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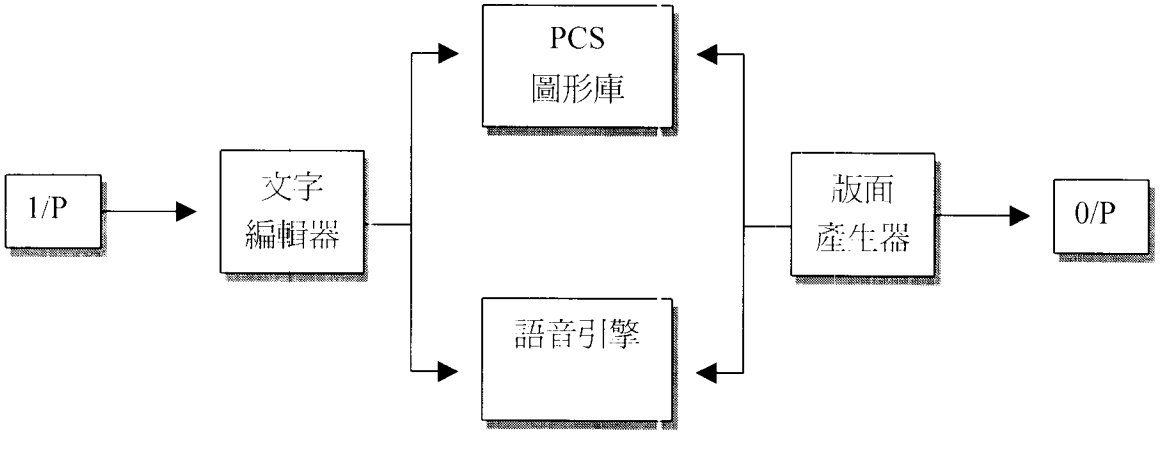
電腦化學習系統增進嚴重語言及肢體障礙學童

基本認字與寫字能力之有效性研究第二年期中/進度報告

本年我們一共進行了兩個實證研究（experimental study）。實證研究一主要在複製第一年的識字教學試探性研究（pilot study）。爲了早期介入障礙學生的識字訓練，本年研究採用了三位年紀較輕就讀特殊學校國小一年級的多重障礙新生爲研究對象。研究的結果與第一年的研究發現類似，以圖形退化策略所設計的多媒體識字學習系統，對受試者學習辨識功能性字詞確實有效（結果詳如附件）。除了上述複製第一年的研究外，本第二年的實證研究二進一步探討受試者在學會目標字詞（如〝耳朵〞）後，是否也能學習辨認個別的單字（如〝耳〞與〝朵〞）。個別單字識字研究雖然尚未完成，唯分析截至目前所收集的資料透露出三位受試者將可以學會辨認個別目標單字。

過去這兩年，我們皆採用財團法人科技輔具文教基金會所發行的版面編輯器（overlay maker），來編輯製作訓練教材。雖然它已經較傳統使用紙上剪貼方式方便許多，但因爲它並非專爲使用褪除策略識字學習的特別目的設計，因此爲了製作每一褪除階段所需的教學版面仍然相當耗時。同時因爲該編輯器功能較爲繁複，學習上也較費時。鑑於使用上述一般用途版面編輯器（general purpose overlay maker）製作識字教學版面所需的學習負載與人力的耗費，第三年的研究我們將開發一個專爲識字教學設計的專用版面製作工具（dedicated authoring tool for word recognition teaching）。

這個識字教學版面製作工具的主要特點爲操作介面簡易。使用者只要完成目標字詞的輸入，以及設定圖文的比例後，電腦即自動產生具語音輸出的識字學習版面。設計完成的版面將可以儲存、修改以及列印出來。同時因爲整個操作介面的簡化，學習使用本軟體的時間將大爲縮短。識字教學版面製作工具的系統結構如圖所示：



第三年研究進行將分爲四個步驟：

一、系統功能的分析。系統輸入部分包括目標字詞內容與個數以及圖文比例設定。系統處理部分包括 PCS 圖形庫與相對應語音引擎的建立與查詢。當系統接受到一特定字詞後，它將自動找出對應的圖檔與音檔。然後系統輸出部分將把目標字詞、圖文設定比例、相對應的圖檔與音檔等連結，產生一個圖文聲音並茂的多媒體識字學習版面。

二、圖形庫與聲音引擎的建立。我們將採用財團法人科技輔具文教基金會的 PCS 圖形製作成圖形庫。另外也將建立圖形庫所對應的語音引擎。利用目標詞將可自動在資料庫中搜尋其對應的圖形與聲音。

三、系統建制與測試。我們將利用 C++與組合語言開發本識字學習版面製作工具。這個軟體將運用上一步驟所建立的圖形庫與語音引擎，自動產生多媒體識字學習版面。

四、識字學習版面製作工具的使用性（usability）評估。評估的項目將包括學習負載、製作版面效率與使用者喜好程度。將有二十至三十位現職或培育階段的特教老師，接受利用一般用途版面編輯器與本識字學習版面製作工具之使用訓練。研究比較本識字學習版面製作工具是否較容易學習？也較有效率？並且也較獲得使用者喜好？

第三年研究預期獲得的主要效益爲，我們過去兩年的識字教學研究成果將得以順利推廣。俗云：『工欲善其事，必先利其器』。在前兩年我們的研究中證實圖形刺激退化策略與多媒體系統是有效的識字教學方法。若欲獲得特教老師的青睞，能把這些有效的方法應用在其平日的教學活動中，則必須提供他們一個學習容易與操作方便的工具以製作識字學習版面。而研發本多媒體識字學習版面製作工具的目的正契合特教老師們的需要，也因此可預期國內特教學生的識字學習效果將能提升。

The Effects of Picture Fading and Word Enlarging Techniques on a Multimedia Learning System for Teaching Chinese Word-Recognition to Pupils with Multiple Disabilities

The purpose of the study was to examine the effects of picture fading and word enlarging techniques on a multimedia learning system for Chinese word-recognition instruction. Three first grade students with multiple disabilities participated in this study. A single subject multiple probe baselines design across subjects was used. The three subjects received word-recognition instruction with picture fading and word enlarging techniques to identify four Chinese printed words. The results of this study showed that all subjects could identify the four printed words correctly without the presence of known pictorial cues. In conclusion, the use of picture fading and word enlarging techniques on word-recognition instruction can function as a bridge between printed words and pictorial cues.

Keywords: word-recognition; stimulus fading strategy; multimedia learning system; students with disabilities

Topics of interest: 45 Special Education & 46 Teaching/learning strategies

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1 Introduction

Word recognition and comprehension are two essential elements of reading. Good word recognition abilities lead children to successful reading. The frustration of not being able to recognize words prevents many children from having successful learning. In the past, children with moderate or severe mental retardation were not considered candidates for reading instruction [2][4]. Thereby they often experience many difficulties in learning to recognize and comprehend words. It is only recently that researchers and practitioners in Taiwan began addressing Chinese word-recognition instruction for children with moderate or severe mental retardation [5].

Since each Chinese symbol has its meaning, many special education teachers in Taiwan use a "whole-word" approach with pictorial cues as word-recognition instruction for teaching students with moderate or severe mental retardation. Such method employs a pictorial cue in the presence of an unknown printed word with a view to reducing the complexity of word recognition, increasing the motivation of learning, and leading to success, [2][4]. However, literature has shown that children with disabilities learn to identify printed words more easily in the absence of pictorial cues [4][5]. The literature also considered that pictorial cues could interfere with students' attempts to deal with written word since students were likely to pay attentions on the picture instead of on the word.

To shift students' attention from pictorial cues to written words, investigators employed "fading strategies" for teaching word-recognition to students with moderate or severe mental retardation [5]. Sue (1992) examined two stimulus-fading strategies, internal stimulus and external stimulus, as word-recognition instruction to teach three second graders with moderate disabilities to learn Chinese sight-words. For the internal stimulus-fading strategy, a picture was superimposed directly on the written word and the picture was systemically and gradually faded out. For the external stimulus-fading strategy, a picture was presented separately in space form the word and the picture was systemically and gradually faded out. The results of Sue's study showed that both stimulus fading-strategies were effective to teach word recognition skills to children with disabilities.

Much research has been shown the effectiveness of the use of stimulus fading strategies in word-recognition teaching, but do special education teachers use them as their daily reading instruction to children with moderate or severe disabilities? The answer is that many teachers are not inclined to use them because the use of picture fading strategies as word-recognition instruction involves labor consuming work on the teachers' part for preparing materials. Additionally, teachers have to devote any amount of time to each child when applying picture fading strategies in teaching.

For the purpose of removing the barriers of implementation of picture fading strategies on word-recognition instruction, using a computerized multimedia learning system may be more effective and efficient [5]. The advantages of using a multimedia system not only save teachers' time, via copy and paste functions, but also provide learners with options of their own learning speed [3]. Additionally, the speech synthesizer of multimedia systems systemically providing feedbacks and reinforcements offers further possibilities to help the students. Thus, the research team at National Taiwan Normal University designed a multimedia learning system that embedded stimulus fading

strategies to exam the effectiveness of word-recognition instruction to pupils with moderate to severe disabilities.

2 Method

2.1 Participants and setting

Three first graders with multiple disabilities in the Chia-Y special school participated in this research. The participants were selected on the following four criteria. First, they were severely mentally retarded combined with physical or sensory impairments. Second, they could use one of their hands to make direct selection. Third, they could follow their teacher's directions. Fourth, they had history of not being able to recognize printed words taught on their classes.

Due to the three participants' ages as well as mental and physical limitations they were unable to take the standard IQ test, the WISC-Ⅲ, and the Peabody Picture Vocabulary Test, but they were believed that they were moderately to severely mentally retarded. A summary of the participant's characteristics based on the researchers' reviewing their individualized education plans (IEP) and interviewing with their teachers and therapists is shown in Table 1.

Table 1. Participants' Characteristics

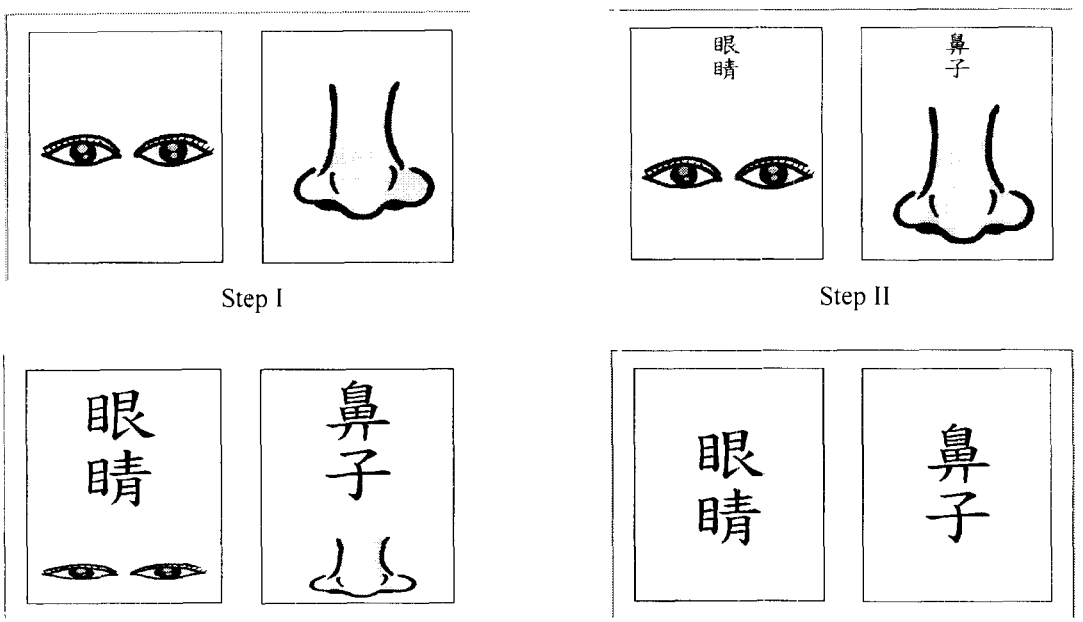
Participant	Age	Gender	Diagnosis	Cognition & language abilities
A	6	Male	physical disability, mental retardation, and visual impairment (strabismus)	• Could identify pictures of familiar things. • Received speech-language therapy
B	7	Female	physical disability and mental retardation	• Could identify pictures of familiar things • No oral language • Received speech- language therapy
C	7	Male	physical disability and mental retardation,	• Could identify pictures of familiar things • Could repeat single word • Received speech- language therapy

All of the three students had speech disorders and received speech therapy. Student A could respond to the teacher's questions in four-word short phrases. Student B made no oral responses. Student C could repeat single word, but could not use the actively expressive language. A personal computer with an U1 adaptive computer interface system was installed in the therapy room and placed on an adjustable table. The U1 system, designed by the Assistive Technology Foundation in Taiwan,

was a kind of programmable keyboards. The participants were sited in front of the computer and received the word-recognition instruction in the therapy room.

2.2 Stimuli

Four functional Chinese words (eye (眼睛) ,nose(鼻子) ,mouth(嘴巴), and ear(耳朵)), based on the schedule of the students' reading program, were selected and served as the target words. We used the editor of U1 system to create the instructional overlays. There were two frames on each overlay and each frame was sized by 11cm x 16cm. For the purposes of this study and according to the four fading steps, four types of instructional overlays were created for each target word. The first type of instructional overlays consisted of pictures only. The picture was placed in the center of a frame. The second one contained a target word printed in 50-point Ming type font with a picture in 10cm x 10cm. The target word was printed vertically and located above the picture. The third one contained a target word printed in 130-point Ming type font with a picture in 3cm x 3 cm. The target word was printed vertically and located above the picture. The fourth one was a printed word in 130-point Ming type without the presence of a picture. The word was located in the center of a frame. To prevent the participants from responding to the stimuli on fixed locations, each word was presented on both sides on different overlays. An sample of instructional overlays is shown on Figure 1.



Step I Step II

Step III Step IV

Figure 1 sample Overlays for four fading steps

During instruction sessions, one of the overlays (e.g., Step II or III) was placed on the U1 system. When the participant touched the frame of the overlay on the U1 system, the computer spoke out the target word, showed the picture of the target word, and then presented the target word on the screen.

2.3 Definitions of independent and dependent variables

The independent variable was stimulus fading strategy. The participants were taught to identify four functional words with pictorial cues. As they progressed, the pictorial cues were systemically and gradually faded out.

The dependent variables were the effectiveness and efficiency of the instruction. The effectiveness of the instruction was defined as the number of correct responses to target words. The efficiency of the instruction was defined as the number of sessions needed to reach mastery levels.

2.4 Design

A multiple probe baseline across subjects was used to assess the effectiveness of stimulus fading strategy on word-recognition for the elementary students with multiple disabilities. The reasons for choosing the multiple probe baseline design were: (a) the treatment was not reversed, (b) prolonged baseline measures were unnecessary, and (c) the design permitted of the evaluation of academic learning [1].

2.5 Procedure

2.5.1 Baseline

In the baseline period, the participants' familiarity with the target words was tested. The students were asked to point out the target word under researchers' directions. During the baseline assessments, the researchers just recorded students' responses and no feedback or prompt was given. Each target word was assessed five times. The number of correct response for each target word was recorded. Each participant took the probe testes at least three times.

2.5.2 Instruction period

Prior to the instruction, researchers divided the four target words into two groups and decided which group would be taught at the beginning. 'Eye '(眼睛) and 'nose'(鼻子) were placed in the same group and taught first. ' Mouth' (嘴巴) and ' ear'(耳朵) were placed in the same group and taught later.

Each participant had a twenty-minute learning session in the morning twice a week. There were four steps for teaching each target word. During the first training session, student A attended Step I instruction. Researchers put the picture only overlay on the U1, consisting of the target picture and an accompanying picture, read the target word, and then asked the student to make a selection of the target frame. If he selected the frame correctly within 10 seconds waiting period, the researchers said" you did a good job" as the reinforcement to the student. Otherwise, the researchers made a demonstration and asked the student to do it again. Then, the researchers pulled out the overlay, put another overlay with the same target picture and a different accompanying picture on the U1, and repeated the above procedure. The researchers recorded the student's correct responses during the instruction. The student would not move to the next fading step until he reached the master criteria, 4 correct responses

of five tries for each word of Group I in three consecutive sessions. Then the instruction procedure was repeated during Step II (smaller pictures with small printed words) and Step III (the smallest pictures with large printed words) and the final step instruction (printed words only). After the student could recognize the two printed words of Group I with no pictorial cues, then he moved to learn the words of Group II. The student B would attend the training immediately after student A entered Fading Step IV of the Group I instruction. The same procedures were followed for student B and student C.

2.5.3 Maintenance

In order to examine whether the participants could recognize the printed words that have been taught, maintenance testes were administered after the instruction peroid. No instruction was delivered during the maintenance stage.

2.6 Reliability

The students' teacher served as the primary data collector and the aid served as the second data collector. They checked and graded the subjects' work for ten instruction sessions. The total number of agreements divided by the total number of agreements plus disagreements and multiplied by 100 yielded a reliability index. The reliability index for this study was 100%.

3 Results

Figure 2 shows the number of correct responses of the four target words during the baseline, instruction, and maintenance sessions for each participant. The results of baseline assessments tests showed that all subjects were unable to recognize the four target words. During the word-recognition training sessions, all subjects demonstrated progressions in identifying the four printed words and reached the master levels. The results suggested that stimulus fading strategy was effective in teaching word recognition to the three subjects. Maintenance assessment tests were conducted after the word-recognition training period. The results indicated that all the participants could maintain their correct responses above the master level for each printed word.

Table 2 shows the number of sessions needed by the subjects to move to next step of instruction and the total number of sessions needed by them to identify each printed word. Each student toke 12 to 24 sessions (16.4 in average) to learn to recognize a printed word. These results implied that all participants could transfer their attention from the picture to the printed word without much difficulty. In other words, stimulus fading strategy was efficient in teaching word recognition to the three subjects.

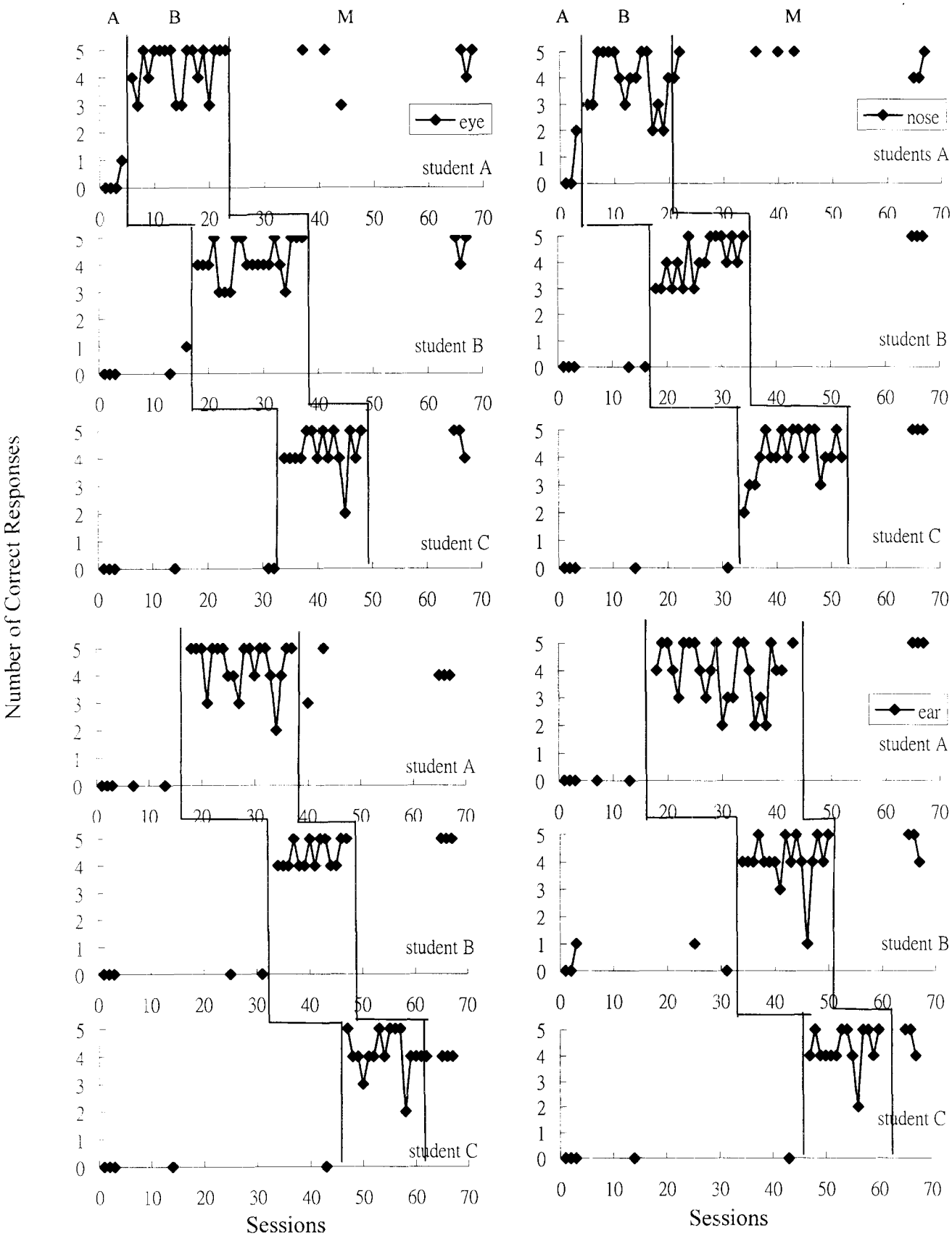


Figure 2. The number of correct responses during baseline, instruction, and maintenance period for three participants

* A: Baseline, B: Instruction, M: Maintenance

Table 2. The number of the sessions that the participants took n four fading steps

		eye	nose	mouth	ear
Student A	Step I	5	5	3	3
	Step II	3	3	4	5
	Step III	5	3	6	10
	Step IV	5	7	3	6
	Total	13	18	16	24
Student B	Step I	3	11	3	3
	Step II	7	3	3	3
	Step III	3	3	3	5
	Step IV	3	4	3	5
	Total	16	21	12	16
Student C	Step I	3	6	3	3
	Step II	3	3	4	3
	Step III	3	3	3	3
	Step IV	6	6	5	4
	Total	15	18	15	13

4 Discussion

In this study we examined the effects of picture fading tec nique on a multimedia learning system for teaching Chinese word-recognition to pupils with mo lerate or severe disabilities. Like the findings reported by Sue (1992), the results of this study showed that the three subjects could recognize the four printed target words in the absence of known pictorial c ues. These results indicate that using stimulus fading strategies on word-recognition instruction can be effective teaching methods. The use of picture fading strategies can function as a bridge between pri nted words and pictorial cues. Further, our findings repetitively support that children with moderate or severe disabilities can be taught to recognize written words. Thus, special education teachers should not lower their expectations on word-recognition instruction to students with moderate or severe disabilities. Finally, a multimedia learning system can be an effective and efficient teaching tool for teaching students with disabilities.

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