

Visual Discrimination Skills in Learning to Read

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Abstract: Approaches to the decoding of print in the English language have highlighted many important theories as well learning strategies needed to achieve competency in the language. Visual discrimination, visual attention, visual memory and vocabulary learning are among the key strategies listed. The use of technology to facilitate the specific intentional acquisition of visual discrimination, visual attention and visual memory are presented as a possible complementary aid to support the learning, especially among weak young children of the English as a second language.

Initial trial using mobile applications (apps) has yielded promising results in supporting the acquisition of visual discrimination and visual attention to print, strengthening the essential basic building block for reading.

Key words: *Visual discrimination, reading approaches, early literacy skills, weak readers, mobile applications*

INTRODUCTION

Ryan is a 6 years old child, who is currently attending a regular preschool setting. He has little knowledge on letter-sound correspondence. When Ryan is given a simple book with a three-word sentence on each page, he reads impulsively without looking at the print and one-to-one word correspondence. He relies on picture cues to guess unfamiliar words in his reading. Ryan confuses letters that look alike when reading. For example, Ryan reads the word 'We' as 'Me'. When pointing at the letter 'W', he reads it as 'M' and says the sound of /m/ for the letter 'W'. His parents are concerned about his reading ability as he is going for primary one in a primary school in two months time.

Learning to read is the acquisition of skills necessary to construct meaning from printed words. Visual discrimination is an essential skill in learning to read.

This paper examines the importance of visual discrimination in learning to read.

Mobile applications (apps) can be a potential support medium to assist in the building up of children's visual discrimination skills.

LITERATURE REVIEW

1. Reading Approach and Early Literacy Skills

Reading is to derive meaning from text. There are three classic types of reading models to understand how readers construct meaning from what they read. According to Gough [1], reading is a sequential process, or bottom up process, where in decoding, readers first identify and recognize written language (letters), translate letters into speech sounds, and put sounds together to decode words. They understand the whole text after accurate decoding of words. It is a sequential process from letter to sound, to words, to meaning. According to the bottom up approach, reading begins from part to whole processing of a text.

The top down approach emphasizes that reading is a meaning driven process. According to Goodman [2], reading is a selective process. Goodman [2] described reading as a psychological guessing game. Readers use their background knowledge and language knowledge (semantic, grammar and sentence structure) to comprehend what they are reading. They can comprehend the text without having identified all the words in it by using their language and background knowledge to predict or guess the meaning of unknown

words. The top down approach is also known as the whole language approach.

Rumelhart 1977, cited in Stanovich [3], proposed an interactive approach, where reading involves both bottom-up and top-down processes. Readers use the simultaneous interaction of both processes during reading.

Regardless of the approach used, acquiring early literacy skills is critical for the development of later literacy achievement. The National Early Literacy Panel (NELP) in the United States [4] conducted a meta-analysis to identify the essential abilities and skills of young children (age birth through five years or kindergarten) relevant to later literacy development. The panel reported that visual processing, which is the ability to match or discriminate visually presented symbols, was one of the essential skills that consistently predicted later literacy achievement. Ten other skills were also found to be critical in the development of children's early literacy skills. These early skills were alphabet knowledge, phonological awareness, rapid automatic naming (RAN) of letters or digits, RAN of objects or colors writing or writing name, phonological memory, concepts about print, print knowledge, reading readiness (include vocabulary), and oral language.

Visual discrimination is the foundation building block of critical reading readiness skills.

2. Visual Discrimination in Reading

Visual discrimination is a visual perceptual skill, which is the ability to discriminate dominant features of visual stimuli.

In a developmental study, Gibson, Pick and Osser [5] examined the development of visual discrimination of letter-like forms with 167 children aged four to eight years. Letter-like forms were constructed comparable to printed Roman capitals, and there were four types of transformations: line to curve or curve to line, rotation or reversal, perspective (slant left and backward tilt) and topological (break and close). All of these transformations except the perspective transformations are critical for discriminating letters. Errors were classified according to the type of transformation. Results found that errors of rotation and reversals were high in children four years old but declined to nearly zero in eight years olds. Similar changes were observed on line to curve transformations. For perspective transformations, the errors were high at four years old, and were still high at eight years of age. Errors were few even for the four years on topological transformations and declined to almost zero at eight years. These results suggest that children between four and eight learn to discriminate between features which are critical for

differentiating letters, such as break verse close (i, e. the difference between C and O), line verse curve (i.e. the difference between U and V) and rotations and reversals (i.e. the difference between M and W, d and b, p and b)

According to Gibson [6], learning to differentiate written symbols one from another is the initial stage of learning to read. She described learning to read as a three phase process: learning to differentiate written symbols; learning to decode letters to sounds ('map' the letters into sounds); and using progressively higher-order units of structure (.e. spelling and morphemic patterns in letter sequences, and syntactic and semantic patterns in word sequences.)

Kavale and Forness [7] conducted a meta-analysis to determine the relationship between auditory and visual perception processes and reading ability. They measured seven visual perception skills: visual discrimination, visual memory, visual-motor integration, visual closure, visual association, visual spatial relationship and figure-ground discrimination. Of these, visual discrimination and visual memory were reported as the best predictors for general reading and word recognition.

Feagans and Merriwether [8] studied the relation between visual discrimination abilities and reading intelligence and other achievement areas in children with learning disabilities and normally achieving children. 66 children with learning disabilities aged between six and seven years participated in the study together with 66 normally achieving children of the same age. Children with visual discrimination problems were identified using the letter-like visual discrimination task developed by Gibson et al. [5]. Results indicated that children with visual discrimination problems performed more poorly in reading and general achievement over the elementary school years in comparison to children who had no visual discrimination problems.

3. Visual discrimination Training

Learning to discriminate features from one another is critical to children. Gibson et al. [5] suggested that the improvements in discriminating letter-like forms in children aged four to eight years is the result of learning to detect the distinctive features and becoming more sensitive to critical features. Discrimination training to distinguish the differences between similar letters would facilitate children's reading acquisition [9].

4. App-based Medium in Learning Visual Discrimination

Using mobile devices can be an alternative avenue to facilitate children's learning. Young children's access to mobile devices has increased rapidly and dramatically. Media Development Authority (MDA) Singapore [10] conducted a survey to better understand children's media consumption habit and preferences. Results suggested that smartphones and tablets are most often used mobile devices for children aged 0 to 14 years [10]. A national survey of children's media use in the United States [11] was conducted with children aged zero to eight years. Children's access to mobile devices (e.g. smartphone, tablet) had increased from 52% in 2011 to 75% in 2013 of all children [11]. It was a dramatic increase over the two years from 2011 to 2013.

Young children appear to intuitively explore and learn with touchscreen devices because they can touch, repeat, learn by trial and error and experience stimulating features (e.g. sounds, animations, colour, and text) [12]. For educational purposes from the perspectives of early childhood educators, young children and their parents/caregivers, technology and interactive media (such as applications (apps)) are potential learning tools and resources to engage children's learning when used intentionally and appropriately [13, 14, 15].

Beschorner and Hutchison [16] conducted a study on the use of iPads in two pre-school classrooms of four and five year-old children over a seven-week period. iPads were given to teachers to use as instructional tools. Apps were selected that required reading, writing, listening, and/or speaking. Children used the installed apps to read, write or listen during individual, small group and large group learning. Assistance from teachers was minimal to encourage independence during individual and small group learning, though teachers made decisions on how to use the apps for teaching literacy. The study evaluated the results through observations, children's digital work samples, teacher interviews and parent feedback. Results from the study suggested that the iPad, or other similar tablets, can be a tool to support the development of early literacy skills in a variety of ways.

Neumann [12] conducted a pre-post randomised controlled study with children aged two to five years to look at the effect of using literacy apps on emergent literacy skills. Children were randomly assigned to the intervention group (iPad) and the control group. Children in the intervention group were given a nine-week literacy intervention program using iPads with three literacy apps (letter matching, letter tracing and drawing). They used these literacy apps for 30 minutes weekly over the nine-week of literacy intervention

program. The results showed that children in the intervention group performed better on letter name, sound knowledge, print concepts and name writing skills, compared to the children in the control group.

Touch screen tablets can be a potential tool to support children with special learning needs. Chmiliar [17] conducted a pilot study to examine the use of iPads with eight preschool children with disabilities aged three to five. The study was carried out in an inclusive preschool program. Each child had the iPad loaded with early learning apps (such as drawing, tracing, concepts color and shapes, number recognition, alphabet recognition, letter sounds, printing letters) to use at home and school over a period of 21 weeks. The eight children with disabilities showed improvements in many areas including shape and color recognition, letter recognition, and tracing letters.

McClanahan, Williams, and Tate [18] used an iPad as a medium for a reading intervention by a pre-service teacher to assist a struggling reader (5th grade) with Attention Deficit Hyperactivity Disorder. The student was reading at least two years below grade level. The teacher used an iPad with installed apps on word recognition skills and comprehension, games and e-books for the intervention with the student. A comparison of pre-post results showed that the student made noticeable progress equivalent to one year's growth in reading within a six-week time period. The study concluded that the use of the iPad as a medium for intervention could be considered in similar contexts.

Siew and Tang [19] conducted a pilot trial to examine the appropriateness of using mobile apps in supporting a group of Kindergarten 2 children (six year-olds) who were weak in visual discrimination skills and vocabulary recognition when negotiating print. A pre-post test methodological design with 25 kindergarten children consisting of experimental and control groups in regular preschool setting participated in the pilot trial. The experimental group was the children who were weak in visual discrimination skills and vocabulary in in-house screeners focusing on the two skills at the pretest. These children were also weak in reading as identified by their class teacher. The typically developing children were in the control group. The pilot trial was carried out during the learning corner time of 15 minutes within the school. After the pretest, the experimental group received a four-session intervention using the locally developed apps targeting visual discrimination skills and vocabulary. A learning support educator guided the experimental group on how to access a tablet loaded with three apps focusing on visual discrimination skills and vocabulary in the first session. Then the children engaged in a self-directed learning using the tablet for the subsequent three sessions. They engaged with apps

for up to 15 minutes during the learning corner time for four sessions. While the experimental group was receiving the app intervention, the control group (typically developing children) followed the regular routine in the school of playing with peers at the learning corners. The control group did not have the app intervention. When the experimental group completed the app intervention, both experimental and control groups were administered a posttest at the same time. Initial outcomes showed that the experimental group made a significant improvement between pre and posttest, compared to the control group. The experimental group showed a significant shift on visual discrimination skills and vocabulary, from before using the apps and after. The pilot trial concluded that the appropriate use of mobile apps could be a possible complementary support medium to assist in the building up of children's foundational skills in literacy acquisition, specifically visual discrimination skills and vocabulary. The implication of using app based medium could potentially provide an accessible support for children with learning needs at a minimum cost. The accessibility of apps will result in more children with learning needs being supported without solely relying on the often expensive and scarce human resources [19].

SUMMARY

Visual discrimination is a preliminary step, critical in learning to read [5, 6, 7], regardless of the reading approach used. Visual discrimination problems can persist over time as showed in poorer achievement over the elementary school period [8]. Providing interventions to children who are weak in visual discrimination skills is crucial. Mobile apps can be a complementary support medium to assist in building up children's visual discrimination skills and in the acquisition of reading.

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