

第五章 結論

本論文的研究目的是在建立一個數位設計課程的理論模型，透過觀察與分析數位設計課程，一方面發掘設計課的構成元素，另一方面找出數位設計流程的特質，期望在學術的領域，能建構一套有效的數位設計課程的理論模型，提供有心涉入與發展數位設計課程的老師和學生一個參考的架構。本研究透過參與觀察一個數位設計課程，分析之後獲得了設計課的六個構成元素，建立了第一層的分析架構；接著剖析幾位對數位建築的理論和技術有著重大突破和貢獻的建築師，包括 Frank Gehry、Peter Eisenman 和 Greg Lynn，擷取出他們作品中數位設計流程的特有性質當作第二層的分析因子，來進一步分析本研究的數位設計課程，最後得到設計課構成元素與數位設計流程特質之間的關係，這個數位設計課程的理論模型如圖 5.1 所示。

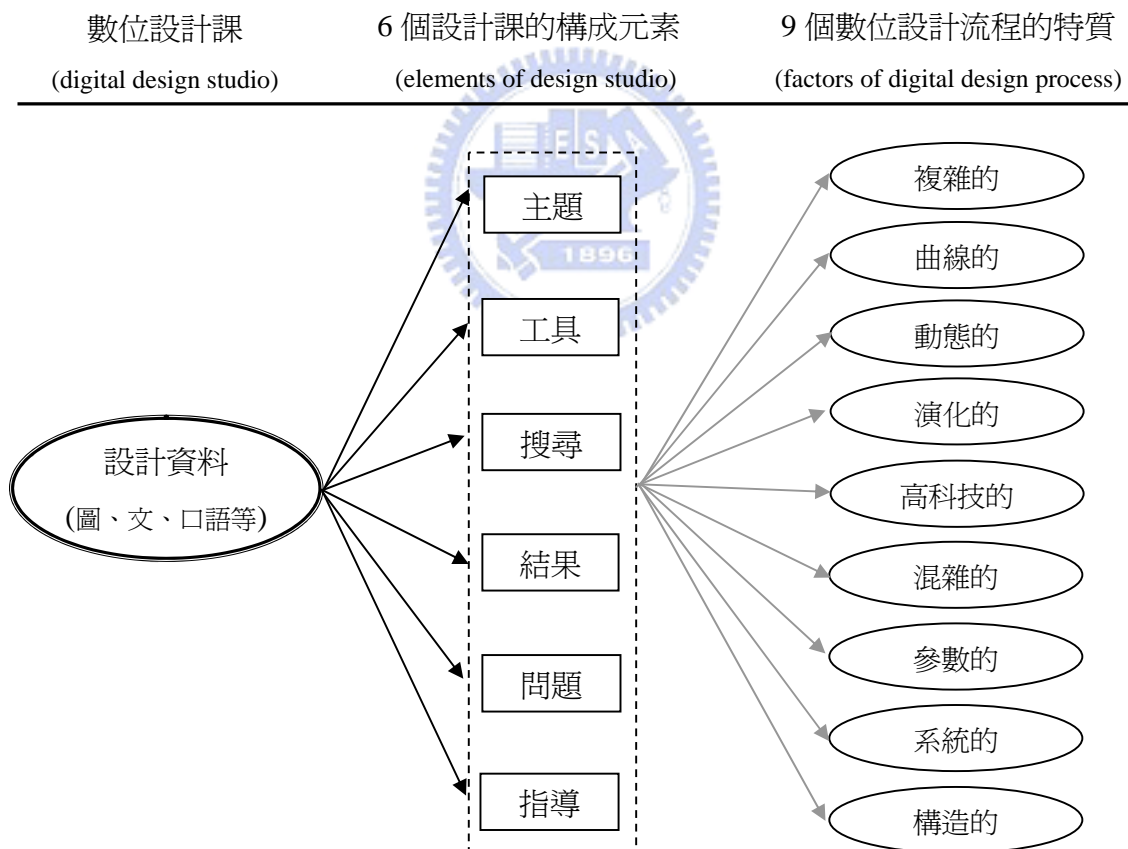


圖 5.1 數位設計課程的先期理論模型

如本論文第三章的論述，透過一整學期的參與式觀察法的資料蒐集，讓研究者獲得了充分的實地資料，再從大量的資料當中篩選出關鍵性的第九堂課，以此堂課的資料為主，做詳細的描述與分析，再以其他堂課的資料當作輔助性質的說明，企圖以這樣的方式清楚且有效的建立起本研究所需的數位設計課程的先期理論模型。

如圖 5.1 的左半部所示，第一層的分析架構是由「設計課的六個構成元素」也就是主題、工具、搜尋、結果、問題和指導所組成，強調每一堂設計課都會有這六個元素存在，只是分配比重上會隨著每堂課的目的、時間和重點等而有所不同。例如在設計課程的早期階段，受測者會投注比較多的心力在主題的探討和搜索，反之在後期階段，設計結果的呈現會逐漸的佔有重要的份量。而這也是為何本研究挑選課程的中期階段為主要資料來源，在這個階段當中，受測者多半已經將設計早期的主題與概念發展到某一個階段，而對於未來的設計結果也進行了一定份量的探索與呈現，因此這個時期的各設計課元素資料量比較平均，有助於將每個元素作詳細的分析，進而建立先期的理論模型。

第二層的分析架構則顯示在圖 5.1 的右半部，灰色的箭頭表示並不是每一個設計課的元素都完整的具有這「九個數位設計流程的特質」。以受測者 A 為例，他在工具的操作和搜索的過程兩個元素中，都具有全部九個數位設計流程的特質；然而在結果元素中擁有八個、主題和指導有七個、問題有兩個數位設計流程的特質。也因此 4.4 節中便討論到這六個設計課的構成元素應對於九個數位設計流程特質時的關係，顯示出三組基本的關係。

第一組是工具、搜尋和結果，這一組元素充分展現出數位設計流程的特質，其他設計課的元素不論具有數位設計流程的特質是強或弱，對這一組元素的影響都不大。第二組是主題和指導，這一組元素是最有彈性的，可以和數位的議題相關，也可以關係不明顯。最後一個是問題這個元素，唯獨它和其他五個設計課的元素都成反比，當其他五個設計課的構成元素出現次數愈多的時候，問題的出現次數就會愈少；這是因為數位設計課程的目標多半是設定在數位媒材的測試、數位設計流程的建立、自由形體的創造等這一類在一般設計課做不到的事情，所以在數位設計課程中，當受測者將各個設計課的元素操作得更具有數位設計流程的特質時，結果也就會愈接近目標，所產生的問題也會相對的減少。

研究貢獻

本論文以一種比較全面性的視野去整合設計教育和教育科技，以及兩個領域所交集的數位設計課程。在科技發展迅速的今日，建築設計相較於其他領域隨時受科技影響的情況來說，以一種比較緩慢的步調在回應著科技的日新月異；尤其教育科技的蓬勃發展，已經影響與改變了無數個學科的發展，但是建築設計教育卻甚少善用數

位工具來輔助學習與促進專業發展，因此本研究的成果也提供了建築設計領域一個可以整合專業與科技的新趨勢與方法。

對於教育科技領域來說，因為過去較少關於建築設計課程應用數位科技的相關研究，因此對於如何提供有效的且適當的教育科技輔助建築設計不甚了解。本研究所提供的架構可以讓教育科技領域較清楚的看到科技在建築設計領域的潛力與發展願景，提供教育科技一個可能發展的新方向。

本研究所提出的數位設計課程模型可以提供有心發展數位設計課程的老師或設計者一個參考的依據，並且根據此理論模型去設計、創造出獨特的數位設計課程，也可以比較全面的規劃出一系列的相關課程，或者是用此模型來對進行中的設計課做檢視，幫助發現與解決設計問題。

研究限制

參與式觀察團體的選擇

在選擇進行參與式觀察實驗的對象團體(group)方面有比較多的限制，因為使用參與式觀察法來獲取研究的資料不一定都能成功，關鍵點之一便是研究者在進入實驗的場域之後，必需獲得所觀察團體的接受而被視為自己人，以及研究者的加入不對此團體的日常活動及表現帶來影響，如此才能得到有效的實地資料，因此能夠被選擇來當作本研究參與觀察的對象便非常的有限，在各方面的條件都必需剛好讓研究者能自然而然的融入。

另外，目前雖然部分建築學系已經開始開設數位設計課程，但是數量仍然有限，尤其還有很多課程並未把數位工具運用在關鍵時刻來對設計產生影響，對於本研究來說，這些都不能算是數位設計課程；因此真正能夠提供本研究實驗的對象選擇其實很有限。

資料蒐集的過程

爲了要維持研究場域不受干擾的狀態，研究者在現場最好像個隱形人，但也會因此而造成資料蒐集的限制。例如在課程進行當中，研究者在教室角落擺設的錄影器材沒電或記憶卡用完時，不能立刻上前更換，因為這樣的突兀動作很容易會便成全場的焦點而影響正常活動的進行；因此研究者必需等待中場休息或大家討論熱烈吵雜的時刻再不聲不響的讓器材繼續運作，部分資料會因此而未被蒐集完全。錄音的狀況也是如此，爲了讓受測者能自然的發表意見與討論，研究者不能要求對著錄音筆大聲說話，而受測者的座位又散落在教室各處，每個人的聲音大小也都有所差異，因此並無法每次都錄到完整而清楚的對話。

受測者的選擇

本論文的研究目的的一方面是獲得設計課的構成元素，另一方面是分析各元素的數位設計流程特質，以獲得一個數位設計課程的先期理論模型，所以需要取得較平均且大量的資料加以分析。因此雖然本研究的參與觀察團體一共有六位學生在這門數位設計課程中，但其中有三位學生因為過去沒有使用數位媒材的經驗，卻也沒有接受老師的建議在暑假先去修一門叫做基礎數位設計媒材的課程，因此在本設計課開始之後花了頗多的時間在認識數位工具而無法製造足夠的材料供本研究觀察與分析的需要；雖然這樣的學生也許在某些設計課元素的特質上會表現得特別明顯，或者是在某一堂課中會表現出強烈的數位設計流程因子，但這並不是本研究的問題與重點，因此這三位學生便不被納入本研究的受測對象；而另外三位同學所產生的資料則能符合本研究的需求，因而被選作本研究的受測者。

資料的篩選

本研究中的設計課程共持續了十五週，第九週的設計課之所以被挑選出來當作主要資料來源的原因，首先是因為本論文的研究目的是獲得一個數位設計課程的先期理論模型，所以需要取得較平均且大量的資料加以分析，然而在設計課程的早期階段，受測者會投注比較多的心力在主題的探討和搜索，反之在後期階段，設計結果的呈現會逐漸的佔有重要的份量；而第九堂課的時間差不多座落於總課程的一半，中期的課程對於早期的設計概念、目前的設計發展以及未來設計的方向均會涵概在內，因此資料分配較平均，有利於將設計課的每個構成元素都說明清楚。

然而若從設計的過程來看，有些學生也許在其他堂課中，強烈的在某一個設計課的元素中表現出與數位設計流程相關的特質；又或者若從不同的課堂中分別擷取不同元素的資料來分析，能夠得到不同的理論模型，這些可能性並不在本研究的探討範圍內。

後續研究

本研究的部分限制是來自於不打擾參與觀察的現場以及對授課老師的尊重；因此接下來計畫將參與觀察的現場帶到研究者本身所開設的數位設計課程，令研究和數位設計課程的目標與問題更為一致；例如研究者希望獲得師生之間的互動資料也是數位的，比方說透過網頁輔助教學或用 email、skype、msn 等電子介面互動。另外，對於本研究所獲得的數位設計課程模型，研究者希望能進一步將之應用於不同的設計課中(或研究者自己開設的課程)，測試其效度並調整細部的內容。

另外，本研究中的設計課程共有十五週，在每一週的課程中，受測者的設計資料展現在設計課的構成元素中，會因為個人因素或是處於學期的初、中與晚期而有不同的呈現，而不同週次的設計資料相對於數位設計流程的特質展現也會呈現不同的結

果，這些差異與特質對於數位設計課程來說也是相當值得探討的議題。

除此之外，到了下一個階段，希望能夠以本研究所提出的數位設計課程模型為基礎，發展出網路 **e-learning** 的設計課程。若要發展這樣的系統，有一些重要的基本學習理論與數位技術還必需繼續被探討，例如如何直接以數位工具教導設計、在虛擬環境中的助教與鷹架系統、設計過程與內容的合理性與清楚性、提供回溯系統讓學生將後設想法與過程外化、提供學生虛擬的與真實的環境能觀察專家行為、學習專業知識等。再進一步將本研究所獲得的設計課的六個構成元素與數位設計流程的九個特質轉化為 **e-learning** 的元件，並以此架構發展出多樣的網路數位設計課程，這也是本研究下一步想要探討與發展的議題之一。



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研討會論文

- Wu, Pei-Ling (2005). A Framework of Digital Design Studio in the Future Learning Environment. CAADRIA '05, TVB School of Architecture, India. (abstract accepted)
- Wu, Pei-Ling (2004a). Playful and Creative Learning: A Preliminary Model for Digital Design Studio, In *Proceedings of CAADRIA '04*, Yonsei University, Korea, 405-418. (accepted rate around 50%)
- Wu, Yen-Liang, Liu, Yu-Tung, Huang, Ying-Shiu, Wu, Pei-Ling, Wong, Chien-Hui, Wang, Tsung-Hsien, Wan-Bing, Wen-Li Shih (2004b). New Interaction of Digital Exhibition: Figures and Spaces, In *Proceedings of CAADRIA '04*, Yonsei University, Korea, 731-740. (accepted rate around 50%)
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專書

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