gap between the traditional experience of using actual brush work and the current digital simulation practice while maintaining an affordable and reasonable adjustment on the new installation.

The main driving force is that many users may have issue when adapting to the pen-based input device. It is because the pen-based input device (i.e. Wacom tablets) cannot provide the same feedback as natural as the traditional brush. There are two main reasons. Firstly, the pressure sensor on the head of the stylus is very different from the Chinese brush's which is made up of thousand of hair strands and bristles which are softer and provides very subtle haptic feedbacks. Secondly, it is unnatural for users to manipulate the brush on the tablet surface while they are looking on the monitor to observe the result where the actually footprint is generated – Figure 2.

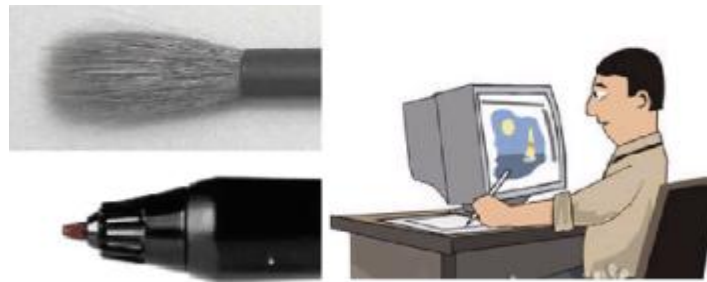


Figure 2. Two reasons for Interaction discomfort.

Instead of using common pointing device, our alternative setup would consist of two extra webcams to track the motion of the real brush, which is holding by the user as original setup and a flat LCD monitor using as interactive display for the simulation – illustrated in Figure 3.

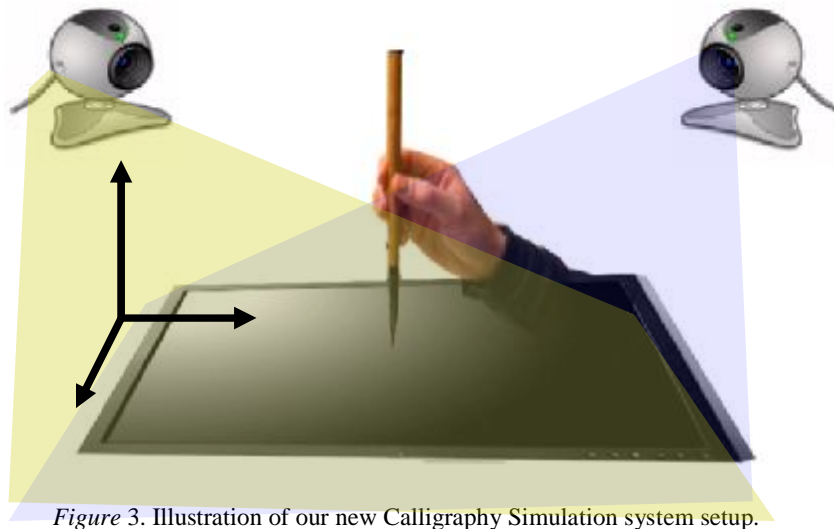


Figure 3. Illustration of our new Calligraphy Simulation system setup.

The setup employs two standard digital cameras (webcams) to record continuously in an alternating sequence (so as to double the framerate) over the painting area to deliver accurate tracking of the motion path of the brush. The recorded images will be transferred to Feature Point Tracking algorithms (Gabriel, Hayet, Piater, & Verly; Tsai, 1986; Zhou, Yuan, & Shi, 2009) for analyzing the actual motion and extracting the 3D motion path through 3D points matching algorithm. These techniques and algorithms have been intensively researched in academics over the years and have been proven to be reliable.

Finally, the simulation system will receive the motion input, perform the dynamics simulation and paint flow modeling in second and third layer in Figure 1 and output the simulated results to the LCD display. The user is expected to experience the simulation immersive as if he is practicing the brush work in the tradition way.

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The proposed system will provide students with a more meaningful way of spending their leisure time. We believe it is better to keep the students' role as the makers of the art work rather as operators of computer programs. We believe that the acquisition of artistic skills through practice gives them a sense of achievement. There are several benefits that digital tools can give. One main benefit is that they are highly mistakes tolerant. Students are often discouraged to experiment because they are afraid to waste art materials when they make mistakes. An



Figure 2: (Left): Traditional calligraphy practice. (Right): Digital art lesson at school in Singapore (Figure 2 Right).

experienced teacher in Chinese brush painting, commented that it often takes some thirty pieces in a painting session to get one masterpiece. Digital tools also make the creation process more convenient. Traditional calligraphy requires first setting up the tools and materials and relatively larger working space (Figure 2 Left). It is often easy for one to stain one's hands, clothes and tables. Cleaning up the used brushes and utensils is also time-consuming. Digital calligraphy eliminates the hassles.

Brush strokes can be recorded and played back for students to learn from teachers or each other. In the West, the number of qualified Chinese teachers may not be enough for the growing number of students. When networked, our proposed digital tool facilitates remote tutoring demonstrating how technology can be used to relieve the stress of teacher's demand. Livemocha is the world's largest language learning community with over 4 million members. The innovative idea of interests match making give learners opportunity of practice with native speakers and make the language learning fun and effective. Many Singapore schools have friend schools and summer visits in China. Through the proposed learning community, students can learn and teach each other in a virtual learning environment. Brush motion can be sent to other users' machines in real-time for collaboration. Calligraphy is often described as a dance of brush and this dance can be a group dance rather than a solo. Note that having two persons concurrently writing or painting at the same area is difficult in the real world but is perfectly fine if we move to the virtual painting scene.

4. Summary and Future Work

In this paper, we described a new setup for user interaction with the Virtual Brush Simulation model employing optical-based tracking technology in order to minimize the discomfort from common tablet devices, in order to provide users' higher immersive interaction in such edutainment system. Future work will comprise an implementation of the describe approach and testing against the previous interaction design to evaluate the usefulness and the immersion of optical brush tracking approach.

Our system can be installed in classroom as well as students' homes. Therefore, students can continue practicing calligraphy at home after class in an informal setting. Since the pen strokes can be recorded, the whole writing process can be easily transmitted to the teacher or other students via computer network. Students can see how the artwork is produce by watching the playback of recorded stroke motions (order, relative size, and even strength of stroke can be monitored if need be). The produced artwork can be used in both real and virtual worlds in, for example, making greeting cards, thus encouraging students to make friends or learn from their peers. We plan to explore the use of online virtual environments to further promote the adoption of digital calligraphy.

References

- Baxter, B., Scheib, V., Lin, M., & Manocha, D. (2005). *DAB: interactive haptic painting with 3D virtual brushes*.
- Chetverikov, D., & Verestói, J. (1999). Feature point tracking for incomplete trajectories. *Computing*, 62(4), 321-338.
- Chu, N., & Tai, C. (2004). Real-time painting with an expressive virtual Chinese brush. *IEEE Computer Graphics and Applications*, 76-85.
- Gabriel, P., Hayet, J., Piater, J., & Verly, J. Object tracking using color interest points. *IEEE AVSS*, 159-164.
- Heymann, S., Maller, K., Smolic, A., Froehlich, B., & Wiegand, T. (2007). *SIFT implementation and optimization for general-purpose GPU*.
- Nelson, S., & Tai, C. (2005). MoXi: real-time ink dispersion in absorbent paper. *ACM Transactions on Graphics (TOG)*, 24(3).

- Plante, E., Cani, M. P., & Poulin, P. (2001). *A layered wisp model for simulating interactions inside long hair*.
- Rolland, J., Davis, L., & Baillet, Y. (2001). A survey of tracking technology for virtual environments. *Fundamentals of wearable computers and augmented reality*, 67-112.
- Saito, S., & Nakajima, M. *3D physics-based brush model for painting*.
- Sinha, S., Frahm, J., Pollefeys, M., & Genc, Y. (2006). *GPU-based video feature tracking and matching*.
- Stein, G. (1999). *Tracking from multiple view points: Self-calibration of space and time*.
- Strassmann, S. (1986). Hairy brushes. *ACM SIGGRAPH Computer Graphics*, 20(4), 225-232.
- Tomasi, C., & Kanade, T. (1991). *Detection and tracking of point features*: Citeseer.
- Tsai, R. (1986). *An efficient and accurate camera calibration technique for 3D machine vision*.
- Wacom Intuos, T. (2000). User's Manual for Windows. May, 22, 1-165.
- Wong, H. T. F., & Ip, H. H. S. (2000). Virtual brush: a model-based synthesis of Chinese calligraphy. *Computers & Graphics*, 24(1), 99-113.
- Xu, S., Tang, M., Lau, F., & Pan, Y. (2002). *A solid model based virtual hairy brush*.
- Yeh, J., Lien, T., & Ouhyoung, M. (2002). *On the effects of haptic display in brush and ink simulation for chinese painting and calligraphy*.
- Zhou, H., Yuan, Y., & Shi, C. (2009). Object tracking using sift features and mean shift. *Computer Vision and Image Understanding*, 113(3), 345-352.

Multi-Player Targeted-Content Video Games in Education

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Students in the U.S. are becoming disengaged with traditional teaching practices. A major problem with drill and practice is that it can be boring for students, and teachers struggle to motivate students to practice math facts. To close this gap, new avenues are needed to connect with today's technology-driven students to engage them at a young age, and get them interested in practicing math and science.

Of the 53 million K–12 students in the U.S., 51 million (or 93%) play video games. Multi-player games are the most popular type of game. Competitive aspects of multi-player games can help improve student performance through increased time on task, increased student motivation and engagement, and increased corrective feedback. Games have the potential to significantly increase the number of meaningful opportunities to engage students in understanding the concepts in a creative and interesting manner, and to extend the instructional day beyond the school day.

Keywords: Edutainment, Games, Multi-player games, Online, Computer

1. Youth and Video Games

According to the Pew Report (2008), youth appear motivated to spend large amounts of time engaged in playing video games and many researchers argue that games have a significant educational potential (Prensky, 2001). Students can acquire high levels of skill in playing games by processing information quickly and in parallel with other information, and by exploring in a non-linear fashion. A well-designed game can also promote collaborative learning.

Games challenge and engage in ways youth appreciate. Students are not usually excited by difficult tasks, a problem to which all teachers and parents can relate. While students will complain if a homework assignment is too hard, they also complain if a game is too easy (Jenkins, 2006). Current game development thought suggests that because good games are engaging, they can provide effective instructional support (Van Eck, 2006), and game developers recognize that most youth who play games do not want them to be either short or easy. This is because game developers attempt to make games challenging enough that players enter what they call “the zone” or “the flow,” terms based on the work of psychologist Mihály Csíkszentmihályi. Game developers apply this concept by presenting successively harder material until the player reaches a challenging difficulty level. Educational games are designed to provide a level of excitement beyond that of typical classroom activity. Interactions are rapid, feedback is immediate, and difficulty levels are used to increase competition and the feelings of success and attachment that accompany competition. This type of competitive game attachment has been described as compelling grip or compulsion in game play.

2. Targeted Games

Discussion about the role of games in education has identified two main types of educational games – immersive and targeted. Prensky (2005) differentiates targeted mini versus complex immersive games and describes mini-games as “trivial.” He suggests that complex or immersive games are more significant as educational tools because they require learning multiple skills, foster research and inquiry, and support social interactions. Many of these games require 10 or more hours to learn, or can take upwards of 40 hours of practice to get beyond the novice levels does not necessarily present the differences between types of games as good versus bad, but rather as two ends of a game spectrum: targeted versus immersive. We find his distinction to be useful in our understanding of the educational use of games. It is our view that mini games are engaging for students, and can be used to practice skills and support instruction and learning. The discourse about the best educational use of games should not focus on game types as either good or bad, but whether educational games are or are not fun for students and engage them in learning. Fun educational games have a role in supporting student learning. Well-designed, fun, targeted games have a different role in education than well-designed, fun, immersive games.

Targeted-content mini games, unlike immersive games that deal with extensive scenarios and role-play, have a number of attractive features for educational use. Targeted games deal specifically with more focused goals, are easy to learn, simple to play, and offer quick rewards with forgiving game-play. Targeted games can also incorporate characteristics of engaged learning. For example, games can be designed in order to increase in complexity, engage problem solving, and allow for discovery and autonomy.

Targeted games are additionally characterized by a high number of opportunities to practice a specific skill within game play and researchers have noted that multiple opportunities to practice a skill, within the context of instruction, are a key component for learning. For example, in a single player multiplication game a student may average 20 correct responses in one minute. More intense play in a multiplayer competitive multiplication game may result in students reaching a rate of 40 or more correct responses per minute. Critics of targeted games see this type of game play as training rather than learning, drill and practice rather than understanding (Prensky, 2001; Van Eck, 2006). Alternatively, this rate of play could be seen as building fluency and automaticity so a skill can be more easily applied within more complex problem solving situations (Binder, 1996)

Early game developers predicted that the most exciting opportunity for game players lay in sharing the experience and playing with other players. Since then, a significant percentage of games have been developed that support competitive or collaborative play. Many targeted games take advantage of the greater emotional attachment found with group play. Several Arcademics.com games provide opportunities to practice skills as a single player or in a multiplayer format, either competitively or collaboratively. We are particularly interested in students’ selection of multiplayer over single player games and the role that collaboration and competition have in game performance.

3. Teachers Use of Targeted Games to Build Fluency

For targeted games, we will look at the multi-player math games at from Arcademics.com The games, while presenting mathematics practice, allow students to evaluate their rate of correct and incorrect responding, determine the problems that were answered incorrectly, and, most importantly, compete against others in the class, or with others on the web.

Teachers typically describe using the games to practice mathematics facts, supporting the development of fluency. For example, the teacher may review with the students all the games that address addition and subtraction. The students interact with each of the different game formats for addition and subtraction including: the single player games, and competitive and collaborative games. The teacher then allows the students to select any of the game formats to play, as long as they remain in the designated area of mathematics. In this example, the games build fluency in the area of addition and subtraction.

Several game features were specifically included in game design in order to increase game engagement. The games are easy to learn, simple to play, have targeted goals, and frequent feedback. The feedback reflects correct and incorrect responses as well as a visual display of their rate of correct and incorrect responses. Depending on how the teacher manages sessions of game play, the students additionally may have control over the game actions and have autonomy in play. These games are also designed to take advantage of the positive and engaging influence of the social component of game play. Many of the scenario and role-playing games clearly take advantage of the engagement offered through group play, but few targeted games incorporate this design characteristic. A review of user data across games that are similar in all facets except for the game format (single player, competitive, or collaborative) suggests that students prefer targeted games in which they can interact with other students.

4. Anecdotal Teacher Report

It is clear that teachers use the games for instruction and that the students are engaged playing competitively and improving their skills. Teachers have reported their use of games to support learning.

The kids seemed to be kind of "stuck in a rut" and not making much progress. As second grade teachers, we decided at our bi-weekly grade level meeting to make it a goal to improve those scores, so we were brainstorming ways to do it...so I began to look further and stumbled upon your site - just what I was looking for.... basic repeated practice of the addition facts in a fun, exciting way!

I introduced Jet Ski Addition to the class ...the children could hardly wait for their turn. We played the games for a few weeks while taking timed tests to check for progress.

Here are the Scores :

Feb. 19 14 out of 24 children passed with 80% or higher 9 had 100%

Feb. 29 20 out of 24 children passed with 80% or higher 14 had 100%

Nine children improved their score on the 29th from the score that they had on the 19th. (this is children that may have been above the 80% already, but not to 100% yet.)

One boy went from a score of 63% to 100%. Two boys went from 77% to 90%. A girl went from 57% to 73% and is excited to go home every day to play the game! Even my lowest student at 47% made it to 67%. The children were very excited to see how their scores had gone up!

I am of course thrilled with that improvement of scores! I am sure that much of the improvement is due to the fact that many of the children played Jet Ski Addition.

Ms. Smeltz

Stories such as these suggest that two game features contribute significantly to the motivation to play the targeted games found at Arcademics.com. These include the opportunity to engage in competitive or collaborative play and the availability of feedback to allow students to improve.



Figure 2. Competitive game and feedback interface

The competitive games, as seen in Figure 2, allow up to four players to compete against each other on the same game. The players see the same challenge questions and rapidly try to answer correctly in order to race their speedboat on a course and beat the challengers. Each player is also aware of the position of the other players relative to their own position on the racecourse. As with the single player games, players receive feedback on errors and are able to view a graph of their rate or correct and incorrect responding over time.

Collaborative games allow two teams of up to four players to compete against another team. Each player views the same set of questions and attempts to respond correctly, as quickly as possible. One of the collaborative games involves two teams engaged in a tug-of-war game. Up to four members of one team try to pull the other team across a line. The stronger team, the team that collectively answers more questions correctly, wins the game. As with the other formats, individual team members receive corrective feedback on their own performance. Both the competitive and collaborative games allow for private game play, usually set up between or within classes at the same school, and public games that have no restrictions on who can join.

5. Implications

Targeted games have a number of attractive features for educational use: easy to learn, easy to play, dense engagement, and immediate feedback. Currently, users of a wide age range and equal gender split, people outside the traditional young male demographic, are playing targeted games. These attributes alone warrant further development of targeted games across grade and subject, including mathematics and science and the experimental analysis of their impact on student centered learning.

Practice alone does not guarantee that students will achieve rapid recall of facts and apply that knowledge to other problem types. Practice needs to be accompanied by high quality classroom instruction. Research has repeatedly demonstrated that best practice classroom instruction utilizes assessment information to differentiate for individual student needs (Marzano, 2003). Unfortunately, quality analysis of timed test worksheets is time consuming and tedious, and teachers rarely can devote the time to the task. Perhaps more disturbing is that timed tests can raise anxiety for many students who are already struggling, and thus perpetuating the cycle of failure.

The competitive and fun aspects of multi-player educational video games, if used in classroom settings with instruction, may be able to increase student engagement, time on task, and lower student anxiety, yielding increased math proficiency and overall performance.

References

- Prensky, M. (2001). *Digital game-based learning*. NY: McGraw- Hill
- Marzano, R.J. (2003). *What works in schools: Translating research into action*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Binder, C. (1996). *Behavioral fluency: Evolution of a new paradigm*. The Behavior Analyst, 19.
- Van Eck, R. (2006). *Digital game-based learning: It's not just the digital natives who are restless*. EDUCAUSE Review, 41(2), 16–30.
- Pew Reports. (2008). *Teens, Video Games and Civics: Teens' gaming experiences are diverse and include significant social interaction and civic engagement*. Retrieved September 01, 2008, from http://www.pewinternet.org/PPF/r/263/report_display.asp
- Jenkins, H. (2006). *Fans, bloggers, gamers: Exploring participatory culture*. New York: NYU Press.

Scaffolding for Productive Reflection in an Intelligent Learning Environment

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Abstract: *This study tries to investigate whether agent prompts, acting as scaffolding, can promote students' reflection when they act as tutor through teaching the agent tutee in a learning-by-teaching environment. Two types of agent prompts are contrasted in this research, both from the perspective of a tutee, differing in their specificity. Reflective prompts are content-independent tutee questions, aiming at fostering students' general reflection on metacognitive strategies and beliefs. Interactive prompts, on the other hand, are content-dependent tutee questions that encourage students' specific reflection on domain-related and task-specific skills and articulation of their explanatory responses. The result indicates that designers on intelligent learning environment should concentrate on fostering students to reflect on their metacognitive strategies and beliefs, and allow students to take responsibility for directing their own learning autonomy.*

Keywords: Reflective Prompts, Scaffolding, Learning-by-Teaching

1. Introduction

The ability to carry out meaningful reflection is considered as indicative of the highest level of deep learning (Moon, 1999). Question prompts, as the literature suggests, can be an effective way of fostering reflection (Lai, 2008), because they provide the cognitively complex ways learners think about, feel about, and make connections in experience (Davis & Linn, 2000). Specially, recent research shows the evidence of learning benefits to tutors from tutee's question prompts in the context of peer tutoring (Cohen, 1986; Graesser, Person, & Magliano, 1995). Roscoe and Chi (2008) note that tutee questions can motivate tutor explanations and metacognition, and thus have a significant and positive influence on the tutor's learning activities and opportunities.

Previous research in intelligent learning environments has demonstrated that question prompts can be positive in fulfill a number of cognitive and metacognitive functions (e.g., (Ge & Land, 2004; Xie & Bradshaw, 2008). Meanwhile, mechanisms of supporting self-explanation, tutorial dialog or reflective dialog have been prevalent in traditional intelligent tutoring systems (ITS), in which the computer plays the role of tutor (e.g. Cognitive Tutor (Aleven, Pinkwart, Ashley, & Lynch, 2006), AutoTutor (Graesser, VanLehn, Rose, Jordan, & Harter, 2001)). However, little research has addressed the different types of question prompts as scaffolding strategy to guide the learner's reflection with a computer simulated tutee when playing the role of tutor in learning-by-teaching context.

In this paper, we investigate the use of agent tutee as an active and inquisitive learning partner to scaffold student to elicit general or specific reflection when taking the role of a tutor in an adapted learning-by-teaching agent environment, Betty's Brain ((Leelawong & Biswas, 2008). We compare two types of agent prompts to address the challenge to facilitate reflection of student tutor. Interactive prompts (IP), as the specific tutee questions, are content-

dependent and provide students a structure through the learning-by-teaching process. They lead the students to complete the specific cognitive task and articulate their explanatory responses. On the other hand, reflective prompts (RP), as general tutee questions, are content-independent and stimulate students to monitor their learning-by-teaching processes and consider various perspectives and values regarding their learning-by-teaching activities.

The remainder of the paper is organized as follows. First, we present an overview of agent prompts generation in the adapted Betty's Brain. Second, the classroom study and the results of how these agent prompts deliver their proposed benefits to middle school students in learning-by-teaching environment are provided. Lastly, conclusions and future directions for this work are described.

2. Agent Prompts Generation

2.1 Overview

The design and implementation of agent prompts are within the Betty's Brain system (Figure 1) (Leelawong & Biswas, 2008). The purpose of generating agent prompts is to enhance the learning-by-teaching agent environment, reifying the epistemic, metacognitive, task-specific and domain-related reflection of students involved in such an environment, by forming a student-agent reflective dialogue.

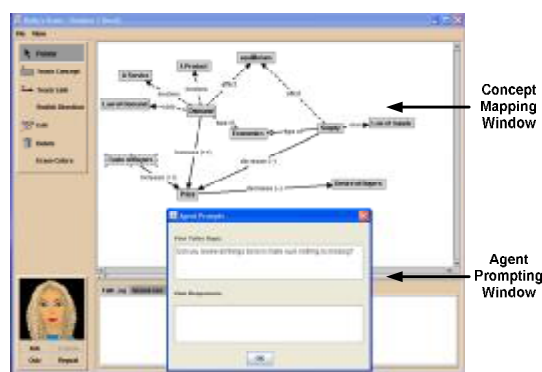


Figure 4. Adapted Betty's Brain with Agent Prompts

2.2 Reflection Types

We design agent prompts to foster two major types of reflection for students in the learning-by-teaching environment based on the three levels of instruction (Gama, 2004) for designing metacognitive components. (i) General level (ii) Domain-related level (iii) Task-specific level

- General Reflection is content-independent, stimulates students to monitor their learning-by-teaching processes and consider various perspectives and values regarding their learning-by-teaching activities.
- Specific Reflection is content-dependent, provides students a structure through the learning-by-teaching process and leads them to complete the specific cognitive task and articulate their explanatory responses

2.3 Patterns and Agent Prompts

Table 1 shows the samples of patterns found in student maps and appearing corresponding agent prompts stored in the repository.

Table 3. Patterns in Student Map

Pattern	Description
Missing Expert Concepts (e.g. Missing “Income” concept)	Reflective Prompts: “Can you review all things to check for missing important parts to teach me and give me an explanation?” Interactive Prompts: “Do you consider that you could teach me the concept of ‘Income’ and give me an explanation?”
Incorrect Expert Concepts (e.g. Incorrect “Electricity” concept)	Reflective Prompts: “Can you stop and review each part in the map to see if you have made a mistake and give me an explanation?” Interactive Prompts: “Do you want to reconsider the concept of ‘Electricity’ you teach me and give me an explanation?”
Incorrect Expert Links (e.g. Incorrect Link between “Opportunity Cost” and “Demand”)	Reflective Prompts: “Can you stop and review each part in the map to see if a mistake has been made and give me an explanation?” Interactive Prompts “Do you want to reconsider the link of ‘Determine’ between ‘Opportunity Cost’ and ‘Demand’ you teach me and give me an explanation?”
Missing Expert Links (e.g. Missing Link between “Income” and “Demand”)	Reflective Prompts: “Can you review all things done to make sure nothing is missing and give me an explanation?” Interactive Prompts: “Do you consider teach the link between ‘Income’ and ‘Demand’ and give me an explanation?”

3. Pilot Study

To investigate the impact of agent prompts to student’s reflection and learning, we took a pilot study on 33 students from two local secondary schools (ages ranged from 13 to 15) on a voluntary basis. They were randomly assigned to one of three conditions. Eventually, 29 students (76%), 20 female (69%) and 9 male (31%) completed all activities of the experiment, resulting in the following division over the three conditions: no prompts (NP) condition as control group: $n = 10$, interactive prompts (IP) condition: $n = 10$ and reflective prompts (RP) condition: $n = 9$,

Figure 2 indicates that the three conditions were in the approximately same level in pretest while both the two prompted conditions (RP and IP) outperformed the non-prompted condition in the posttest.

The ANOVA test of domain knowledge pretest-to-posttest gains indicated a significant effect of the two prompted conditions compared to the non-prompted condition ($F(2, 25) = 20.145$). The calculation of pre-test-to-posttest effect sizes (Cohen’s d) showed a prominent difference between the IP group ($d = 2.37$) and the RP group ($d = 3.30$). However, the pair-wise comparison showed that there was no significant difference ($\text{Sig.} = .154$) between the IP and RP groups as to the learning gains from pretest to posttest.

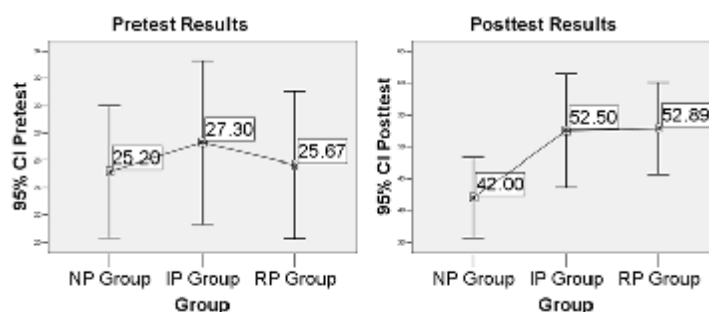


Figure 2. Domain Knowledge Pre- and Post-Test Results

The results of ANOVA tests of students' response statements to agent prompts showed the difference in the level of reflection between the RP and IP groups. The RP group was more likely to respond with contemplative statements representing a higher level of reflection ($F(1, 17) = 20.015$, $\text{Sig.} < .05$). Comparatively, the IP group responded more with reacting statements representing a lower level of reflection which means they pay more attention to the task-specific aspects than the RP group ($F(1, 17) = 18.520$, $\text{Sig.} < .05$).

4. Conclusions and Future Work

In this study, we explored the inquisitive agent tutee as a learning partner in learning-by-teaching activities. Overall results in learning outcomes showed that the agent prompts did add value and encouraged student in reflection and achieving better learning outcomes because the prompted students performed better, on pretest-to-posttest gains than non-prompted students. Students generated better response statements more frequently when they received reflective prompts than interactive prompts. Based on the analysis of response statements, it was concluded that the reflective prompts did promote deeper contemplative reflection and interactive prompts elicited more reactive reflection.

Future work of this study should be on exploring the relationship between agent prompts and intellectual flow. The answers will provide an in-depth understanding of intellectual enjoyment that students encounter when using agent tutee systems as learning partners.

References

- Aleven, V. A. W. M. M., Pinkwart, N., Ashley, K., & Lynch, C. (2006). Supporting self-explanation of argument transcripts: specific v. generic prompts. Workshop of Intelligent Tutoring Systems for Ill-Defined domains, 8th International Conference on Intelligent Tutoring Systems, 47-55.
- Biswas, G., Schwartz, D., Bransford, J., & TAG-V. (2001). Technology Support for Complex Problem Solving: From SAD Environments to AI. In F. Feltovich (Ed.), *Smart Machines in Education* (pp. 71-98). Menlo Park, CA: AAAI Press.
- Cohen, J. (1986). Theoretical considerations of peer tutoring. *Psychology in the Schools*, 23, 175-186.
- Davis, E. A., & Linn, M. (2000). Scaffolding students' knowledge integration: Prompts for reflection in KIE. *International Journal of Science Education*, 22(8), 819-837.
- Gama, C. (2004). Metacognition in interactive learning environments: The Reflection Assistant Model. In *Intelligent Tutoring Systems Intelligent Tutoring System: Proceedings of 7th International Conference, ITS 2004* (pp. 668-677). Maceió, Alagoas, Brazil: Berlin/Heidelberg: Springer.

- Ge, X., & Land, S. M. (2004). A conceptual framework of scaffolding ill-structured problem solving processes using question prompts and peer interactions. *Educational Technology Research and Development* 52(2), 5-27.
- Graesser, A. C., Person, N. K., & Magliano, J. P. (1995). Collaborative dialogue patterns in naturalistic one-to-one Tutoring. *Applied Cognitive Psychology*, 9, 495-522.
- Graesser, A. C., VanLehn, K., Rose, C., Jordan, P., & Harter, D. (2001). Intelligent tutoring systems with conversational dialogue. *AI Magazine*, 22, 39-51.
- Lai, G. (2008). Examining the effects of selected computer-based scaffolds on preservice teachers' levels of reflection as evidenced in their online journal writing. Unpublished PhD Dissertation, Georgia State University, Atlanta, GA.
- Leelawong, K., & Biswas, G. (2008). Designing learning by teaching agents: The Betty's Brain system. *International Journal of Artificial Intelligence in Education*, 18(3), 181-208.
- Moon, J. A. (1999). *Reflection in Learning and Professional Development: Theory and Practice*. London: Kogan Page Limited.
- Xie, K., & Bradshaw, A. C. (2008). Using question prompts to support ill-structured problem solving in online peer collaborations. *International Journal of Technology in Teaching and Learning*, 4(2), 148-165.

Engaging Students in Active Learning: Case Studies in the use of Game Development in Education of Software Engineering

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Abstract: *We report on our experiences with some applied cases of the use of game development in university education to undergraduate and graduate students who major in Software Engineering at the College of Software, Beihang University, China. Our approach is combining game development and practical software engineering related curricula to engage students in active learning by themselves. We will discuss the benefits and challenges that arise from such a combination for both educators and students. The aim of this paper is to clarify the aspects that must be considered to apply game development to Software Engineering Education at university level.*

Keywords: Computer Game Education, Software Engineering Education, Learning by doing, Experiential learning

1. Introduction

1.1. Background

After the internet bubble exploded, many students do not believe in the job market in computer and software anymore, they doubt the career prospects in computer science and fear for the hard and monotone study, which directly induced the dropping of the computer science enrollments. If the decline is standing for a long while, the foundation for tomorrow's computer scientists and software engineers, even whole information technology industry will be impaired. On the other hand, recently computer games have a large and continuously expanding world-wide market, especially in China. Games, entertainment applications and interactive digital media including animation and cartoon, are an important economical factor that cannot be easily neglected.

Facing the dilemma of software engineering education and game industry, many universities have expressed a desire to make the Computer Science major more compelling and enjoyable by adding some computer game factors into the classroom. In fact, for an educator who teaches software development, computer games are ideal examples to demonstrate the pure benefit of computer education, and a more important fact is that the game development process is interesting, which can engage students into an active learning status.

From the technical point of view, computer games comprise a huge variety of important engineering techniques such as modular software design, high performance, ingenious data structures, and interaction design. Practical knowledge in such areas is important for every educator, regardless of his application area. Giving students the opportunity to develop computer games as part of their education encourages them to create new ideas and concepts that may be one of their childhood dreams. So some educators and industrial experts recognize that exposing students to game development concepts in the context of a rigorous program of computer science study is good for the students, educators and the industry.

In summary, the computer game has been a new medium and art form that is new to the generation in universities today. Ignoring the technology of games development in computer education is not sensible. Developing a computer game contains all of the basic elements that are taught in computer science and software engineering classes. Students have fascination and motivation to games and game-related technologies, which can be used to encourage them to learn more about the technical aspects of computer science and software engineering.

1.2. Our Approach

Our master program of Game Development & Design is designed to provide students with the ability to apply core knowledge of software engineering to game development through a set of curriculums that emphasize interactive software development techniques and game development process. For the undergraduate students, although we did not provide explicitly special game development direction to them, game-oriented themes were introduced into their practical curriculums. Applying some viewpoints of Kolb's Experiential Learning Theory and Gibbs's teaching method 'Learning by doing', our approach integrated the features of game development and software engineering process theory. The following list of points and actions has been used in our cases:

- I Active learning is very important in our approach.
- I We emphasize learning from practice.
- I The nature of the activity will be carefully designed by teachers.
- I We advocate team work.
- I We hope the learning result is open and can be reused. This openness may not exist at the outset but may be fostered through successive experiences of the experiential learning cycle (Gibbs, 1988).
- I We arranged some teaching assistants or instructors to supervise the process of student projects by a tailored Rational Unified Process (IBM, 2003) model, which provides a framework of cyclical sequence of learning activities (see Figure 1).

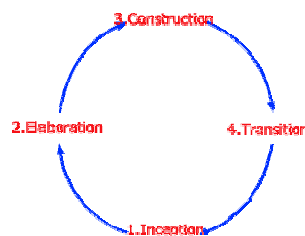


Figure 1. Cyclical sequence of learning activities

- I We emphasize continual and effective learning in project. In each phase of the cycle, students might do iteratively their works in some loops for improving the quality of result, and also do iteratively their whole work in some incremental loops for increasing their project experiences. This learning cycle might involve the sequence of learning activities illustrated below:

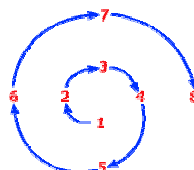


Figure 2. Incremental learning cycle

2. Case Studies

2.1. A Case Study in Undergraduate Practical Curriculum

2.1.1. Practice & Observations

We have applied above approach to our undergraduate practical courses for many years. The students registered in such courses will be required to participate in a software development project, they will be divided into some project groups voluntarily. At the beginning of project the instructor made a list of requirements that the project must fulfill. But the contents and developing technologies were up to students themselves. There are many teams who choose game and graphics direction in every year.

2.1.2. Results & Challenges

Table 1 shows the comparison result of projects in game related and other type.

Table 4. Teaching result from Academic Year 2005 – 2009

Academic Year	Student average score of game related projects (Total:100)	Student average score of other projects (Total:100)
2006	87.5	84.6
2007	82.9	80.2
2008	86.2	80.9
2009	86.4	82.3

The result shows the average score of students who choose game and related projects is obviously higher than the others. And also, every year we will encourage our student team to take part in some contests, such as Microsoft Imaging Cup, BUAA Fengru Cup and so on. The project of game related always can get better awards. For example, the work ‘Digital Beihang’ (Figure 3. left-handed), won the first class award of Fengru Cup in 2006. Another team’s work mobile game ‘Campus Dustman’ (Figure 3. right-handed) won the second class award in 2007.



Figure 3. Some undergraduate students’ gaming works

There are, however, a couple of difficulties and Challenges to both educators and students. The first one is about programming technologies, especially gaming programming related technologies. Many game platforms and related techniques are not open for public, so that we just can narrow directions into a few development platforms and technologies. Another aspect is that the work of content creation, for example artwork design and play design, is hard to students who major in an engineering-related or technology-related discipline. If we neglect content creation, the result of games will become boring and unattractive. To meet this challenge, we suggest the project team invite other students major in arts related discipline to join in. In fact, this collaboration between disciplines was proofed to be really useful for the success of project result.

2.2. A Case Study in Graduate Game Development Curriculums

2.2.1. Practice & Observations

Our graduate students who major in Game Development & Design will take four specialty courses that other directions have not. After finishing them, our students will be organized to some small game development teams consisted of 3 to 7 members before they enter into game companies for internship. During about three months of practice, they will taste of all of things in game development process.

The teachers of specialty curriculums will be their mentors or supervisors. Finally, their product will be given a mark to evaluate their capability for entering into game industry.

2.2.2. Results & Challenges

After one semester special studying and practical training, our students got special abilities of game development differ with the students who major in other directions. Figure 4 shows some works from our graduate students teams.



Figure 4. Works of Graduate students

We found that these game projects were a full success. In the end, although there is always room for improvement, both the teachers and the industrial experts were somewhat amazed about the complexity and the quality of the final result. Therefore the average starting salary of these students is higher than others who major in other direction.

Of course, however, creating game products combines the skills of art and computer knowledge. As undergraduate students, content creation is also a big problem to those graduate students with only engineering background. Besides this, there are many other difficulties which all game designers have to cope with. The development of a game engine with all technical aspects can easily become very complex. However, we see such difficulties more as a challenge for software engineers, so it is the task of the teachers to guide their students to meet these challenges.

3. Conclusions

Developing computer games at a university has several benefits and challenges. According to our near five-year experiences using Game Development in Computer Science Education for undergraduate and graduate students in Beihang University, the following list comprises some important points that we were aware of:

- I Game development offers a playful approach to software development from a didactic point of view.
- I A well-defined process is very important to the use of game development in Software Engineering education.
- I Acquiring effective skills and high starting salary is very important to students. Learning by doing is the best way to help them to reach the goal.

- I Using Game Development in Software Engineering Education at university level should collaborate with game industry closely.

4. Further Work

Now our work is mainly depended on the teachers' experiences. We have to see that creating a structured, detailed and well-defined process and required skills of game development is essential. Our further work aimed at adding more compelling and enjoyable factors of game development and design to practical courses for software engineering and related major students. Accordingly, we'll also develop a set of tangible curriculums ranging from simple game theory to an ambitious game project for building Hands-on Lab to reuse those works.

References

- C. Rezk-Salama, S. Todt, L. BrÄuckbauer, T. Horz, T. Knoche, B. Labitzke, M. Leidl, J. Orthmann, H. Payer, M. Piotraschke, T. Schmiade, and A. Kolb. *Game Development as Part of the Computer Science Education*. Computer Graphics Group, University of Siegen, Germany.
- Gibbs, G. *Learning by Doing: A Guide to Teaching and Learning Methods*. Further Education Unit, London, 1988.
- IBM. *Rational Unified Process: Best practices for software development teams*. Rational Software White Paper, 2003,
- 3
- Kolb, D. A. *Experiential Learning - Experience as the Source of Learning and Development*. Prentice- Hall, New Jersey, 1984.

A Learning System of Qi Gong Calligraphy*

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Abstract *Qi Gong calligraphy (i.e. Qi font) is one of famous calligraphy form in China for its liquid structure and concise strokes. Today, more and more people like this form of calligraphy and would like to learn how to write Qi font. In this paper, a Qi Gong calligraphy learning system with computer is designed through simulating the actual writing process stroke by stroke. This system is mainly composed by three parts: a Qi font vector library with 3755 frequently used Chinese characters, a novel procedural learning simulation, and the result evaluation component.*

Key words: calligraphy, Qi font, vectorization, evaluation, learning system

1. Introduction

Chinese calligraphy has very long history and profound impact to the world's art. Because it uses soft brushes, it is quite different from other format of art. Qi font is a form of calligraphy, which is famous for its liquid structure and concise strokes. Today, more and more people like this form of calligraphy and would like to learn how to write Qi font. In this paper, a Qi Gong calligraphy learning system based on computer simulation is presented, which can be used by calligraphy lovers to practice and learn Qi Gong calligraphy.

Computer-based calligraphy learning system has caught the attention of many researchers. A Japanese character training system (Solis et al., 2002) is developed, the computer will match the strokes rendered by users to the character recorded in library. A Chinese calligraphy training system is established using a six degree freedom delta haptic device and a mirror that collocated visual and force information. The learning process was motion guidance and path constraining (Teo et al., 2002). Nelson Chu focused on simulation of soft brush and the ink deposition during painting process in real time (2004). Furthermore, Xu Songhua (2002) constructed an entity model to simulate a soft brush. Researchers from Zhejiang University also published several work on vectorization of calligraphy and the shape description for digital calligraphy system (Junsong Zhang, Hongwei Lin, & Yingfei Wu, 2008). Most attracted learning system focus on checking sequence of strokes and the spatial characteristics, so they asked learners to write correct strokes and by correct sequence. But it may be difficult for a new learner.

In this paper, we will take Qi calligraphy as an example to present a computer system for learning Chinese calligraphy. In this system, you can learn Chinese Qi font characters stroke by stroke. Our advantages are first we built a Qi gong font-library for first time, second, the system is easy for you to study even if you are not familiar with Chinese, because we defined everything at the beginning, at last the representation of the brush is unique.

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Our system mainly includes two subsystems: offline font-library construction system, and online calligraphy learning system with stroke simulation and evaluation. In the following of this paper, we will first introduce the whole system and the key technologies involved, then we will discuss the offline font-library construction system, and online calligraphy learning system respectively. Finally, conclusion remark and future works are discussed.

2. Introduction to the system

Qi gong learning system includes two main modules: offline font-library construction system and online calligraphy learning system. Chinese character is composed of sequential strokes. So the calligraphy learning system needs to provide characters with their strokes. For this purpose, we vectorized the most frequently used Chinese 3755 characters in Qi font, by tracing the outline of the calligraphy, and decomposed each character to strokes. Vectorization of Chinese characters is an important topic for Chinese Information Processing. In this way, we built a font library, in which each vector character includes the representation of the strokes and their sequence. We built a computer system to automate and manage these processes, and we call it offline font-library construction system.

The online calligraphy learning system has two core components which are brush simulation and evaluation of the result. The online calligraphy learning system can simulate the effect of soft brushes so that user can see the “real” effect just like using real brushes and papers. We designed a novel model to simulate a Chinese brush, which is a basic application of non-photorealistic rendering for Chinese calligraphy. The brush model here we designed consists of a skeleton and a surface, which is deformed as a spring-proton system. The brush model is expressed by Ball B-Spline(Z. K. Wu, H. S. Seah, & M. Q. Zhou, 2007), and the footprint is expressed by Disk B-Spline (Hock Soon Seah, Zhongke Wu, Feng Tian, Xian Xiao, & Xie Boya, 2005), which are parametric solid representation of freeform tubular objects. We also tried to simulate ink diffusion when writing with a brush. Meanwhile, we provided an effective evaluation system based on pixel level comparison, so that after user finishes a whole character a total score can be given. Furthermore, the system also includes a user-friendly user interface, which can tell user to write the character in correct sequence, explain the meaning character, give its pronunciation and etc.

3. Qi gong font-library construction

3.1. Introduction to Vectorization

Vector form is the most important way to save storage. Beside, vector form of ancient Chinese calligraphy is also convenient for research of digital calligraphy document, calligraphy character recognition, document press, and calligraphy education. In this paper, we discussed the contour based vector algorithm, which is a non-thinning based method to implement vectorization of Qi font characters. Firstly, the original calligraphy image of Qi font is converted to a monochrome image, then edge detection step is performed and the outline is traced to find the contour of the calligraphy character. At the same time, key points are detected by corner detection and the character is decomposed into strokes. By using the algorithms, we implement vectorization of 3755 Qi font character and built a database of Qi font vector characters. The details are given below.

3.2. Contour extraction

Boundary is the most important information for identification of a calligraphy image. We use the following algorithm to find the contour of characters. (1) Making the original calligraphy image of a Qi font character to a monochrome image; (2) Boundary detection. Moving the bitmap to all directions with one pixel width respectively, then minus original image to get the edge, and store edge data to an array; (3) Tracing the outline of the character. Traverse the boundary points to build a closed contour. The results are shown in Figure 1.

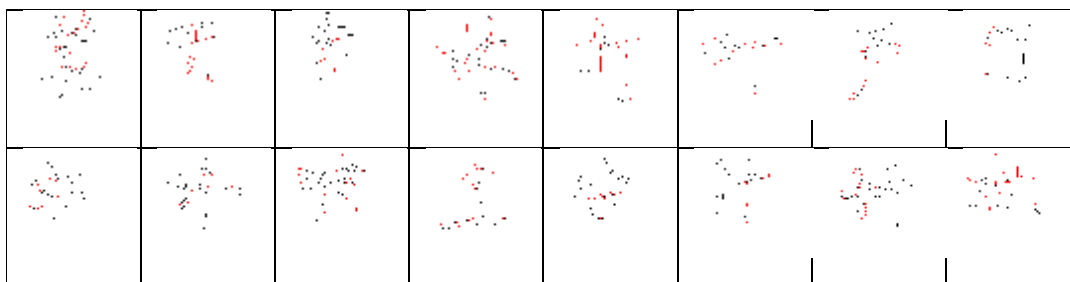


Figure 1 Result of vectorization

3.3. Decomposition of the character

For learning calligraphy system, users need to simulate stroke by stroke. Therefore decomposing a character into strokes with sequence is necessary. The key work for decomposing a character is to find the intersections points among the strokes. Here we refer to Ao's work on Corner detection algorithm⁹, in a 2008 article. At first, the inflexion points of the outline are determined. Then the real corner points are chosen through user' interactions. Finally a complete stroke is obtained by interpolating these points near the corner point.

3.3.1. Corner detection

Compute the cosine of current point P with its before and after another k points' connection a_k, b_k , which is

present as: $\cos q_k = \frac{a_k \cdot b_k}{|a_k| |b_k|}$. If the angle q between a_k, b_k is less than a certain value, which is defined 140 degree here, we will take it as an inflexion point, which can not be a real corner, but only be generated during writing. Therefore, here users' interaction is used to determine the real corners.

3.3.2. The procedure of decomposing a character

Decomposing a whole character is a complex work when there are many intersection points. When these corners are obtained, we need to determine which corners are needed to link to pass through the intersection area when several strokes are intersected. Here we use the neighbor points of a corner to calculate the direction vector on the outline of the character. When the angle between the direction vectors of two corners is the least, the two corners will be linked. These points in the part of intersection area will be computed through interpolating these neighbor points of the two corners. When tracing a closed contour, a stroke is decomposed. By using the method, the whole character is traversed, all strokes are decomposed.

3.4. Optimization of results

The stroke boundary is not very smooth after decomposing, so we do some optimization work. We specify a segment which is not ideal smooth, then do interpolation and fill the closed contour. By this way we finally get a perfect stroke bitmap (Figure 2).

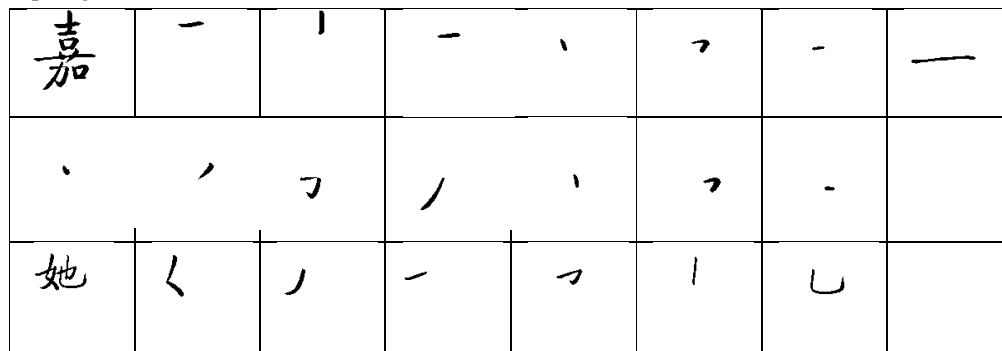


Figure 2 Optimization of result

Sequence of characters is important for next application. Luckily because of human interaction, we can decompose the character step by step at the original sequence, so strokes sequence will be stored correctly as given by you.

3.5. Qi font database

With a contour based non-thinning vectorization method, we found a Qi font database composed of 3755 frequently used characters, which includes of vectorized decomposed strokes and their bitmaps. Then we index the 3755 characters with their sequence in GBI. So in each item, it includes index of character, index of strokes, pixel number of each contour, pixel coordinates of the counter and the sequence of the stroke. In such a way the pre process of Qi calligraphy is finished and it can be used in the learning system, which is shown in Figure 4.

4. Stroke Simulations

In this module, painters can render the character stroke by stroke, the input device is simulated as a real Chinese soft brush, and ink diffuses after writing is also simulated.

4.1 Brush simulation

4.1.1. Introduction

Virtual brush simulates true soft brush, with which brings you a real experience of painting and writing. Because of digital format, the virtual brush is quite convenient.

In this work, we considered the brush as a spring-proton model. The brush has a skeleton which is consist of several spine nodes and some other attributes. In each step, we compute forces of each spine node and integrate the next state with Euler method. Besides, we express the brush model with Ball B-Spline, and the footprint by Disk B-Spline.

The painter facility is Intus III graphics tablet and stylus produced by Wacom Corporation. It can obtain 6 DOFs of the brush in real time. The brush location, pressure, twist degree of itself and the tilt degree can be gained from it.

4.1.2. Brush and Footprint model and their representation

A brush skeleton model consists of spine and lateral nodes, which show bend and twist of the brush. Between two spine nodes is a segment and each segment has its own radius, which decide the brush's size. We use a new way called Ball B-Spline to represent 3D brush model, which is a parametric solid representation of freeform tubular objects. The tubular object is interpolated by a series of balls, which is defined by center point and its radius. So the brush can be represented by spine nodes and its radius.

The imprint of the brush can be expressed by Disk B-Spline, which is a skeleton-based representation of a 2D region. It is interpolated by a series of circles, which is defined by center point and its radius. So it can be utilized in representing brushstrokes.

In general, the brush has three states: initial, dip, and work. So when using a virtual brush, first input parameters, then found the geometry model, then compute dynamic state. The representation of the 3D brush and 2D region of stroke are all new try.

4.1.3 Deformation of brush

We define the brush as a spring-like system. Each spine node may get five forces: press, the mouse dragging force, the friction (if it contacts the paper), the reaction from paper, and spring forces between each other. These forces impact each other and achieve a balance state with Euler method. The brush is different from a real spring system because the brush root is usually much stiffer than the tip, while the spring damp constant is equality everywhere. So we defined different values of stiffness coefficient in the brush, and progressively shorter segments towards the brush

tip in order to dedicate higher resolution for modeling efficiency. Euler integration is used to gain next position after compute spine nodes' forces and velocity during iteration course.

4.2 Ink deposition and diffusion

A good brush model should be flexible enough to accommodate these characteristics. Besides, the ink dense, the moisture of the brush and even the friction of the paper are all greatly affected the last effect. In our system, we tried to do some texture synthesis to simulate the ink deposition and diffusion.

The footprint is obtained by rendering the brush surface model clipped by the paper plane in orthogonal projection view. During this process, ink diffuses a little due to different materials of paper. We can subtract the ink values of stroke edge little by little to simulate ink diffusion

5. Evaluations

Evaluation system gives a score to supervise what you did after rendering the stroke every time. It is called shape match of similarity measurement. Our task is to compare the original stroke decomposed from calligraphy bitmap with what you have rendered. Generally, shape information can be described of contour, skeleton, and area.

In pre processing of calligraphy, each decomposed stroke is present by contour information, while the user imprint is expressed by skeleton according to our system. So we try to make them consistency, it is area description. Then we use a memory filling method to achieve comparison. The similarity of one stroke is regard as weighted sum of percentage of intersect area with original stroke and intersect area with what you have rendered.

After finishing a character, we compute the average score of all strokes, which is the whole character's score:

$$score = (\sum_{i=0}^n a_i A_Intersect_i / A_Orig_i + b_i A_Intersect_i / A_Stroke_i) / n \quad (1)$$

$a_i + b_i = 1$, n is the stroke number of the character, A_Orig is the area of original stroke, A_Stroke is the area of what you rendered, and $A_Intersect$ is the intersect area of the original stroke and what you rendered. The evaluation result is showed in Figure 3.

6. User interface

The brush model has some optional parameters. You can choose stiffness which defines the plastic, style and color of the brush at first. Together you can select different paper to decide frictional coefficient and degree of diffusion.

The Qi font calligraphy learning system is constructed due to these functions above. For better application for foreigners to learn Chinese characters, we show some explanations of the character and its pronunciation on the interface together. A whole system is displayed below (Figure 4).

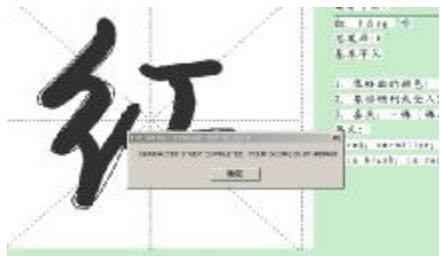


Figure 3 Evaluation of learning



Figure 4 The interface of our system

7. Conclusion and future work

We construct a system for Qi font calligraphy learning, research and implement some functions along, such as vectorization, brush model, ink deposition and diffusion, similarity measurement and so on. It is very delighted that the

system can be applied for character learning effectively. But some function should be enhanced. For example the system is focus on character learning, so the brush doesn't simulate splitting and the paper can try to set more parameters.

References

敖雪峰 基于角点检测的毛笔字笔画分割算法 北京师范大学 2008

B.Baxter, V. Scheib, M. Lin and D. Manocha. DAB: *Interactive haptic painting with 3D virtual brushes*, SIGGRAPH 2001 Proceedings, August 2001.

Nelson.S.H Chu and Chiew Lan Tai. *Real Time Painting with an Expressive Virtual Chinese Brush*. Hong Kong University of Science and technology.

Teo CL, Burdet E, Lim HP: A robotic teacher of Chinese handwriting. *In: Proceeding of 10th international symposium on Haptic interfaces for virtual environment and teleoperator systems*, HAPTICS, pp 335-341, 2002

Solis J, Avizzano CA, Bergamasco M: Teaching to write Japanese characters using a haptic interface. *In: Proceedings of the 10th international symposium on Haptic interfaces for virtual environment and teleoperator systems*, HAPTICS, pp255-262, 2002.

J. Lee. Simulating oriental black-ink painting, *IEEE Computer Graphics and Applications*,19(3), pp.74-81, May/June 1999.

Hock Soon Seah, Zhongke Wu, Feng Tian, Xian Xiao, Xie Boya. Artistic Brushstroke Representation and Animation with Disk B-Spline Curve. *ACM SIGCHI International Conference on Advances in Computer Entertainment Technology (ACE 2005)*, 15th - 17th June 2005. Polytechnic University of Valencia (UPV), Spain (Full paper))

S Strassmann. Hairy Brushes[C]//*SIGGRAPH'86 Proceedings*. USA : ACM Press , 1986 , 20(4):225-232.

S.Saito and M.Nakajima. *3D physics-based brush model for painting*, SIGGRAPH 99 Sketches, Conference Abstracts and Applications, pp.226-226,1999.

吴英飞. 书法重现及其在数字化图书馆中的应用.浙江大学博士学位论文，2008

Z. K. Wu, H. S. Seah, M. Q. Zhou. "Skeleton based Parametric Solid Models: Ball B-Spline Curves", *10th IEEE International Conference on Computer-Aided Design and Computer Graphics*, 15-18 Oct. 2007, Beijing, 421-424.

王亮 形状提取与识别 浙江大学 博士学位论文 2003.

SonghuaXu, MinTang, FrancisLau, YunhePan. A Solid Model Based Virtual Hairy Brush[J]. *Computer Graphics Forum*(S0167-7055),2002,21(3):299-308.

Junsong Zhang, Hongwei Lin, Jinhui Yu. *A Novel Method for Vectorizing Historical Documents of Chinese Calligraphy*. Zhejiang University State Key Lab of CAD&CG Hangzhou, Zhejiang, 310058, China

Second Life for Education

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Abstract: *In 2009, a team of officers in Education Technology Division Ministry of Education (ETD MOE) started exploring the use of Second Life, a 3D virtual environment for education purposes. The project seeks to explore the educational possibilities of participatory immersive environments and their accompanying pedagogical strategies. Five secondary schools are involved in this proof of concept project where teachers will explore the use of Second Life in the teaching of Chinese Language, Geography and Science.*

Keywords: Second Life, Virtual World, Learning, Education, Students

1. Introduction

3D virtual worlds have existed for a number of years. These virtual worlds have developed “through the convergence of social networking, simulation and online gaming (Gartner 2007).” In the virtual world, humans can interact with each other socially and economically via 3D object representations known as avatars. Physical limitations may be overcome in the virtual world, such as avatars having the ability to fly without any machinery aid. One can interact with another avatar, meet other users, create objects and community structures within the virtual world and participate in individual and group activities. A small taskforce within the Educational technology Division (ETD) of the Ministry of Education (MOE) was formed to look into possible applications of Second Life for educational use in 2009.

2. Key Considerations for using virtual worlds in Education.

The uniqueness of virtual worlds versus other Web2.0 applications is their generative capabilities as three dimensional objects can be created by users that can be seen and manipulated by other users in the virtual world. A virtual environment can be generic or built with a theme. This flexibility of being generalized or contextualized can make virtual learning environments very effective learning spaces for many disciplines.

Educators can implement learner-centred pedagogies that “promote active, constructivist and inquiry or problem-based pedagogies with virtual worlds (Kluge & Riley 2008).” Virtual worlds allow a learner-centred model of instruction that often incorporate constructivist learning theories. Activities can be constructed to actively engage the students involving the process of constructing meaning from their experiences.

Virtual environments allow multiple learners to communicate and collaborate on the same issue or problem. Students frequently form learning communities “which interact socially to discuss strategies, share experiences and provide encouragement via websites, discussion boards, blogs and wikis. (Antonacci & Modaress 2005).” Inter-avatar interaction in virtual worlds may facilitate collaboration as the interaction resemble more like ‘real time’ face-to face communications than other popular technologies such as email, blogs and wikipedia.

Hence it can be seen that virtual worlds offer a new type of platform that allows the implementation of learner-centred, constructivist and collaborative pedagogies for learning and teaching in non-threatening virtual settings.

3. Objectives

The ETD Second Life is primarily a pilot test to explore the use of Second Life (SL) as a 3D virtual platform for virtual classroom teaching, with the aim to

- (a) train teachers in using SL as a platform of teaching and learning;
- (b) develop, through pilot studies, pedagogies of teaching in the virtual world.
- (c) facilitate collaboration among students in solving authentic problems.
- (d) study effectiveness of students’ understanding in some subjects concepts.

4. Virtual World Project by ETD

We believe that a good use of technology should support teacher management of his class, provide pedagogic flexibility as well as accessible inside and outside the class. Technology will be able to assist school teachers and students in creating opportunities for discussion, managing dynamic cooperative learning activities and inspiring enlightening self discovery. We noticed that all these can be found in the Virtual World.

The 3D virtual world created by ETD comprises virtual islands where 3D structures and terrains have been customized to cater to the needs of three different subjects Chinese, Geography and Science. The virtual islands are exclusive, and only designated teachers and students will be given access to these virtual islands.

To fully exploit the power of virtual worlds, the content to be created focuses on aspects which traditional ICT platforms do not address too well, especially where users need to interact and examine the objects/scenes from different perspectives. These include:

- extremes in scale – the very big (e.g. solar system, geographical features, etc) and the very small (e.g. cells, molecules, journey through the digestive system, etc).
- historical – things and events of the past where certain artefacts no longer exist or are not easily accessible (e.g. Admiral Zheng He’s flag ship, Singapore in the old days)
- the future – things to come, where the imagined can be visualised in a more concrete manner.

- unsafe environments – locations where a field trip is not possible or hazardous. (e.g. interior of a volcano, deep sea, etc)
- not easily accessible and inaccessible environments – places far away, (e.g. Grand Canyon) and places physically impossible to access. (e.g. hydrothermal vents, etc)

ETD is currently working with 5 secondary schools to pilot the use of Second Life in the curriculum. We have developed a number of resources in the subject areas of the Chinese Language, Geography and Science. Lesson plans incorporating virtual world elements are provided as start-up resources for the teachers. Working sessions are carried out for ETD officers to work with the teachers to co-create more lesson plans for the project. In-world training platforms have been constructed for training workshops to equip teachers with the necessary skills to conduct lessons in Second Life. Likewise, in-world trainings are also provided for students to facilitate teachers in training their students in the basic skills of using Second Life. A teacher training was conducted in Feb 10 to share about the students training platform and the formalization of action research question. An online portal (<http://vworld.edumall.sg>) for the project is set up as a platform for teachers to discuss on the project and exchange ideas. The platform also serves as a repository for the storage, exchange and refinement of lesson plans created by the teachers. Teachers and students will start using the virtual world portal to conduct lessons from mid March 2010.

5. Pedagogical Framework

We based our development of the virtual content and lessons on a proposed three phase pedagogical framework: Engage-Examine-Extend.

The ‘Engage’ phase aims to arouse the interests and entice students to the lessons by the use of lesson elements to enthuse students; possibly directly through engagement with the virtual world or other starter activities.

The ‘Examine’ phase capitalizes on the immersiveness of the virtual world. Students will experience the virtual work in one or more activities (learning by exploring). While doing so, they will, through the avatar (learning by being), embody the characteristics of their projected persona as they work, occasionally on their own and other times, collaboratively (learning by collaborating) with their peers. In-world activities could include acts of exploration, testing of ideas/hypotheses, authentic tasks and other meaningful activities.

The ‘Extend’ phase could comprise a mix of in-world and real world activities. Students would be given the opportunities to apply what they learn to novel situations either in-world or in real world platforms like blogs and wikipedia.

This proposed initial framework will be refined during the course of our experimentations.

6. Virtual World for the Study of Chinese Language

The overall goal of this project is to provide a three dimensional, interactive, avatar-based collaborative learning environments for students' learning and practice. This unique educational metaverse will have a number of scenes based on historical places and events. This will allow students' avatars to personally experience the cultural wonders of ancient engineering work and significant moments in history. For example, students' avatars could board Zhenghe's flagship with nine masts, four decks as well as a massive amount of cargo. Students and teachers are able to interact with the 3D objects in the ship and retrieve information about the ship and era of Ming Dynasty's maritime endeavours. Students are required to write journals and reviews based on their virtual journey. The students learning outcomes will be assessed through their journal writing.

Another example is a virtual trip to Singapore River in the 1950s to have a first person's experience of life in the past and to discover the historical significance of places and place names. Students will experience the coolie and immigrant's lifestyle and the traditional games played in the older days. Students can be engaged in collaborative mode of learning as they can be organized in groups, each looking for specific categories of information and they roam the virtual old Singapore River. They will come back and work collaborative to put up journals about the Singapore River in the 1950s.

By using the avatars in Second Life, students will be able to experience a range of different scenarios that commonly happen in real life environments. Teachers will guide the students to select roles and scenarios and role - play in the virtual world. For example, in the classroom, teacher may divide the class into small groups and assign roles to each group member. Students are required to role-play in the virtual world. Their in-world conversations and actions will be saved as text and videos and reviewed by the teacher.

The unique qualities of a 3D virtual world provide opportunities for rich sensory immersive experiences, authentic contexts and activities for experiential learning, simulation and role-play. This is especially useful as language learning can make good use of a diverse range of scenarios. Virtual world allows for the creation of amazing, immersive environments based on historical places and events which cannot be found in real life. This is important as the learning of the Chinese Language as is often linked to culture related issues and historical artifacts and events.

7. Existing Efforts in Using Second Life for Education

A quick survey of Chinese Language teaching related activities in Second Life seems to reveal a preference for using noticeboard or exhibits to display chinese words, characters or traditional chinese stories. In the National University of Singapore, though not for teaching of Chinese, virtual lessons take place in virtual tutorial rooms where students works with groups to collaborate with one another, using voice chats. In the Taiwanese sim of Virtual Learning Lab in Second Life (operated by 資策會-創新應用研究所), students practise conversational Chinese through station based design activities plus interactions with artificial avatars.

We believe that our model of teaching Chinese using Second Life will offer a possible option to motivate the students in the learning of Chinese language.

8. Moving forward

With the school teachers and students involved in the Second Life project in 2010, data will be collected as the pilot project proceeds. Teachers will be engaged in action research to ascertain the effectiveness of educational use of virtual worlds. Working together with teachers, we aim to develop through this pilot study a set of pedagogy on the use of virtual environments in education. We will also be encouraging teachers to participate in relevant conferences and seminars to share their action research findings on virtual world.

References

- Antonacci, D., & Modarass, N. (2005). Second Life : The educational possibilities of a massively multiplayer virtual world (MMVW). Retrived from <http://connect.educause.edu/library/abstract/SecondLifeTheEducati/43821>
- Dickey, M. D. (2000). 3D Virtual Worlds and Learning: An Analysis of the impact of design affordances and limitations of Active Worlds for formal and informal education.
- Gartner (2007). Gartner says 80 per cent of active internet users will have a “Second Life” in the virtual world by the end of 2011. Retrieved from <http://www.gartner.com/it/page.jsp?id=503861>
- Kluge, S., & Riley K(2008) Teaching in Virtual Worlds: Opportunities and Challenges. Issues in informing science and information technology, 5 Pg 127 – 135.

Intelligent Augmented Storytelling

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Abstract: *Interactive storytelling in virtual world provides a huge potential in learning and education. Alice Storytelling is a successful example. However Alice Storytelling lacks ability to support complex story, dynamic character as well as to handle the conflicts of author narrative and user interactions. This paper investigates Fuzzy Cognitive Map (FCM), for modeling virtual characters' behaviors, user's interaction in interactive storytelling. A reusable practical method and toolkit based on FCM to create Intelligent Augmented Storytelling using Alice is proposed. The experiment result shows the proposed methods are promising for intelligent augmented interactive storytelling.*

Keywords: Augmented Storytelling, Fuzzy Cognitive Map

1. Introduction

In recent years, Computer-Generated Virtual Worlds has popped into the headlines. As people's demand on computer entertainment are getting more sophisticated, the software tools to build virtual world and their underlying technologies must advance with the times as well. However, in most existing virtual world, virtual objects' lack of perception with their environment brings certain rigidness to them; and thus creates gap with attribution of the real world, where human beings and animals perceive things and react upon sensitive things.

Fuzzy cognitive maps (Kosko 85) are signed fuzzy digraphs which models the real world problem into a collection of concepts and their interactive causal relationships. Fuzzy cognitive map is a cognitive map or a "mental landscape" for knowledge representation and inference. It is one of the theories to help to bridge such gap and improve perception and automation to enrich virtual objects, thus FCM satisfies a pragmatic need for intelligence in virtual world.

2. Alice Storytelling

Alice is an innovative and unprecedented 3D programming environment that aims to transfer pure text programming into programming by creating an animation (Jose 2008). Alice has been successfully adopted by many middle school and high school teachers across America, and become their favorite educational software to teach "Introduction to Programming" course. Storytelling Alice, a spin-off of Alice, was created by Caitlin Kelleher (Kelleher 2005&2007) as her doctoral work at Carnegie Mellon University. Its purpose is to motivate students, especially female students to learn programming notation through creating their own 3D animated stories. Compared to Generic Alice, it includes a set of high-level social animation based on the survey they conducted and analysis of storyboards that students created and usability testing with target audience.

Overall, Storytelling Alice has a very interactive and user-friendly interface. Users can drag the tile of every graphical method from the object tree and place it on the script editor with desired sequence in order to construct a virtual story. However, there are many complex causal relationships that exist in real world's entities like human beings as well as in stories that simulates real world. Such causal influence in Storytelling Alice so far cannot be demonstrated, because all the virtual characters don't really have a "brain". Additionally environment variables always change in

virtual stories; such uncertainty can be addressed to improve storytelling. Nevertheless in Storytelling Alice's, story scripts are all pre-fixed and thus characters wouldn't have different behaviors by perception of changes. Moreover, software users are now getting more and more "nitpick" about the virtual world environment. They want more innovation in visual quality, more excitement virtual world, more intelligent in characters; to sum up; they just want to see "more". Hence, it's a pragmatic need for Storytelling Alice to improve and attract users by bring in intelligent models and tools.

Hence, this paper introduces an Intelligent Augmented Storytelling Alice to enhance original application by embedding FCM theory and modeling tools to express certain types of interconnection and emotional behaviors reflected from causal changes.

3. Storytelling Fuzzy Cognitive Maps

FCM was first proposed by Bart Kosko (Kosko, 1985). FCMs are soft computing tools which combine elements of fuzzy logic and neural networks. They can be represented both in graphical view and in mathematical models. In terms of the graphical representation, a FCM is a causal graph which includes the following necessary components:

- (a) Nodes: Each concept node indicates a characteristic of the system such as events, actions, and states.
- (b) Edges: to represent the direct causal influence between concepts.
- (c) Weights: to represent how much one node influence another.
- (d) Activation events at different moment t. The stimulated events can bring changes to certain concepts, edges, or even the overall of FCM.

Beyond the graphical representation of FCM, there is a mathematical model, in which a FCM is a combined set of **(C, V, A, W, Ea, R)** [4].

- **C** = { $C_1, C_2 \dots C_n$ } is an set of n concepts, which will be used to form the nodes of the FCM graph.
- **V** = { V_1, V_2, \dots, V_n } is a vector with size n for values of the set of concepts. Each value should also be bounded in a range.
- **A** $\in C \times C$ is the set of edges A_{ji} to indicate causal relationship of $C_i \rightarrow C_j$, where i and j belongs to range [1, n].
- **W** is the weight associated with all the possible edges set **A**, If value of W_{ji} (weight on edge A_{ji}) is 0, C_i and C_j are not directly related; if $W_{ji} > 0$ or $W_{ji} < 0$, the causal relationship between C_i and C_j exists.
- **Ea** is the sequence of activation events occurs with time, which might or might not change the state of the FCM matrix.
- **R** is a recurrence relation.

During simulation, the value of each concept will be influenced by the set of edges pointed at it, with a function based on appropriate weights and its previous value. The new value V_i for C_i can be calculated by the following formula:

$$V_i^{new} = f(\sum_{j=1, j \neq i}^n \Delta V_j * W_{ji}) + A_i^{old}$$

f is the "activation function", commonly used functions are threshold function, ramp function, linear function, and sigmoid function.

By putting FCM into virtual world (Dickerson 1994, Parenthoen, 2001) it can be used to model story characters, user avatars as well as dynamic scenes. The heart design of this FCM modeler is a java applet, which allows users to add, edit and remove concept nodes and edges and of course to view the overall FCM graph simply by mouse actions.

One of the most important issues to be addressed is the mapping of concept properties and edges properties into Intelligent Augmented Storytelling Alice's created FCM structure. The idea that to construct FCM by allowing users to draw the FCM graph first, is a more convenient and more flexible approach. However, greater flexibility brings in more work to handle in the underlying programming design; as a result, this design needs more restriction and fault-tolerance capability. Also, the created concept and edges must be limited to meaningful ones in connection with the virtual stories. Take concept node for example, the name format of concept must be virtual object plus its characteristic in order to be mapped into virtual stories.

In design of Intelligent Augmented Storytelling Alice, the mapping is done by a predefined pool of the world's current existing characters and their states and action that might be a concern for users to model emotional behaviors. Another issue of concern is the association of event handling in the modeler's graph view area with virtual stories. And the original design involved a button panel to operate the state simulation and training process of FCM, which should be disabled because the simulation and activation of FCM should be done by Intelligent Augmented Storytelling Alice in this case.

4. Intelligent Augmented Storytelling Alice: Result and Discussion

Currently most research about FCM are all working for *one* single entity only, such as FCM for *one* political issue, FCMs for *one* particular control modeling system, FCMs for *one* Robotic experiment. Hence, for this paper, it's an unprecedented design to embed a FCM system that is able to create different FCMs for different virtual worlds which are produced in Storytelling Alice. Meanwhile, the embedding process of FCM system into development tool like Storytelling Alice can present certain challenges. The following figure demonstrates an example on how concepts can be mapped into virtual world behaviors and probably mapped into different ones.

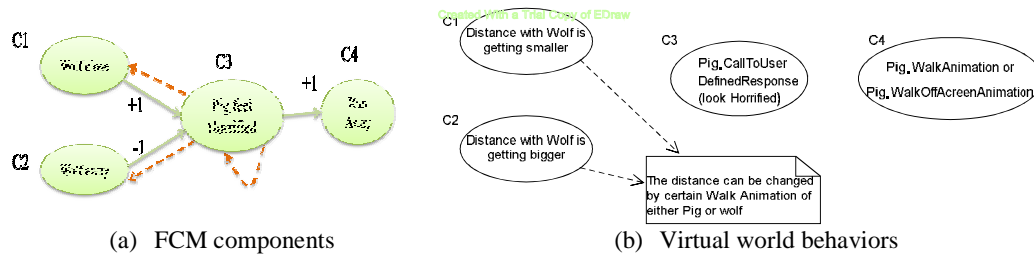


Figure 1: Mapping of FCM components with virtual world behaviors

We now show the results and discuss their significance.

- The embedded FCM system does seamlessly connect to Storytelling Alice.
- The FCM editing tool (FCM modeler) is easily accessible for users via Storytelling Alice's platform.
- The representation of FCM components and its corresponding behaviors in virtual story are consistent and reasonably mapped, and certain error-handling routine are designed to avoid mismatch.
- When an Alice story is associated with a FCM with concept values vector \mathbf{V} and weight matrix \mathbf{W} , once the story starts its simulation running, its FCM will start running as well. \mathbf{W} is considered to be fixed, and when one concept value is changed during simulation, in the same time unit the value of the rest connected concepts will be changed accordingly with the formula mentioned above.
- The activation output of FCM system, which are emotional behaviors can be clearly showed.

- We tested different activation functions as mentioned above. Result shows that the linear function generate the most concrete and meaningful output.

In order to implement and observe the performance of the Intelligent Augmented Storytelling Alice, let's have a simple case study. Its scenario is described as following: The virtual world has main character *littleRed*, *farmerPig*, and *BigBadWolf*, the details of plot are negligible for the time being. The virtual story has constructed an initial FCM graph as the figure shows. Take one concept value update for example to describe the causal relationships: When *farmerPig* escape away, it will reduce its own feeling of worried (negative: red color), cause *littleRed*'s feeling of relaxed increased (positive: blue color) and decrease *BigBadWolf*'s happy factor.

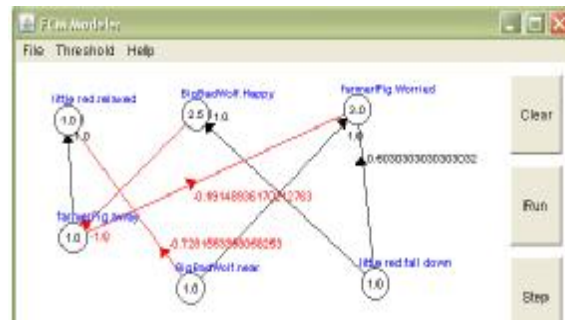


Figure 2: FCM graph and initial values

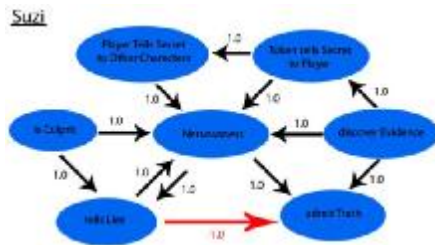


Figure 3: Fuzzy Cognitive Maps for mascot detection by the Scriptwriter Agent



Figure 4: the 3D simulation scene of mascot mystery was created in storytelling Alice

Figure 3 & 4 show “Mascot Mystery in the School”, the story is to find out suspect who steal the school’s team mascot. According to the script and plot of the story, when the story is being played, the FCM’s concept vector value will be updated accordingly and may generate different output behaviors.

5. Conclusions

This paper proposes a new intelligent modeling system based on FCM to extend Storytelling Alice to help virtual characters to perceive environment better and generate autonomic emotional behaviors. Our results indicate that this new system has successfully achieved its design objectives and we believe the ideas and development methodology described in the report can become a useful reference for future work on the subject. The proposed model and development system are not limited to Alice Storytelling; it can be plugged in various virtual world and storytelling systems. Experiments have also been done in Second Life, Active World and Torque Game engine. The experiments show that our proposed model and development toolkits are general and can be reused in various virtual world/storytelling/game engines for creating intelligent augmented storytelling/games.

References

- Dickerson, J.A and Kosko, B. (1994). *Virtual Worlds as Fuzzy Cognitive Maps*.
- Jose, G. (2008). *ALICE, the Programming Language*. Jones and Bartlett Publishers.
- Kelleher, C. Pausch, R. and Kiesler, S (2007). *Storytelling Alice motivates Middle School Girls to Learn Computer Programming*. 2007 Conference on Human Factors in Computing Systems, pages 1455-1464.
- Kelleher, C. and Pausch, R. (2005) *Lowering the barriers to programming: A taxonomy of programming environments and languages for novice programmers*. ACM Computing Surveys, vol. 37 no. 2, pages 83-137.
- [Kosko](#), B. (1985). *Fuzzy Cognitive Maps*, *International Journal of Man-Machine Studies*. 24(1986) 65-75.
- Parenthoen. M, Reignier and Tisseau, P. J. (2001). *Put Fuzzy Cognitive Maps to work in Virtual Worlds*.