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PROGRAMME FOR THE IMPROVEMENT OF METAMEMORY IN PEOPLE WITH MEDIUM AND MILD MENTAL RETARDATION

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Metamemory is knowledge about our memory and about everything that is relevant for the recording, storing and recovery of information. It enables us to detect whether a situation requires greater or lesser effort, and what strategies are most suitable according to the task, our cognitive characteristics and the context. Metamemory develops with age, allowing us to increase the sophistication of our learning strategies. Research in this field indicates that the more developed the metamemory, the better the memory performance. Memory deficits in people with mental retardation are attributed to, among other factors, their poor knowledge about their memory. It is this that motivated us to design the programme. The results confirm the effectiveness of the programme, which indeed helps this population to increase knowledge about their memory.

La metamemoria es el conocimiento de nuestra memoria y de todo aquello que es relevante para el registro, almacenamiento y recuperación de la información. Mediante ella somos capaces de detectar si una situación requiere un esfuerzo mayor o menor, qué estrategias son las más adecuadas en función de la tarea, nuestras características cognitivas y el contexto en el que estamos. La metamemoria se desarrolla con la edad, y nos permite una sofisticación de las estrategias para el aprendizaje. Las investigaciones en este campo indican que a mayor metamemoria mejores ejecuciones en memoria. Los déficits de memoria en deficiencia mental se atribuyen, entre otras cosas, a los pobres conocimientos que los deficientes mentales poseen sobre su memoria. Esta es la razón por la que nosotros hemos diseñado este programa. Los resultados confirman la efectividad del mismo, ya que gracias a él, los deficientes mentales son capaces de aumentar sus conocimientos sobre su memoria.

People with mental retardation have serious difficulties with the majority of intentional memory tasks, the causes of these difficulties being cited as brain damage, metacognitive deficits or a poor knowledge base.

The aim of this work is to check whether people with mental retardation are capable of benefiting from training in metamemory and, if they are, to determine whether they are capable of maintaining over time the knowledge acquired. This research was carried out with a view to seeking possible forms of intervention to improve learning in people with mental retardation.

Metamemory is the knowledge we have about memory in general and about our own memory in particular. Flavell and Wellman (1977), define it as our knowledge of the memory and of all that is relevant for the recording, storing and recovery of information. This knowledge permits us to put into practice a series of strategies for solving our memory problems in any everyday situation (García, 1977).

The majority of studies in people with mental retardation suggest that many of their memory problems derive from their poor knowledge about their memory, which makes it difficult for them to use strategies correctly and to generalize the strategies learned (Borkowski and Wanschura, 1974; Borkowski, Millstead and Hale, 1988; Bellinger, Borkowski, Turner and Hale, 1995; Turner, Haley and Borkowski, 1996; Valkil, Shelef-Reshef and Levy-Shiff, 1997). Other research indicates deficits in control as the cause of their difficulties in memory tasks, since they are incapable of planning, monitoring or evaluating their performance (Sternberg, 1985; Borkowski, Reid and Kurtz, 1984; Flavell, 1987; Butterfield and Belmont, 1977; Brown, 1978).

Our objective is to design a programme for improving the knowledge of people with mental retardation in relation to memory, which covers aspects of both knowledge and control. The specific aims of the present work can be summarized as follows: a) To detect the know-

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ledge of people with mild and medium mental retardation about their memory; b) To apply a programme for increasing this knowledge; c) To check the effectiveness of this programme.

METHOD

Subjects

The sample used for the research was made up of 28 people with mild and medium mental retardation, with a mean I.Q. of 52, assessed using the WISC-R. Chronological age ranged from 13 to 17 years, with a mean of 15 years 3 months. All were from the same institution. For the assignment of the experimental and control groups we took as a reference the scores obtained in Belmont and Borkowski's (1988) Metamemory Battery.

Hypotheses

1- People with mental retardation have a poor metamemory.
2- They can benefit from training in metamemory.

The training programme

Our training programme combines general and specific strategies and knowledge, since it appears that such programmes are those that produce most benefits in people with mental retardation.

Our instructional approach took into account the principles of Brown and Palincsar (1982) for teaching any strategy and the metacognitive training patterns of Osman and Hannafin (1992) and Borkowski (1992). We employed a discriminative phase with regard to the situations in which it is and is not appropriate to apply a given strategy (Mayor, 1988; Mayor and Sainz, 1988) and provided feedback on the choice and execution of strategies (Campione, Brown and Ferrara, 1982). Finally, we tried to ensure that the adolescents assessed their performance, as this increases their potential for transfer (Cox, 1994).

The general objective of the programme is that the participants acquire clear knowledge of what memory is (general metacognitive knowledge) and what they can do to improve their memory performance, and they are taught specific strategies (repetition and organization) and general ones (planning and control). This general aim can be subdivided as follows: a)- To help the adolescents to identify and define problems, training planning as a general and highly generalizable strategy; b)- To teach them to consider effective strategies for the solution of a problem; c)- To help them to assimilate self-assessment techniques, assessing their personal work and their weak and strong points; with this objective we worked on the person knowledge variable and the control checking variable; and d)- To help them to locate connections between the tasks trained and everyday life, working on generalization.

The programme consisted of 40 one-hour sessions, which were applied from October until April. The experimental group was divided into two groups for the training, which was carried out during school time. The application of the programme was structured in four stages: Introduction, Teaching of metacognitive variables of knowledge and control, Conceptualization (planning and checking), and Cognitive strategies of repetition and categorization. These were followed by a Combined phase.

In the *Introduction stage* we told the adolescents about the characteristics of the work they would be doing and the goals proposed, and provided a general outline of the programme.

The *Metacognitive knowledge variables stage* was focused on defining among everyone what memory is and what its uses are, detecting the participants' strong and weak points, defining what a strategy is, identifying and being aware of the strategies they used, judging whether strategies helped us to recall things better, and detecting which type of material was easiest to recall and which was most difficult, and why. This stage included a modelling phase, a guided phase and an individual phase.

In the *Conceptualization stage* we worked on concepts and categories, which are fundamental for organization strategies.

In the *Control variables stage* we focused on identifying and defining memory problems themselves, seeking different ways of solving them according to the participants' personal characteristics and those of the task. Subsequently, we assessed the results obtained, both individually and in groups.

In the final *Combined phase* we integrated all the stages.

All the sessions except that of the presentation had the following structure: 1- Activation of previous knowledge, with a brief summary of the last session; 2- Performing of exercises corresponding to that session; and 3- Session ends with a synthesis of it.

Example of a person variables session

The objectives of these sessions are that the participants become aware of their strong and weak points in relation to memory and of the spontaneous strategies they use. The session begins with the activation of previous

knowledge, stressing the concept of memory (we should point out that in the presentation sessions we had already defined among everyone what memory is and what its uses are). In the modelling phases the researcher mentions two activities that s/he recalls with no problem, and explains why s/he has no difficulty. S/he then says the following to the adolescents: " *Now you are going to tell us two things that you remember without any difficulty, and just as I did, you must explain to us why it's no problem".*

The adolescents write their replies in a notebook. When all of them have finished, they must read them out to the class and demonstrate that they can easily recall that task or situation. Subsequently, they must explain why they have no difficulty to recall them. It is important to listen to all the replies given by the participants. It should be borne in mind that in principle there are no right or wrong responses, and all are noted down on the blackboard. It is most important that the researcher makes no judgement about any reply, since the aim of the session is for all the participants to "become aware" of their strong and weak points. We believe that if we do not take note of all the replies given by the adolescents, this may cause inhibition in those with the greatest difficulties. Subsequently, the same procedure is carried out for two tasks that the adolescents find it difficult to remember. It may be that in these initial sessions the replies given by the adolescents are not appropriate, and in this case we can suggest everyday situations in which they do not normally have problems and allow each to respond in turn.

Table 1
Means and standard deviations of the experimental and control groups at the three measurement points

VARIABLES	Experimental group			Control group		
	M1	M2	M3	M1	M2	M3
Total score in metamemory	10.00 (2.45)	19.46 (3.97)	20.08 (5.29)	9.71 (2.18)	12.42 (5.15)	11.29 (3.87)
Organized list	1.00 (1.52)	4.00 (1.63)	4.46 (2.18)	0.57 (1.22)	1.86 (1.66)	0.71 (1.68)
Preparation of the object	1.50 (0.86)	2.54 (1.45)	3.69 (1.50)	1.93 (0.99)	2.56 (1.49)	2.42 (1.30)
Associated pairs	0.79 (1.67)	4.77 (2.29)	3.69 (2.69)	0.43 (0.85)	1.57 (2.50)	1.28 (2.16)
Circular recall	0.14 (0.54)	0.62 (1.75)	0.61 (0.96)	0.00 (0.00)	0.14 (0.54)	0.14 (0.53)
Rating of memory	6.57 (1.02)	7.54 (1.20)	7.69 (1.84)	6.64 (1.21)	6.50 (1.10)	6.71 (2.12)

Example of a combined session in which we unite the task variables, the repetition strategies and the metacognitive variables of checking and control.

The aim of these sessions is that the participants identify which material is easiest to remember and why. We should stress that known material is easier than unknown material, that remembering a little material is simpler than remembering a lot of material and that organization of the material favours recall. We teach the use of the cumulative repetition strategy. Our aim is for the adolescents to detect the nature of the problem and to check their performance. It should be borne in mind that all of these variables must initially be worked on individually. The material that can be used consists of two lists with six words in each, one with closely related words, such as animals, and one with non-related words.

In the modelling phase the researcher explains the entire process in the following way: "If I have to choose one of these two word lists to learn, let's see which one is easier for me. In order to find this out, I have to read them" (s/he reads them aloud). On reading the first list s/he says aloud "it has six words and they're all animals". The second list is then read aloud, and s/he says: "it also has six words, but these can't be put into a group, because one is a piece of furniture, one is an item of clothing, and so on." The researcher then talks about the comparison of the two lists, deciding that the first is simpler, since the words are related. Next, she says: "Right, the following step is to learn them and I'm going to repeat them; I know they're animals and that I have to repeat 6 words." The repetition is made aloud. "Once we think we've learned them properly we check our learning and decide that we know them."

This is followed by the guided phase, in which the adolescents are helped with carrying out the exercise. A series of questions is provided to guide them: "What do

Table 2
Significant effects in the different variables analyzed

VARIABLES	F. Group DF (1, 25)	F. Change DF (2,50)	F. Interaction DF (2,50)	Contrast 1	Contrast 2
Total score in metamemory	17.30***	45.45***	19.09***	67.07***	37.14***
Organized list	18.78***	19.59***	10.08***	15.07***	0.01NS
Preparation of object	0.75NS	11.77***	4.81*	6.82*	0.19NS
Associated pairs	9.80**	17.21***	5.14**	6.9*	6.40*
Circular recall	2.75NS	1.26NS	0.35NS	1.32NS	0.19NS
Rating of memory	3.52NS	1.14NS	1.19NS	3.49NS	1.79NS

NS: non-significant *p< 0.05 **p< 0.01 ***p<0.001

we have to do?", "What are we going to do first?", "Which list is easier?", "Why?", "How do I have to learn it?", "Am I sure I know it now?", "Why?".

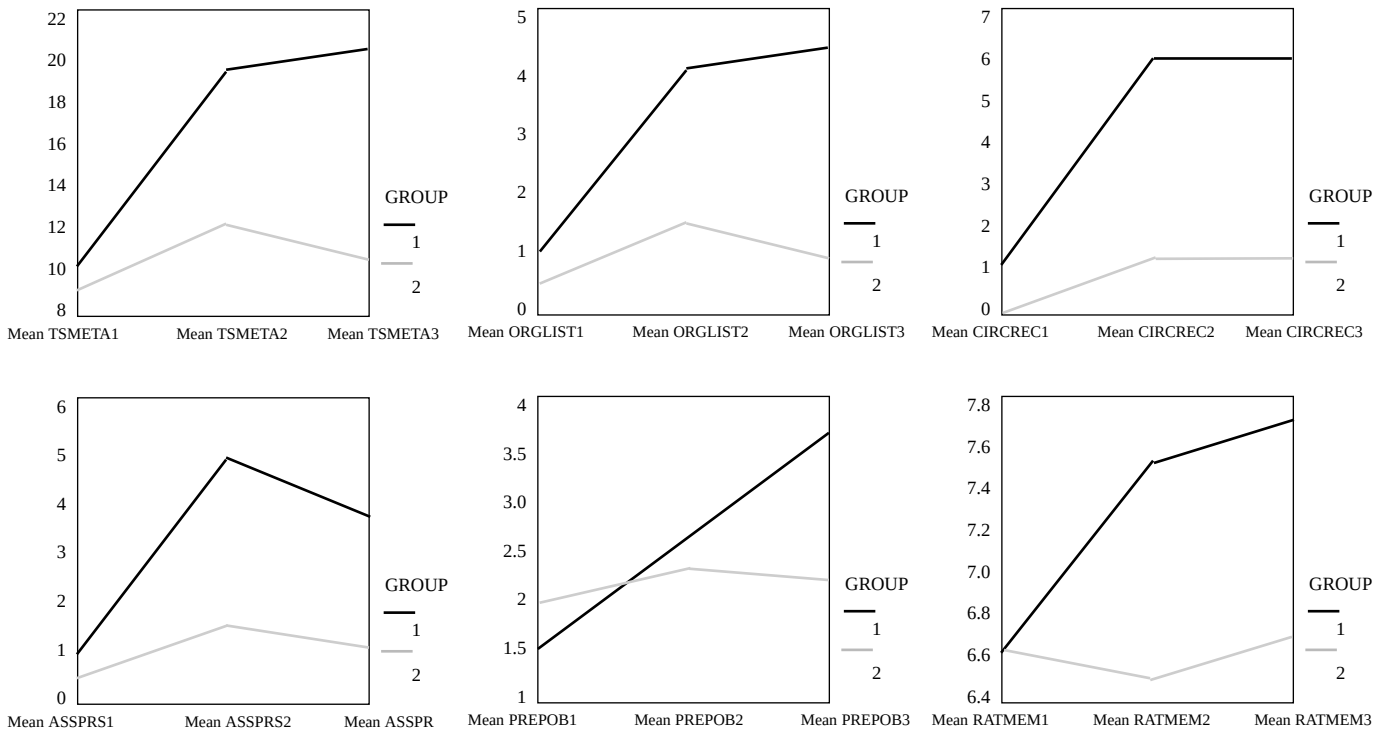
In the individual phase the participants carry out the task alone, and subsequently tell the group what they have done. The assessments are made by the group.

RESULTS

The statistical analysis used was that of the General Linear Model of Repeated Measures, Type III. Treatment acted as the between-subjects variable, dividing the population into experimental group and control group. As within-subjects variable we used the measures taken in the Metamemory Battery before, after and in the maintenance phase. For the effects of the research we took into account only the analyses corresponding to the interaction between the between-subjects variable and the within-subjects variable, since our objective was to determine the effects of the training in the experimental group. Table 1 shows performance at the three measurement points. In order to determine the point at which the differences occur we carried out a "post-hoc" contrast, specifically a deviation contrast, which is a within-subjects contrast.

The results of the repeated-measures analysis (Table 2) indicate significant effects in the following variables: Total score in metamemory, $F(2,50)=19.09$, $p< 0.001$, and the subtests Organized list, $F(2,50)=10.08$, $p<0.001$, Preparation of object, $F(2,50)=4.81$, $p<0.05$ and Associated pairs, $F(2,50)=5.14$, $p<0.001$. The contrasts indicate the point at which the changes have occurred. We applied "post-hoc" contrasts, observing that in the variable "Total score in metamemory" the change occurred between the scores pre/maintenance, Contrast 1, $t=67.07$ $p< 0.001$ and post/maintenance, Contrast 2, $t=37.14$, $p<0.001$. In the "Associated pairs" variable the changes also took place in the pre/maintenance phase, Contrast 1, $t=6.9$, $p< 0.05$ and the post/maintenance phase, Contrast 2, $t=6.40$, $p< 0.05$. In the variables "Organized list" and "Preparation of the object" these changes were only observed in the pre/maintenance phase. In the variables "Rating of memory" and "Circular recall", although no statistically significant differences were found, we did observe a tendency of

Figure 1
Graphs at the three measurement points. Group 1 is the Experimental Group and 2 is the Control Group. Order of the graphs is Total Score in Metamemory, Organized List, Circular Recall, Preparation of the Object, Associated Pairs and Rating of Memory



the experimental group to improve more than the control group (Figure 1).

DISCUSSION AND CONCLUSIONS

The data from the first assessment indicate the low level of knowledge in people with mental retardation about the processes underlying a memory task, data which confirm our first hypothesis. Moreover, these results concur with the findings of other studies on metamemory and mental retardation (Turner et al., 1997; Turner et al., 1996; Bellinger et al., 1995, Borkowski et al., 1988; Kurtz and Borkowski, 1987; Schneider, Körkel and Weinert, 1987; Valkin et al., 1997; Lodico et al., 1983; Brown, 1978; Campione and Brown, 1977).

The analysis of each one of the subtests shows the participants to be unaware that when we have to remember a task we can use external strategies and notes, or that others can serve as external information stores; in accordance with the studies of Kreutzer, Leonard and Flavell (1975) and Ceci, Lea and Ringstrom (1980), our population functions like pre-school children. They are also unaware that semantic organization favours recall and that few words are recalled better than many, and they do not detect the fact that words with a high degree of association are remembered better than non-associated words. With regard to the variable "Rating of memory", they tend to underestimate it; this finding does not coincide with that of Brown et al. (1977), who found that that people with mental retardation tended to overestimate their memory capacity.

With regard to the way our participants approached the task, we observed that they were unsure of what to do, and did not ask questions to clarify. Also, they failed to analyze the information presented, and we observed no checking strategy. It can be said that they do not present an ability to plan, understood as the construction and/or use of hierarchical anticipatory representations (plans) for guiding activity (Hoc, 1987).

After the training, the experimental group improved more than the control group in knowledge about their memory, and these data indicate that people with mental retardation can benefit from training in metamemory, which confirms our second hypothesis. What is most remarkable in our view, however, is that they are capable of maintaining this knowledge and even continuing to improve after the training has finished. The participants have learned that organized material can be learned more easily than non-organized material, and that content with a high degree of association is remembered better than non-associated content. This is encouraging with a view to pedagogical intervention, as it appears the adolescents in our study have learned that certain procedures and strategies will help them to improve their recall. In accordance with Biggs (1988), we infer that they are aware of their intentions and motives, of their cognitive abilities and the task demands, and that they are capable of controlling their cognitive resources and their performance.

By way of summary we can state that although people with mental retardation possess scarce knowledge about their memory – metamemory –, they are capable of benefiting from metacognitive training, being able to maintain their improvements after the training. The most significant improvements occurred in the variables of task and strategy. With regard to the person variable Rating of memory, although the results are not statistically significant, we did observe that the experimental group is more realistic, with the disappearance of certain features of helplessness that were noticed in the pre-treatment phase. As far as strategies of control are concerned, they appear in the experimental group in both the post-treatment and maintenance phases.

In future research it will be necessary to determine whether these improvements in metamemory have an influence on memory performance and, if so, on what specific types of memory. In other words, to determine whether this type of population is capable of updating this knowledge, or whether, as Flavell (1978) argues, they will present an executive deficit.

REFERENCES

Belmont, J.M and Borkowski, J.G (1988). A group test of children's metamemory. Bulletin of the Psychonomic Society. 26, 206-208

Bellinger, E; Borkowski, J.G; Turner, L.A; and Hale C.A. (1995). Perceived task difficulty and intelligence: Determinants of strategy use and recall. Intelligence. 20, 125-143.

Biggs, J. (1988). Approaches to learning and to essay writing. In R. Schmeck (Comp.). Learning strategies and learning styles. N.Y. Plenum Press. 185-228

Borkowski, J.G. (1992). Metacognitive Theory: A framework for teaching literacy, writing and math skills. Journal of Learning Disabilities. 25, 4. 254-257.

Borkowski, J.G; Millstead, M.; and Hale, C. (1988). Components of children's metamemory: Implications for strategy generalization. In F. Weirnt and M. Permultter (Eds.). Memory development individual differences and universal changes. Hillsdale: LEA.

Borkowski, J.G; Reid, M.K; and Kurtz, B.E. (1984).

Metacognition and retardation: Paradigmatic, theoretical and applied perspectives. In P.H. Broosk, R. Sperber and C. McCauley (Eds.) Learning and cognition in the mentally retarded (pp. 55-75) Hillsdale, N.J.: Erlbaum.

Borkowski, J.G.; and Wanschura, P.B. (1974). Mediational processes in the retarded. In Elli, N.R. (dir.). International review of research in Mental Retardation. Academic Press, N.Y. 7, 1-54.

Brown, A.L. (1978). Knowing when, where and how to remember: a problem of metacognition. In Glaser R. (Ed). Advances in Institutional Psychology. Vol. 1. Laurence Erlbaum Associates, Publishers, Hillsdale, N.J.

Brown, A. and Palincsar, A.S. (1982). Inducing strategic learning from tests by means of informed, self-control training. Topics in Learning and Learning Disabilities. 2, 1-16.

Butterfield, E.C. and Belmont, J.M. (1977). Assessing and improving the retarded. In N.R. Ellis (Ed). International review of research in mental retardation. Vol. 7, N.Y. Academic.

Campione, J.C. and Brown, A.L. (1977). Memory and metamemory development in educable retarded children. In R. Kail and J. Hagen (Eds.). Metacognition, motivation and understanding. Hillsdale: LEA.

Campione, J.C.; Brown, A.L.; and Ferrara, R. (1982). Mental retardation and intelligence. In Sternberg, R. (Ed.). Handbook of Human Intelligence. Cambridge University Press. N.Y. (Spanish translation: Inteligencia Humana. Vol.2. Paidós (1987).

Ceci, S.J.; Lea, S.E.; and Ringstrom, M.D. (1980). Coding processes in normal and learning-disabled children: Evidence for modality-specific pathways to the cognitive system. Journal of Experimental Psychology: Human Learning and Memory. 6. 785-797.

Cox, B.D. (1994). Children's use of Mnemonic Strategies: Variability in Response to Metamemory Training. The Journal of Genetic Psychology. 155 (4), 423-442.

Flavell, J.H. (1978). Metacognitive development. In Scandura, J.M and Brainerd, C.J. (Eds.). Structural process theories of complex human behaviours. Alphen A.D. Rija: Siggthoff and Noordehoff.

Flavell, J.H. (1987). Speculations about the nature and development of metacognition. In F. Weinert and R. Kluwel (Eds.). Metacognition, motivation and undertanding. Hillsdale: LEA.

Flavell, J.H. and Wellman, H.M. (1977). Metamemory. In R.V. Kail and J.W. Hagen (Eds.). Perspectives on the development of memory and cognition. Hillsdale, LEA.

García, E. (1997). Inteligencia y Metaconducta. Revista de Psicología General y Aplicada. 50, 297-312.

Hoc, J.M. (1987). Psychologie cognitive de la planification. Grenoble: PUG.

Kreutzer, M.A.; Leonard, C.; and Flavell, J.H. (1975). "An interview study of children's knowledge about memory". Monographs of the Society for Research in Child Development, 40. (1, nº 159). pp. 1-58.

Kurtz, B.E. and Borkowski, J.G. (1987). Development of strategic skill in impulsive and reflective children: A longitudinal study of metacognition. Journal of Experimental Child Psychology. 43. 129-148.

Lodico, M.G.; Ghalata, E.S.; Levin, J.R.; Pressley, M.; and Bell, J.A. (1983). The effects of strategy monitoring training on children's selection of effective memory strategies. Journal of Experimental Child Psychology, 35, 263-277

Mayor, J. (1988). Manual de Educación Especial. Madrid. Anaya.

Mayor, J. and Saínz, J. (1988). Procesos cognitivos en la deficiencia mental. In J. Mayor (Ed.). La Psicología en la Escuela Infantil. Madrid. Anaya.

Osman, M.E. and Hannafin, M.J. (1992). Metacognition research and theory: Analysis end implications for instructional design. Educational Technology Research and Development. 40, 2. 83-99.

Schneider, W.; Körkel, J.; and Weinert, F.F. (1987). The effects of intelligence, self-concept, and attributional style on metamemory and memory behaviour. International Journal of Behavioral Development. 281-299.

Sternberg, R. (1985). Beyond IQ: A triarchic theory of human intelligence. Cambridge. Cambridge University Press.

Turner, L.; Hale, C.; and Borkowski, J.G. (1996). Influence of Intelligence on Memory Development. American Journal on Mental Retardation. Vol. 100. nº. 5. 468-480.

Turner, L.; Hale, C.; Wilcox, M.; and Borkowski, J.G. (1997). The emergence of strategies in EMR and nonretarded children: Influences from home. Paper presented at the Gatlinburg conference on research and theory on mental retardation and developmental disabilities. Gatlinburg, TN.

Valkil, E.; Shelef-Reshef, E.; and Levy-Shiff, R. (1997). Procedural and declarative memory processes: Individuals with and without mental retardation. American Journal on Mental Retardation. Vol., 102, nº2, 147-160.