

Adapted multimedia design for language learning in children with autism

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This paper reports the pilot study and the theoretical framework of a study on speech acquisition in childhood autism in a multimedia-facilitated learning environment. Reflections, based on findings of the pilot, on the theoretical framework, the conceptualization of multimedia design, and the pedagogical/instructional modifications are discussed.

Keywords multimedia design; language learning; autism

1. Focus reflecting main study's objective

This is a report of a pilot study focusing on rooms of adjustments for the original multimedia product one of these researchers designed for his main study exploring the prospective changes in the verbal vocabulary acquisition in childhood autism with limited speech in a multimedia-facilitated context.

With the findings of this pilot study which help refine the software design and adaptive pedagogy for children with autistic spectrum disorders (ASD) in the intervention period, this researcher expects to investigate further the learning styles in childhood autism [1] and then construct multimedia-assisted learning models for these students through collaborative efforts of professional educators, cognitive psychologists, information and communication technologists, neuropsychologists, and many other related specialists in a further investigation.

2. Theoretical framework

Our principal study adopts a cognitive perspective of information processing theory in multimedia learning [2-3] based on the ideas and findings of Robert E. Kozma and his associates [4-6] and of Richard E. Mayer [7], and on the concept of information processing (IP) defined as a joint product of information theory and computer sciences [8]. We support the argument that IP with its specific characteristics is able to explain and contribute to the progress of vocabulary learning [9] in students with autistic features. Our assumption is that the children with autism's speech difference than their typically developed counterparts is likely an outcome of delayed development in the ability of retrieving appropriate information in their working memory from their long term memory instead of their receptive language capability.

Such a language learning gap in children with autism, when their working memory is not able to retrieve ample relevant or corresponding visual and audio information from the long term memory [10] as those typically developed do, we hypothesize, may be bridged theoretically with a variety of processing qualities [5] displayed in the procedure system, which is part of Kozma and Mayer's multimedia learning theory, in which multimedia presentation is a crucially essential symbol system, incorporated with Levelt's [11] application of IP theory to speech formulation in human learning.

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Graphical representation in Figure 1 below shows how automaticity and interactivity [12], two key features of computer-based multimedia program, help students with autism develop their spoken vocabularies with the guidance of the teacher or facilitator in the learning process involving the role and function of this kind of learning tool, designed from the constructivist IP perspective, instead of a literal interpretation [13], for students with autism in the process of the interaction between the learner as a processor and humanized multimedia program and computer technology in the leaning ecology, a concept of design experiment's supporters [14].

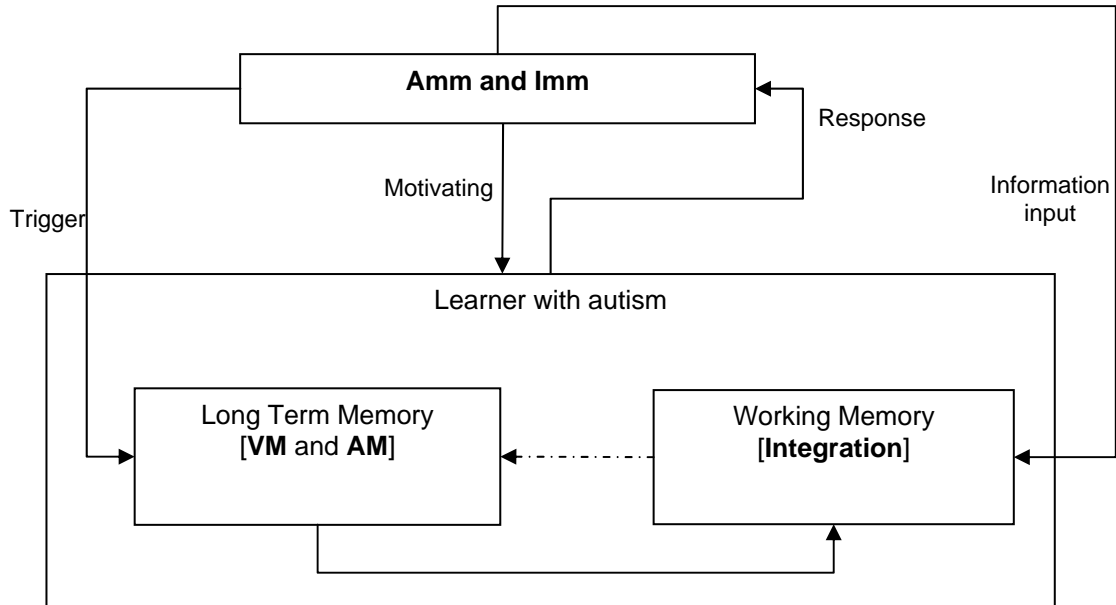


Figure 1 Learning process with multimedia system as external memory. Key concepts are bolded. Amm=Automaticity of multimedia, Imm=Interactivity of multimedia, VM=Visual memory, AM=Audio memory. Broken line=Incomplete transmission of information

3. Pilot study

3.1 Participants

Three boys, who had been diagnosed as autistic in representative and authoritative organizations such as educational psychologists in the Education and Manpower Bureau (EMB) or Duchess of Kent Hospital Child Assistance Centre and whose parents are native Cantonese speakers, from 7 to 8 in their chronological age but in their language age of 2 to 3 were selected from a special school in Hong Kong other than the target school for the main study. A speech therapist of that school administered and coordinated the whole process.

3.2 Methods

The boys had equally 6 sessions of various topics within two weeks and were exposed to a commercial multimedia learning program for kindergarten Level 2 which is catering for children of 4-5 years old in Hong Kong. In other words, the cognitive and language level was relatively higher than the boys' actual and assessed level. In order to minimize the effect of some unexpected behaviours, two sets of play kits and some snacks were prepared. Their performances were video-taped for further analysis.

3.3 Findings

3.3.1 Knowledge of vocabularies

S1 was able to speak simple vocabularies, for example, “yes”, “cup”, and to identify the characters “people”, “bed” with his finger without speaking it out. He apparently is weak in verbal expression and just made some sound to express his needs and/or emotions.

S2 was able to express his need verbally at intervals and to respond with fairly complex vocabularies, for example, “Put the schoolbag”, “electric cooker” or words for location, for example, “Here”, “On desk top”. The boy responded, “Thank you” when asked what should be said in receiving gift. Occasionally, the boy was able to ask questions, for example, “where is this?”.

S3 seldom talked but was found able to speak such expressions as “Good” and even some complex statement like “Yes, I do want to eat!”. In second session, this boy did try on the game and he knew most of the items.

3.3.2 Communication with researcher

S1 was able to understand researcher’s instructions but showed no response to researcher’s appreciation. He accepted researcher’s help to point at his choice of answer on the monitor. At intervals, the boy shut his ears with his hands, or curled up in the chair, or turned half of his back to the researcher. At the end of the first session, this boy shook hand with the researcher and scratched slightly and softly on the latter’s hand.

S2 followed facilitator’s instructions or the program narrator’s step by step. He felt interested in the researcher’s forehead without hair and touched on researcher’s head top.

S3 pulled researcher’s hand away when he wanted to close the program, and tried to get back the mouse when researcher took control over the mouse. Researcher insisted to holding the mouse, the boy started to gape and to press the keyboard. Obviously this boy wanted to do things on his own and did not want to follow researcher’s request and instruction. He usually made no response to researcher’s explanation and/or questions.

3.3.3 Responses to the program

S1 at first expressed little interest in the program but started to use or touch the mouse when requested to play the game matching a picture with the appropriate word. But it seemed he was not able to manage the mouse well and did not quite understand the audio instructions of the program and his initiative was still weak because he stopped and withdrew sooner after researcher helped him and he got the correct answer but he leaned back to the chair and seemed not interested in the marks he had got. The boy seemed interested in playing the mouse instead of watching the program.

S2 did not interrupt the program and could complete the tasks with very good marks most of the time. He was able to manage the games and to choose the most appropriate answers. He appeared quite concentrated on what displayed on the screen, looking more carefully at these items, and frequently touched either the mouse or the keyboard; looked like to do something with these devices. S2 was able to work alone without distraction even when the researcher departed for a while. This boy was excited at getting correct choices. The boy seemed interested in the themes of the program such as cooking and food and had clear concepts of different kinds of food, heat, and coldness. Playing computer game or task likely did not pose difficulty or problem on this boy and this kind of design seems appropriate for this boy. Sometimes, the boy needed researcher’s help to move the mouse in the game of moving items from one place to another location.

S3 switched off the program or exited the running portion of the program. That means the user might not follow the flow of the program. This boy showed frequently his desire to control the device and was quite interested in other icons than those he was required to press in order to perform the task. But he knew how to re-enter the program after exiting. When a game started, he appeared more attentive and be able to pay longer span on the program but very soon he began to move expressing his impatience. But some exciting sound from the program seemed attractive to the boy whose successful three tries in a task when he re-tried the program showed his ability in the task.

3.3.4 Need for materialistic reinforcement

Both S1 and S3 were aware of the existence of materialistic reward for tasks completed. S1's impatience and irritation were expressed when snacks were not given for correct answers as promised. S3 turned his head back looking at the desk behind after the researcher asked if he wanted some snacks.

4. Discussion

Results reflect the potentials of using multimedia software to help language learning in children with autism. The needs for reconsideration in theory-building, multimedia design, and pedagogical or instructional modifications, however, deserve our further discussion and exploration.

4.1 Reflection on the theoretical framework

Some reflection about the provision of facilitator in our theory-building has been briefly discussed [3], but this pilot study further discloses the need for additional variables. S3's reaction to the program seems to indicate automaticity and interactivity of the multimedia software may not be desirable as initially expected in the learning process. In other words, automaticity and interactivity may not be independent of some other equally significant factors, for example, efficient use of cognitive strategies [4] that is closely related to individual characteristics of learners with autism.

Hardy et al. [12] argued that the automatic features may help reduce or minimize childhood autism's easy distraction. In the case of S3, it may imply some connection of automaticity with other dimensions, e.g. the psychological and cognitive needs of the child, in the issue of distraction. This in turn is related to the relevancy of information to the children with autism's functioning [15].

4.2 The conceptualization of multimedia design

The significance of a simple layout of a piece of multimedia software is obvious. It was found in this pilot study that the colourful and sophisticated layouts were too easily to distract the participants' attention. The behaviour of S3 described in the preceding paragraph is able to elaborate the influence of this factor. In the view of, additionally, increasing the retrievability of the spoken vocabularies the subjects in our main study would learn, they were at the same time stored and displayed in three forms, verbal and pictorial plus text [4].

Multimedia design, discovered in the interaction of the boys with the commercial product, should not be confined in the media themselves involving organization of learning and/or teaching material, the format of presentation, tasks to be completed, and the like. The concept, in fact, is better understood in such a way that the multimedia software as a cognitive tool as Kozma [4] suggested should be constructed as one of "adaptive learning systems [which] are learning programs capable of adapting themselves to the individual abilities of the learner, e.g., previous knowledge, interests, weaknesses or preferences with regard to forms of representation" [16]. This is why Kozma in 1991 agreed that "such tools will be more effective if they activate the task-relevant cognitive skills that writers already have while they model and support those cognitive processes and skills the writers lack" [17] when he explained the relationship between computer-based writing tools and the writers' cognitive needs.

4.3 Pedagogical/Instructional modification

The role of materialistic reward is further supported in this pilot study. The two boys' expectation for rewards may define the significant importance in the learning and teaching processes of students with autism. However, whether it should be part of and integrated with the pedagogical or instructional considerations, like a recent conference [1] attendee's question, remains further in-depth investigations.

Individual difference, nevertheless, has demonstrated its necessary and essential impact on our curriculum design, instruction adaptation, and pedagogical adjustment including an attempt of shifting S1's attention to other topic but drawing him back to the program, identifying explicitly this boy's interest in the mouse and his possible fear of the researcher, and assisting him to make a selection of appropriate answer. For S3, our intervention approach was slightly changed with the focus on game activity and time per session was deliberately shortened. In the multimedia-support context, personal interaction and verbal explanation on activities is still significant. These refinements were made due to the awareness of the boys' cognitive needs, comparatively difficult interpersonal relationship, relatively shorter attention span, and weaker ability in decision-making.

Last but not the least relevant reflection on multimedia system design [4-5] for children with autism is how to include some imperative ad hoc events with learning implications during intervention and how to produce a product catering for this kind of users to navigate on his/her will.

References

- [1] F. K. Lau, A. H. K. Yuen, and J. M. G. Lian, Learning Styles and Language Intervention with Information Technology in Children with Autism , Paper presented at International Conference on Special Education, Hong Kong, 2-3 June 2006
- [2] F. K. Lau, Spoken vocabularies development in children with autism through multimedia-supported instruction, *Research Studies in Education*, **3** (2005)
- [3] F. K. Lau, A. H. K. Yuen, and J. M. G. Lian, Enhancing spoken vocabulary performance in children with autism in a multimedia-supported context, Paper presented at the Hong Kong International Information Technologies in Education Conference, Hong Kong, 6-8 February 2006
- [4] R. E. Kozma, The implication of cognitive psychology for computer-based learning tools, *Educational Technology*, **27**, 11 (1987)
- [5] R. E. Kozma, Learning with media, *Review of Educational Research*, **61**, 2 (1991)
- [6] R. E. Kozma and R.G. Croninger, Technology and the fate of at-risk students, *Education and Urban Society*, **24**, 4 (1992).
- [7] R. E. Mayer, *Multimedia learning*, Cambridge, Cambridge University Press (2001)
- [8] S.M. Alessi and S.R. Trollip, *Multimedia for learning: Methods and development* (3rd ed.), Boston, Allyn and Bacon (2001)
- [9] D. W. Massaro and N. Cowan, Information processing models: Microscopes of the mind, *Annual Review of Psychology*, **44**, 1(1993)
- [10] C.M. Bird, F. Castelli, O. Malik, U. Frith, and M. Husain, The impact of extensive medial frontal lobe damage on 'Theory of Mind' and cognition, *Brain*, **127**, 4 (2004)
- [11] W.J.M. Levelt, *Speaking: From intention to articulation*, Cambridge, MA, MIT Press (1989)
- [12] C. Hardy, J. Ogden, J. Newman, and S. Cooper, *Autism and ICT: A guide for teachers & parents*. London, David Fulton (2002)
- [13] R. E. Mayer, Learners as information processors: Legacies and limitations of educational psychology's second metaphor, *Educational Psychologist*, **31**, 3/4 (1996)
- [14] P. Cobb, J. Confrey, A. diSessa, R. Lehrer, and L. Schauble, Design experiments in educational research, *Educational Research*, **32**, 1(2003).
- [15] H. Lee Swanson, Information processing theory and learning disabilities: A commentary and future perspective, *Journal of Learning Disabilities*, **20**, 3 (1987)
- [16] R. Steinmetz and K. Nahrstedt, *Multimedia applications*, Berlin, Springer-Verlag (2004, p. 162).
- [17] R. E. Kozma, Computer-based writing tools and the cognitive needs of novice writers, *Computers and Composition*, **8**, 2 (1991, p. 35)