

# 行政院國家科學委員會專題研究計畫 成果報告

## 運用傳統式數位教育平台與數位化行動學習輔具探討國小 自閉症學童學習聲音辨識之成效 研究成果報告(精簡版)

計畫類別：個別型  
計畫編號：NSC 99-2511-S-263-001-  
執行期間：99年08月01日至100年07月31日  
執行單位：致理技術學院資訊管理系

計畫主持人：張慧

報告附件：出席國際會議研究心得報告及發表論文

處理方式：本計畫涉及專利或其他智慧財產權，2年後可公開查詢

中華民國 100 年 10 月 19 日

行政院國家科學委員會補助專題研究計畫  成果報告

運用傳統式數位教育平台與數位化行動學習輔具探討  
國小自閉症學童學習聲音辨識之成效

**The Exploration of the Effects on the Adoption of Traditional Digital Educational Platform and Digital Mobile Learning As Assisting Tools in Learning Audio Recognition by the Elementary Autism Students**

計畫類別：個別型計畫

計畫編號：NSC 99-2511-S-263-001

執行期間：2010年8月1日至2011年7月31日

執行機構及系所：致理技術學院 資訊管理系

計畫主持人：張慧

成果報告類型(依經費核定清單規定繳交)： 精簡報告  完整報告

本計畫除繳交成果報告外，另須繳交以下出國心得報告：

- 赴國外出差或研習心得報告
- 赴大陸地區出差或研習心得報告
- 出席國際學術會議心得報告
- 國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢

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中 華 民 國 100 年 10 月 10 日

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## 摘要

計畫主持人在本計畫中將邀請了國小特教教師參與作業，以實際使用者角色參與本研究計畫整體規劃與執行；由於特教教師對於自閉症學童熟捻與教學主題方向的掌控，使得本研究計畫實質層面與教學實務趨近合一。本研究計畫提昇傳統式數位教育平台至數位化行動學習輔具，協助特教教師在教導國小自閉症學童進行聲音辨識的時候，進行無所不在的學習。本研究計畫「運用傳統式數位教育平台與數位化行動學習輔具探討國小自閉症學童學習聲音辨識之成效」運用了「文獻分析法、深度訪談法與實驗設計法」進行研究。經由個案訪談擷取需求，由本研究團隊進行資訊技術規劃設置，達成新四大目標【實踐聲音辨識課程情境領域管理彈性化目標、實踐數位教育平台系統功能資源共享化目標、實踐數位教育平台系統功能知識化建構目標、實踐校園教育平台資源數位行動化學習目標】。在過程中，運用建置的學習網站，提供特教教師上傳教材資源分享，同時可以將下載的音訊資源儲存至行動載具，讓老師帶領著學生進行情境的學習模式；在過程中確實經歷許多的挫折與失敗，但是在磨練過程中，獲得國小特教教師，輔導主任與校長的支持，讓這個計畫能夠完成，並得以肯定的是一在擁有充足資源與人力的前提下，行動化的學習確實可以讓學習產生出更佳的成效。最終期望運用豐富資源牽引自閉症孩子走出封閉的世界，在台灣溫暖社會中縮短國小自閉症學童數位教育落差。

關鍵字：自閉症、數位學習、數位教育、知識管理、行動學習

## ABSTRACT

In this project, the elementary special education teachers are invited to join this project. They acted as the real users in this entire project. Owing to the elementary special education teachers' familiarity in teaching subjects and teaching programs, the project reached the proposed objects finally. In this project, the tradition digital education platform would be upgraded to mobile learning tools those will give the special education a great help in teaching the elementary autism students in learning audio recognition. The literature review, the interview and the experiment design method will be used in this new project. Based on users' requirements analysis, there will be a new four goals: 'Achieve the flexible management goals of audio recognition course environmental fields.', 'Achieve the resources sharing goals of digital education platform system functions.', 'Achieve the knowledgeable constructing goals of digital education platform system functions.' And 'Achieve the digital mobile learning goals of campus education platform resources.' In the research process, the web-site was utilized all the way. The web-site provides the materials resources uploading of the elementary special education teachers, the web-site also provides the audio file downloading into the mobile tool that help the teachers leading the environmental learning model. A lot of mistakes and failure occurred in the establishing process. But the whole research process was supported by the elementary special education teachers and the elementary principal and reached the goals at last. One thing can be sure, if there is sufficient resource and human power, the mobile learning creates better efficiency outcomes in learning programs. Finally, the Autism students are led to join the bright society and the gap of the Autism students' digital education will be shorten in Taiwan.

Keywords: autism, e-learning, digital education, knowledge management, mobile learning

## **1. Introduction**

Most of the Autism children like mechanical equipments and appear interesting in the animated display of the monitor. Therefore, the computer assisted instruction method becomes the most favorite of the Autism children. The benefits of using the computer assisted instruction method include the consistence of the operation and reaction and the Drill & Practice method. The computer is not affected by the motion and the influence of the external environment. The computer displays the same teaching content repeatedly. The positive evaluations made by many scholars apply the usage of computers on the teaching of the Autism children [1]-[5]. The e-learning teaching platform is an inter-active center of knowledge. It gathers and shares knowledge. The knowledge are gained, processed, stored and re-created in the platform. The extending functions of the platform can be organized in establishing an e-learning platform that belongs to the Autism students only. All the teaching modes and materials are designed for the Autism students by the special education teachers.

There are three objectives in the proposed “An Interactive Information System for Autisms” for the Elementary School Autism Students in Learning Audio Recognition course: Object I – To establish a free digital education platform as the assisting tool for the Autism student individual learning in audio recognition. Object II – To integrate the materials designed by the special education teachers and to reach the integration of teaching resources. Object III – To record the learning history of each Autism student and support the special education teachers in arranging the continuous learning programs. This paper is organized in the following manner. Section 2 presents the literature review. The methodology and system design of the proposed ‘An Interactive Information System for Autisms’ is presented in section 3. Section 4 presents the Simulations and brief Conclusion.

## **2. Literature Review**

The literature reviews of this paper stated below: Digital Learning and Special Education Autism Students’ Learning and An Experimental Autism Student Audio Recognition Learning Network Platform.

### **2.1 Digital Learning and Special Education**

The usage of internet is without the constraints of time and space and makes the knowledge spread rapidly and conveniently. The e-learning that is on the basis of internet becomes the most popular today. The e-learning are promoted from government to schools. Many business of the digital industry join the e-learning market one by one. But there are a small group of special students who can’t adopt the normal education resource as the general people do. So are the Autism students.

The special education principles in Taiwan announce to the public: ‘The handicapped citizens own the authority in obtaining the basic education to fully develop their life, their normal characteristics and increase the service ability for the society [6]. There are four important points in special teaching: Matching the students’ characteristics and require elastic range, doing the research in improving special education course, materials and teaching tools, implementing on the guideline of professional group cooperation and arranging individual education program [7]. There are three types of the sub-principle of ‘The Materials Implementation Principles of the Special Education Course’ [6]: Team Mode: Individual instruction, small team teaching in the class, cross-class/grade/school teaching. Personnel Resource: Teacher v.s. student, collaboration teaching, colleague teaching, computer or multimedia assisted teaching, e-learning and community resource application. Other teaching modes, the Individualized Education Program has been presented in the Education of All Handicapped Children Act of U.S.A. [8]-[10]. It begins with the students’ special requirements and matches teachers’ teaching style, too. There are six categories of special education materials: living education, social adaptation, practical language, practical mathematics, leisure education and career environment. The Autism students are not interesting in these materials without fail. As shown in Fig.1. Therefore, some of the special education teachers develop the self-made graphs by themselves or buy the graphs in the market. As shown in Fig.2-4.

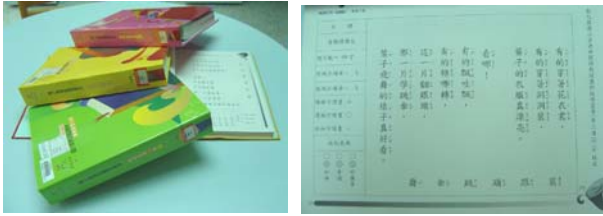


Fig.1 Traditional Chinese Materials Published by the Ministry of Education in Taiwan

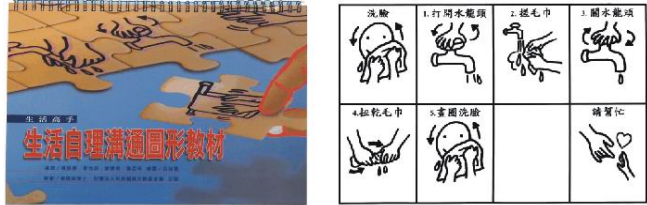


Fig.2 The Communication Learning Graphs



Fig.3 The Micro-computer Voice Communication Board

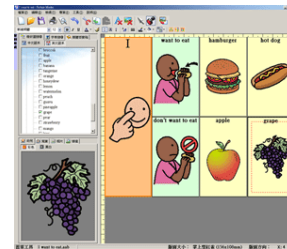


Fig.4 Picture Master

## 2.2 Autism Students' Learning

There are six subjects of literature review in this session, such as: The Introduction of Autism, the Levels of Autism, the Autism Student's Learning Model – Structured Instruction, computer Assisted Instruction v.s. Autism Student's Learning, Autism Students and e-learning and the Autism Student Learning Assisted Organization in Taiwan. In [1]-[3] and [11]-[15], the following authors submitted their summarization toward the general behavior of the Autism students in the following: The Autism children lack the ability in understanding themselves and the interactions of social ability. Therefore, the Autism children don't talk to others in face. They can't establish close relationships with family members. There are four levels of Autism status: the most serious status, the serious status, the medium status and the light status. The description is listed in Table 1. The samples of the Autism students selected in the proposed "An Interactive Information System for Autisms" for the Elementary School Autism students in learning Audio Recognition course are toward the Autism students who can operate computer. Therefore, the medium status and the light status of Autism are preferred in the proposed "An Interactive Information System for Autisms". The learning record and the reactions of the Autism students are recorded in the implementation process [16].

Table 1 The Levels of Autism

Levels	Descriptions
Very Serious	Those who belong to this status can't survive with the fully relying on others' care.
Serious	Those who belong to this status can develop the basic daily life ability. They can't develop work ability and reply on others' care.
Medium	Those who belong to this status can arrange their daily life in a protected area. They may gain simple work ability after special education and training.
Light	Those who belong to this status can work in a specific environment after special education and training.

In [7]-[10], [13] and [17]-[23], the authors submitted their summarization toward the learning mode-structured teaching for the Autism students in the following: The structured teaching mode is developed by the University of North Carona of U.S.A. It becomes one of the most important special education methods for the Autism students. The spirit of the structured teaching is to arrange a structured teaching environment and to create structured materials. The teaching mode of the structured teaching includes the following four factors: the structured teaching environment, the structured daily activities, the individual work system and the structured sense of vision.

Most of the Autism children like mechanical equipments and appear interesting in the animated display of the monitor. Therefore, the computer assisted instruction method becomes the most favorite of the Autism children. The benefits of using the computer assisted instruction method include the consistence of the operation and reaction and the Drill & Practice method. The computer is not affected by the motion and the influence of the external environment. The computer displays the same teaching content repeatedly. The positive evaluations made by many scholars apply the usage of computers on the teaching of the Autism children [1]-[3] and [24]-[27]. The e-learning platforms created today are designed for general people. The content of the course is more complicate that the Autism students can't realize easily. Therefore, the Autism students can't use the general e-learning teaching platform. In [6]-[7] and [28]-[31], the authors submitted their opinions toward e-learning and summarize in the following: The definition of e-learning is that the learners and teachers break through the tradition face-to-face learning method and adopt the interactive teaching method through the internet. The e-learning breaks through the limitations of time and space. The learners adjust their learning progress. The teachers adjust the teaching programs based on the learners' learning result. The e-learning is like one-to-one teaching mode. The characteristics of e-learning include: multi-types of course contents, a channel for learning experience exchange, the virtual learning group and the professional network providers. The digital education platform is used for one-to-one assisted teaching method. The special education teachers and parents help the Autism students in operations. The contents of the audio courses are daily life environment, such as home, school, classroom, transportation and animals, etc. Combining with the pictures and audio creates the simulation teaching environment. The Autism students will become independent after a period of learning.

### **3. Research Methodology and System Design**

Under the instructions of various kinds of education modes those are benefit in helping the Autism students' learning. The research methods in the proposed 'An Interactive Information System for Autisms' include Literature Analysis Method, Depth Interview Method and Experimental Design Method.

#### **3.1 Literature Analysis Method**

Many literatures concerning Autism fields are collected in the proposed "An Interactive Information System for Autisms". The definition, category and exploration of the related knowledge are processed that support the establishment of the digital education platform in the "An Interactive Information System for Autisms". The sources of the literatures include books, journals, research reports and the published reports of the Ministry of Education. After the analysis, comparison, processing and summarizing, the conclusions become the theoretical basis in this research.

#### **3.2 Depth Interview Method**

We also collect many precious opinions from the Elementary special education teachers. The real teaching situations are supported by them. The content of the depth interviews are:

- Interview with the Elementary special education teachers.
- Provide the multimedia materials trial versions to the special education teachers.
- Collect the feedback opinions from the special education teachers.
- Transform the contents of the interview into the digital tables.

#### **3.3 Experimental Design Method**

We made several interviews with the Elementary special education teachers and invite the special education teachers become the experimental participants in the proposed "An Interactive Information System for Autisms". The special education teachers assist us verifying the learning efficiency as to the Autism Students in Learning Audio Recognition course. The samples of the Elementary school Autism students are separated into 'Experimental team' & 'Control team' for experimental research. The detailed experimental implementation and experimental result is introduced in following section.

An Experimental Autism Student Audio Recognition Learning Network Platform



A protocol type “An Interactive Information System for Autisms” as to the Experimental Autism Student Audio Recognition Learning Network Platform created in previous research [32] is shown in Fig.5. The descriptions of the system function framework diagram are listed in Fig.6:



Fig.5 A protocol type of “An Interactive Information System for Autisms” Function Framework

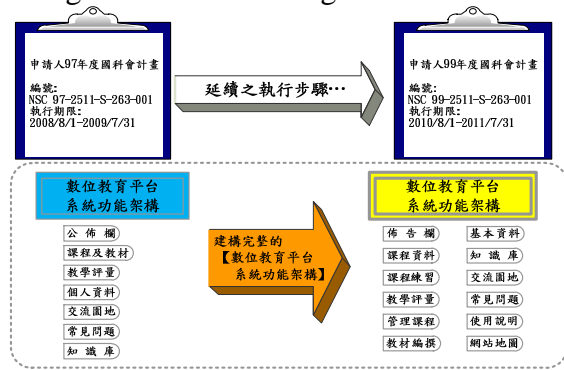


Fig.6 System Function Framework Diagram

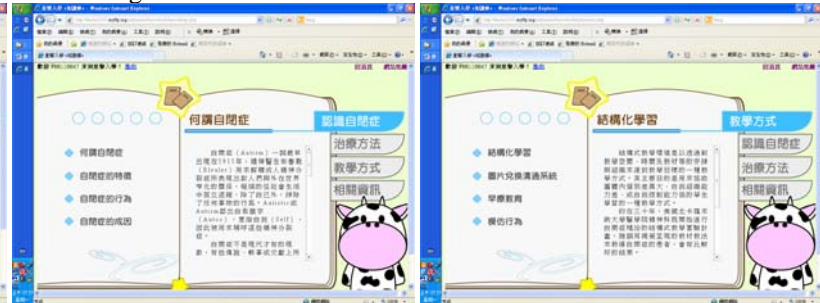
#### 4. Simulations and Conclusion

We have made numerous simulations, including the experimental environment, the experimental implementation, the independent variables and dependent variables, the experimental design digital education platform, the experiment results and obtain some successful results. Some web pages of the experimental design digital education platform are listed below:

Registration



Knowledge Base



Courses



Course—Family Life



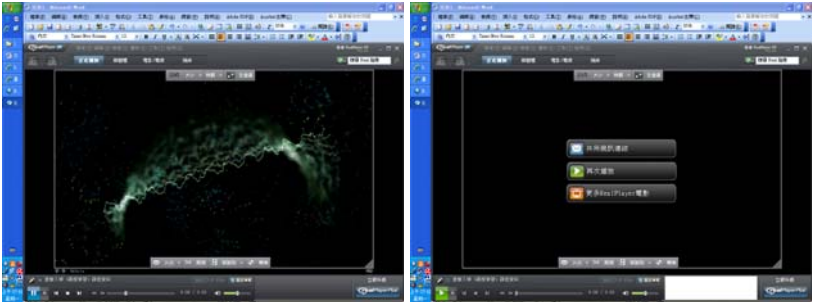
Play the 'Alarm Audio File'



Introduce the 'Alarm Audio'



Download the 'Alarm Audio File' to the Mobile Tool

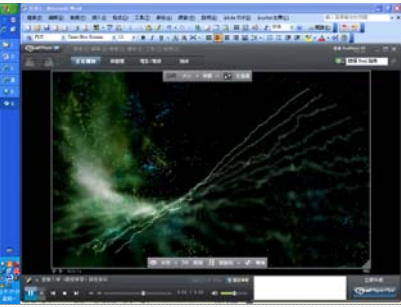




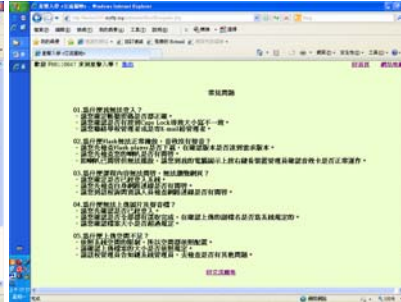
Introduce the 'Fan Audio'



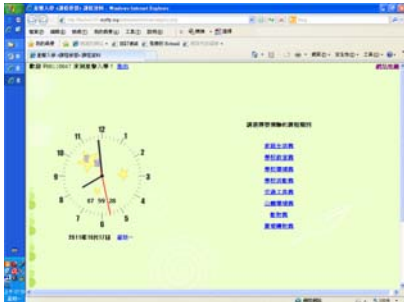
Download the 'Fan Audio File' to the Mobile Tool



Communications



Courses Tests



Listening and Answering



Corrections



Administrator Log In



Review Registrators' Data



Teacher Log In



Selecting Course



Exporting Test Result



Teaching Evaluation

Class ePortfolio

Maintaining Courses



Editing Course Materials... Selecting 'disgram/audio', Typing 'description text', finished!



Eight categories of mobile courses are designed in this project, too. As shown in Fig.7.

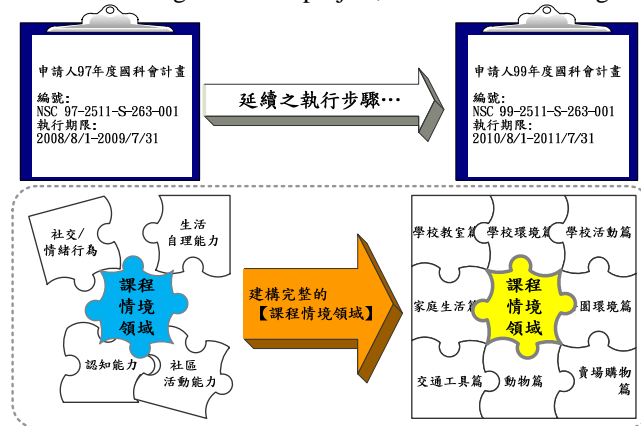


Fig.7 Eight Categories of Mobile Courses

### Acknowledgment

This research work was supported by National Science Council in Taiwan under grant and NSC 99-2511-S-263-001-99-2511-S-263-001-.

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### **List of Published Papers**

1. Huay Chang, 'A Research in Learning Audio Recognition for the Elementary Autism Students', The 1<sup>st</sup> Conference on Engineering Education, pp.178-188, Taipei, Taiwan, May 13 2011.
2. Huay Chang, Ai-Ling Hwung, Pei-Wen Jeng, Yi-Chi Wu, 'Autism Babies Knowledge Platform', 2011 International Conference on Management Learning and Business Technology Education, pp.61, Kaohsiung City, Taiwan, May 9-11 2011. (ISBN: 978-986-6486-06-7)
3. Huay Chang, 'An Interactive Information System for Elementary Autism Students', 2011 2<sup>nd</sup> International Conference on Innovative Computing and Communication, pp.374-377, Macao, China, March 5-6 2011. (ISBN: 978-1-4244-9734-8)

# 國科會補助專題研究計畫項下出席國際學術會議心得報告

日期：100年3月8日

計畫編號	NSC99-2511-S-263-001		
計畫名稱	運用傳統式數位教育平台與數位化行動學習輔具探討 國小自閉症學童學習聲音辨識之成效		
出國人員 姓名	張慧	服務機構 及職稱	致理技術學院資訊管理系講師
會議時間	2011年3月5日至 100年3月6日	會議地點	Macau, China
會議名稱	(中文)2011 創新運算與溝通國際研討會 (英文)2011 2 <sup>nd</sup> International Conference on Innovative Computing and Communication		
發表論文 題目	(中文)國小自閉症學童互動資訊系統 (英文) An Interactive Information System for Elementary Autism Students		

## 一、參加會議經過

本人於會議前抵達澳門，在會議期間參與各項活動，並於會議中發表本人論文，之後接受與會人員提問討論。

## 二、與會心得

因此會議為國際性型態，本人藉此機會與多國與會學者進行多元學術主題交流，並於各學者發表各項創新運算的主題之時，學習到許多的新知，並開啟本人日後多元研究之構想。

## 三、考察參觀活動(無是項活動者略)

無

## 四、建議

本人日後如再參與國科會專題計畫製作，本人將更積極的參與更多國際性的研討會議活動，以擴大本人研究層面之視野；期勉本人日後能以更寬廣國際觀的基礎進行自閉症學童的聲音辨識數位學習之研究。

## 五、攜回資料名稱及內容

研討會議手冊、論文光碟、繳費收據等資料。

## 六、其他

無

# 國科會補助計畫衍生研發成果推廣資料表

日期:2011/10/19

國科會補助計畫	計畫名稱: 運用傳統式數位教育平台與數位化行動學習輔具探討國小自閉症學童學習聲音辨識之成效
	計畫主持人: 張慧
	計畫編號: 99-2511-S-263-001- 學門領域: 應用科學教育-科學教育理論
無研發成果推廣資料	

## 99 年度專題研究計畫研究成果彙整表

計畫主持人：張慧		計畫編號：99-2511-S-263-001-			計畫名稱：運用傳統式數位教育平台與數位化行動學習輔具探討國小自閉症學童學習聲音辨識之成效	
成果項目		量化			單位	備註(質化說明： 如數個計畫共同 成果、成果列為該 期刊之封面故 事...等)
		實際已達成 數(被接受 或已發表)	預期總達成 數(含實際已 達成數)	本計畫實 際貢獻百 分比		
國內	期刊論文	0	0	100%	篇	
	研究報告/技術報告	0	0	100%		
	論文著作 研討會論文	2	2	100%		1. Huay Chang, 'A Research in Learning Audio Recognition for the Elementary Autism Students', The 1st Conference on Engineering Education, pp. 178-188, Taipei, Taiwan, May 13 2011. 2. Huay Chang, Ai-Ling Hwung, Pei-Wen Jeng, Yi-Chi Wu, 'Autism Babies Knowledge Platform', 2011 International Conference on Management Learning and Business Technology Education, pp. 61, Kaohsiung City, Taiwan, May 9-11 2011. (ISBN: 978-986-6486-06-7)
	專書	0	0	100%		
專利	申請中件數	0	0	100%	件	
	已獲得件數	0	0	100%		
技術移轉	件數	0	0	100%	件	
	權利金	0	0	100%	千元	
參與計畫人力 (本國籍)	碩士生	0	0	100%	人次	
	博士生	0	0	100%		

		博士後研究員	0	0	100%			
		專任助理	2	2	100%		致理技術學院兩位大學生	
國外	論文著作	期刊論文	0	0	100%	篇		
		研究報告/技術報告	0	0	100%			
		研討會論文	1	1	100%			3. Huay Chang, 'An Interactive Information System for Elementary Autism Students', 2011 2nd International Conference on Innovative Computing and Communication, pp. 374-377, Macao, China, March 5-6 2011. (ISBN: 978-1-4244-9734-8)
		專書	0	0	100%		章/本	
	專利	申請中件數	0	0	100%	件		
		已獲得件數	0	0	100%			
	技術移轉	件數	0	0	100%	件		
		權利金	0	0	100%	千元		
	參與計畫人力 (外國籍)	碩士生	0	0	100%	人次		
		博士生	0	0	100%			
		博士後研究員	0	0	100%			
		專任助理	0	0	100%			
其他成果 (無法以量化表達之 成果如辦理學術活 動、獲得獎項、重要 國際合作、研究成果 國際影響力及其他協 助產業技術發展之具 體效益事項等，請以 文字敘述填列。)		無						
科 教 處 計	成果項目		量化		名稱或內容性質簡述			
	測驗工具(含質性與量性)		0					
	課程/模組		0					
電腦及網路系統或工具		5		運用電腦設備與平板電腦設備進行研究。				



畫 加 填 項 目	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	1	設置數位學習網站
	計畫成果推廣之參與（閱聽）人數	50	參與教師、學生與家長總計人數。

# 國科會補助專題研究計畫成果報告自評表

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

## 1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

## 2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表  未發表之文稿  撰寫中  無

專利： 已獲得  申請中  無

技轉： 已技轉  洽談中  無

其他：（以 100 字為限）

本研究已經發表三篇文章，詳細資料列於下列第 3 項中。

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

學術成就... 僅列出已發表文章資料

1. Huay Chang, 'A Research in Learning Audio Recognition for the Elementary Autism Students', The 1st Conference on Engineering Education, pp.178-188, Taipei, Taiwan, May 13 2011.

2. Huay Chang, Ai-Ling Hwung, Pei-Wen Jeng, Yi-Chi Wu, 'Autism Babies Knowledge Platform', 2011 International Conference on Management Learning and Business Technology Education, pp.61, Kaohsiung City, Taiwan, May 9-11 2011. (ISBN: 978-986-6486-06-7)

3. Huay Chang, 'An Interactive Information System for Elementary Autism Students', 2011 2nd International Conference on Innovative Computing and Communication, pp.374-377, Macao, China, March 5-6 2011. (ISBN: 978-1-4244-9734-8)

本研究已經分別在澳門、高雄與台北發表三篇論文，其中並將本研究之內容延伸以 '知識平台' 與 '數位學習平台' 兩種形式建置，並開放給本研究參與實驗人員使用。雖然本研究期限已至，但是本人仍期勉日後能繼續貢獻能力在照顧社會弱勢的國小自閉症學童的事業上，繼續投入本人所可能運用之資源。

