1983

The Effectiveness Of Metamemory Instruction In Promoting Generalisation Of The Keyword Mnemonic Strategy: A Developmental Study

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THE EFFECTIVENESS OF METAMEMORY INSTRUCTION IN PROMOTING GENERALISATION OF THE KEYWORD MNEMONIC STRATEGY: A DEVELOPMENTAL STUDY

by

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Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

Faculty of Graduate Studies
The University of Western Ontario
London, Ontario

February, 1983

ABSTRACT

The effectiveness of an instructional programme, consisting of strategy training supplemented by metamemory instruction in promoting generalisation of the keyword mnemonic strategy, was assessed. Three experiments were conducted to investigate three specific issues. In Experiment 1, the effectiveness of the metamemory instructional programme in promoting generalisation was compared to that of other instructional routines. Eleven-year-old students learned a list of cities paired with their products. Children in the four experimental conditions were instructed in the use of the keyword strategy to learn city - product pairs. In addition, children in three of the experimental conditions received one of the following types of supplementary instruction: Metamemory instruction, experience with the strategy on a variety of memory tasks, or metamemory instruction plus experience training. Following learning on the city - product task, all the subjects were asked to learn a list of Latin nouns and their English translations. Children who received a metamemory component in instruction demonstrated the most successful generalisation of the keyword strategy. In Experiment 2, the effectiveness of the metamemory instructional programme in promoting maximal generalisation was assessed. Eleven-year-old subjects learned the city - product and Latin - English lists used in Experiment 1. The performance of children who received either (1) keyword strategy instruction with city - product pairs, or (2) strategy instruction plus metamemory training was compared to the performance of children instructed in keyword strategy use with both city - product and Latin - English pairs. Children who received metamemory instruction achieved maximal generalisation, demonstrating comparable recall performance and reporting using the strategy as frequently as children directly instructed in the use of the technique on the generalisation task. In Experiment 3, the issues addressed in Experiments 1 and 2 with younger children were readdressed for 19-year-old students - both in a single experiment. For these older subjects, keyword strategy training with city - product pairs was sufficient to promote maximal generalisation of the technique to the Latin - English task. Implications for instructional research are discussed.

In Memory of Nannie

(1886–1972)

ACKNOWLEDGEMENTS

I would like to thank several people whose support and cooperation played an important part in my research, and in the completion of this manuscript. I am grateful to my advisor, Michael Pressley, for his encouragement and guidance and particularly for his continued expression of confidence in this research. My thanks to the members of my advisory committee, Cynthia Miller and Allan Paivio, whose courtesy encouraged me to seek their advice freely. I am indebted to Mark Howe for his support and advice, both personal and academic. Several of the finer methodological points in this work are directly attributable to his guidance. I would like to give special recognition to my good friend and fellow student, Darlene Elliott-Faust. She gave generously of her knowledge, time and support, and without her this research would have taken considerably longer to complete. My thanks to Susan Bryant for scoring the interview protocols, to Yvonne Triesman for the excellent secretarial work, and to both for their friendship and support.

I am grateful to all the university students who participated as subjects and to the children, parents and teachers of the following Elementary Schools in London: Masonville, Sir Arthur Stringer, Orchard Park, and University Heights. A special word of thanks to

those children in the Control condition who persevered with what appeared to be a very arduous task for them.

I would like to take this opportunity to express my deep appreciation to the Faculty of Graduate Studies and the Department of Psychology at The University of Western Ontario, for giving me the chance to pursue graduate work in North America. This has been an invaluable experience for me and I hope that cross-cultural educational opportunities will continue to be available to interested students. I will always be grateful to all those people who helped to make my stay here so memorable and to the following relatives and friends in Ireland whose continuous support helped to shorten the road: My parents, Michael and Marie O'Sullivan; Sheila Meehan; Peggie Bracken; and Elma Carey.

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A mnemonic strategy is usually defined as a course of action or plan which is deliberately undertaken for the purpose of remembering (Brown, 1975; Flavell, 1970). Mnemonic strategies can be conceptualised as voluntary activities which are deliberately adopted by memorisers in order to enhance the encoding, storage, and or retrieval of information (Brown, 1975; Pressley, Heisel, McCormick & Nakamura, 1982). A recurrent finding in the memory development literature is that a major difference in memory functioning between age groups, lies in the use of mnemonic strategies (e.g., Brown, 1975; Flavell, 1970, Pressley, 1977).

Deliberate memory processing is less likely to occur in young children than in older individuals. Young children may spontaneously use very simple memory strategies, such as frequent looking or touching in a delayed reaction test (e.g., Wellman, Ritter & Flavell, 1975), but these strategies are little more advanced than the orienting behaviours of infrahuman species in similar tasks (e.g., Hunter, 1913). When the memory task is more complicated than the delayed reaction test, young children do not always use an appropriate strategy spontaneously (e.g., Appel, Cooper, McCarrell, Sims-Knight, Yussen & Flavell, 1972); sometimes they use an inappropriate strategy (e.g., Cuvo, 1975), and sometimes they use an appropriate strategy inefficiently (e.g., Kobasigawa, 1974).

During the course of development the tendency for children to invoke task-appropriate strategies to facilitate memory increases (Brown, 1978; Flavell, 1978; Paris, 1978). The developmental progression in effective strategy use appears to be directly linked to improvements in memory (e.g., Hagen & Stanovich, 1977). For example, memory span increases with development. However, this improvement cannot be attributed exclusively to the development of structural features of memory (Atkinson & Shiffrin, 1968). Rather, memory span improvements seem to be due in part to the development of strategic behaviour (e.g., Dempster, 1978).

The importance of strategy development has led to extensive study of the processes which children use to memorise information. During the last fifteen years, most of the research on strategy development has been concerned with the processes which children use <u>spontaneously</u> to memorise. Brown (1978) points out that such studies provide little more than descriptive accounts of the various mnemonic routines that are used at different stages of development. While a catalogue of children's mnemonic activities is useful, such research fails to elucidate on the variables influential in the acquisition and use of different strategic routines during the course of development. The way in which children acquire and use behavioural and cognitive actions to mediate and facilitate recall, is the fundamental question for researchers in the area (Flavell, 1970).

An alternative research method is to examine children's ability to use and benefit from instructions to use mnemonic strategies. Belmont and Butterfield (1977) have defined instruction as calculated models, rules, suggestions, or injunctions that have a known influence on the way a child thinks about the materials with which he works in a laboratory task. This definition excludes instructions about the task demands and variables relating to materials such as arrangements, modes, and rates of presentation. Task instructions and arrangements of materials do influence a child's thinking, but Belmont and Butterfield (1977) point out that the thinking they influence concerns grasping the task requirements. In contrast, cognitive instructions are directed at solutions to meet those requirements.

In instructional research, children are induced to use strategic operations designed to facilitate the attainment of task demands. The aim of this method as Resnick and Glaser (1974) describe it "is not to investigate the question of instructability as such; rather the instructability of particular processes is assumed, and these processes are taught. If the instruction ... is successful and if the instructed individual behaves in ways similar to individuals who have become good problem solvers on their own, then presumptive evidence will exist in favor of the reality of the processes we have hypothesised", p. 62. Thus, instructional studies show whether the particular process under investigation is sufficient to account for the performance observed.

The major distinction of the instructional approach is not the particular method of instruction used, but simply that children are induced to use particular cognitive routines (Belmont & Butterfield, 1977). Through instruction, variables that might influence the acquisition and use of mnemonic strategies can be studied. The instructional method, therefore, provides the opportunity to reconstruct empirically how the developmental progression from memory novice to expert might progress by testing the sufficiency of specific variables to account for improvements in performance following instruction.

Strategy Instruction and Learning Gains

Several criteria are employed to measure the success of instructional programmes. The usual criteria are (1) the child who did not spontaneously employ the strategy, processes the materials in accordance with the training after instruction takes place, and (2) use of the instructed strategy produces an improvement in the level of performance. Fifteen years of research on strategy instruction have contributed enormously to our understanding of the factors necessary for successful strategy instruction. First, strategy instruction does not always produce learning gains. A variety of person and task variables are associated with minimal instructional effects (for a review, see Pressley et al., 1982). For example, children may already be executing the target strategy spontaneously so that instruction in its use is not necessary or helpful. Second, some strategies are more helpful than others. For example, strategies that involve more than just representing the to-be-learned stimuli to oneself produce larger learning gains (Levin, 1981). Third, different tasks require different strategies in order for learning gains to be realised. Thus, the strategy must be well matched to the task.

Positive instructional effects have been obtained with mentally retarded, learning disabled, and normal children (for a review, see Pressley et al., 1982). These children have demonstrated significant learning gains following instruction with a wide variety of mnemonic strategies (e.g., rehearsal, categorisation, verbal, and imaginal elaboration), on a variety of mnemonic tasks (e.g., free recall, paired associate learning, and prose learning). An example involving rehearsal will be used here to illustrate the way in which instruction can be used to teach children of different ages to employ and benefit from increasingly sophisticated strategic routines.

Five year old children typically do not use rehearsal strategies spontaneously (e.g., Flavell, Beach & Chinsky, 1966). However, when Kingsley and Hagen (1969) instructed five-year-olds to rehearse cumulatively the names of animals, they could more capably recall the items in order of presentation than subjects who simply labelled the pictures. This finding has been replicated a number of times (e.g., Hagen, Hargrave & Ross, 1973; Naus, Ornstein & Aivano, 1977). Thus, young children who do not typically rehearse can be instructed to do so with the result that recall is facilitated.

Young children begin to use rehearsal spontaneously in the early elementary school grades. During the grade school years, use of the strategy develops and the rehearsal used by eight graders is more diversified and effective than that used by younger children (Ornstein & Corsale, 1979; Ornstein, Naus & Liberty, 1975). Rehearsal continues to develop past the grade school years and one efficient rehearsal technique whose development extends into adulthood has been labelled "cumulative rehearsal, fast finish" strategy by Belmont and Butterfield (1969). The individual using this strategy rehearses a to-be-remembered list adding on each new item as it is presented until the last several items are presented. For the last items the subject fast finishes by simply saying the item names. At testing the optimal strategy is to recall the last items presented immediately and subsequently retrieve the earlier portions of the list.

Through an analysis of pause times (a sensitive chronometric of ongoing processing, Butterfield & Belmont, 1977), Barclay (1979) demonstrated that grade school and high school students do not have the cumulative rehearsal fast-finish strategy in their repertoires. However, even this complex rehearsal strategy can be trained. Barclay (1979) gave one demonstration trial to sixth, tenth and twelfth graders. On a subsequent trial, the students recalled more items than students who had not been trained.

In summary, children can execute many more strategies under instruction than they do spontaneously. When children are instructed in the use of mnemonic strategies, they can achieve levels of memory performance ordinarily demonstrated only by older children. Thus, results of instructional research provide support for the hypothesis that improvements in memory with age reflect in part a developmental progression in effective strategy usage. While learning gains following instruction demonstrate that children are capable of executing and benefitting from a trained strategy, they do not necessarily indicate that children will continue to use the strategy in the absence of further training. It has been suggested that the ultimate aim in instructional research is to promote children's understanding of a trained strategy, so that they will produce it spontaneously following training. This theme will recur throughout this paper, with the degree of success achieved by instructional researchers in meeting this goal discussed next.

Maintenance of Trained Strategies

The most striking aspect of the instructional approach is the use of instructions concerning how or what to think (Belmont & Butterfield, 1977). When training techniques are designed to change children's thinking, different standards of evaluation must be adopted to measure the success of the instructions. Three criteria are usually employed to evaluate the effects of instructions: performance evidence of the instructional effect, maintenance, and generalisation of the trained strategy. Performance evidence of the instructional effect was discussed earlier. However, even if children have the ability to carry out a strategy that impacts on their memory performance, it cannot be assumed that the children fully understand what the instructions are about. Tests of strategy maintenance and generalisation have been proposed as better assessments of the extent to which children may have understood the instructions (Brown, 1978).

Maintenance refers to the continued unprompted application of the trained strategy to new items in the same task on which the strategy was originally trained. The argument is that the longer children can maintain a strategy without further training, the more surely they must have understood it when first instructed (Belmont & Butterfield, 1977). Maintenance is usually assessed in the following manner. Children are presented with a memory task, for example, a list of words with the requirement to remember them. Following study the children's free recall of the list is assessed (uninstructed baseline, Trial 1). A training trial follows during which children are taught to use a specific strategy, for example, rehearsal (Trial 2). On the third trial, subjects are simply instructed to remember the stimuli without additional strategy instruction (immediate unprompted maintenance, Trial 3). Children between 4 and 8 years of age often fail to use the rehearsal strategy on Trials 1 and 3 but do use it to mediate recall on Trial 2. The usual conclusion has been that the child is capable of executing and benefitting from the instructed strategy (i.e., mediational ability), as evidenced by performance on Trial 2. However, such a child also demonstrates a production deficiency for spontaneous selection and application of the response, as evidenced by performance on Trial 3 (Paris, Newman & McVey, in press).

Why do children abandon a trained strategy when minimal changes (i.e., new items) are made to the training list? Failures to observe maintenance have usually been attributed to inadequacies in the instructional programme. For instance, Belmont and Butterfield (1977) argued that when instructions fail to elicit maintenance, the problem is probably not with the child, but with the instructions, or the task analysis on which the instructions were based. Those authors suggested that the response to instructional failures should be to improve the training until maintenance is achieved.

Consistent with Belmont and Butterfield's (1977) recommendations, researchers have focused on the development of thorough training programmes designed to enhance maintenance. The last ten years have witnessed the development of several exemplary instructional packages which promote maintenance of trained strategies for both normal and retarded children (Brown, 1978). For several years, retarded children were regarded as incapable of maintaining trained strategies. However, under optimal training conditions, for example, with several training sessions on a specific task (Borkowski, in press), these children can maintain trained strategies for several weeks. For example, Wanschura and Borkowski (1975) trained moderately retarded children to execute a prepositional strategy (in, on, or under) for use in paired associate tasks. These children evidenced sizeable maintenance effects two weeks after training. Burger, Blackman, Holmes and Zeitan (1978) trained normal and retarded adolescents to use a categorical sorting and retrieval strategy. These subjects demonstrated impressive maintenance effects following training and continued to maintain the strategy six months later.

Exceptionally thorough training programmes have also been designed to teach grade school children to execute and maintain basic information processing strategies, which they would not use spontaneously until much later in development. For example, elaboration in paired associate learning rarely occurs in grade school children (Pressley & Levin, 1977). Nevertheless, Borkowski, Levers and Gruenenfelder (1976) have been able to teach children as young as four years to maintain elaboration strategies. In addition, it has been demonstrated that children in the six year old range can maintain a complex elaborative strategy which included self-interrogation about the elaborations (Kestner & Borkowski, 1979).

It appears, therefore, that under optimal training conditions, children can be taught to maintain sophisticated mnemonic strategies. The demonstrated ability to maintain a trained strategy has been interpreted to mean that children fully understood the instructions during training (Belmont & Butterfield, 1977). However, maintenance can also be likened to rote learning (e.g., Borkowski & Wanschura, 1974; Denney, 1973; Kuhn, 1974) in that children may simply parrot the instructor. The ability to maintain a trained strategy does not necessarily mean that children exhibit real understanding or as Denney (1973) labelled it "real acquisition of generalised cognitive functions." Several authors (e.g., Belmont & Butterfield, 1977; Brown, 1974) have argued that unless children exhibit activity similar to the trained activity in some situation other than the training task, they may have done nothing but parrot the instructor.

Generalisation of Trained Strategies

Generalisation as used here refers to the unprompted application of a trained strategy in a task situation that is not identical to the original training task (Pressley et al., 1982). The difference between the training and generalisation tasks need not be great, however, an adequate generalisation task requires that children have to adapt the trained strategy in some way to fit the new task (Pressley et al., 1982). The extent of generalisation is typically manipulated by changes in stimulus materials and task demands between the original training and subsequent generalisation tasks (Borkowski & Cavanaugh, 1979). Undoubtedly, a generalisation continuum exists with "near" generalisation reflecting minimal changes in the training task and "far" generalisation reflecting substantial changes (Burger, Blackman, Clark & Reiss, 1982). The essential difference between a maintenance and a generalisation task is that a maintenance task is identical to the training task except that new items are used, therefore, the child has only to think to use the trained strategy. However, a generalisation task involves a new task and the child must first think to use the trained strategy and then try to adapt it to fit a task on which it has not been trained.

Tests of generalisation of trained strategies are more demanding tests of instructional success than maintenance tests. Given that the aim of training is to encourage children to think in an intelligent manner on single tasks and in a range of similar situations (Brown, 1978), demonstration of effective generalisation following training is a crucial criterion for success of the instructional method. In addition, during the course of development children learn to select and modify strategies to meet different task demands (Brown, 1978). Thus, if a potential developmental progression in acquisition and use of mnemonic strategies is to be reconstructed empirically through the medium of instruction, then the variables influential in strategy generalisation must be identified. However, it is becoming increasingly clear than even in studies which include thorough training and in which children demonstrate good strategy maintenance over an extended period, little or no generalisation is obtained.

To illustrate this point, consider the Burger et al. (1978) study alluded to earlier. Normal and retarded adolescents were taught a categorical sorting and retrieval strategy during three sessions. Impressive effects of training were demonstrated on a maintenance task in terms of both process and performance measures, and the subjects continued to maintain the strategy six months later. However, when subjects were given a near generalisation task (a free recall task similar to that used during maintenance except that the mode of presentation was changed from visual to auditory) no evidence for generalisation was obtained. Not surprisingly, these subjects failed to transfer the strategy to a far generalisation task.

Kendall, Borkowski and Cavanaugh (1980) hypothesised that self-instructional training might provide children with the processes for selecting and modifying strategies. Self-instructional routines such as those outlined by Meichenbaum (1977) involve teaching the child to produce covert verbalisations about various aspects of the task including: (1) task definitions; (2) behavioural or strategic guidance; (3) self-evaluation and coping; and (4) self-reinforcement. Self-instructional packages force greater awareness and conscious control over processing (Pressley, 1979) and provide a general approach to learning applicable to many different memory problem-solving situations (Brown, 1978).

Kendall et al. (1980) studied strategy maintenance and generalisation with educable retarded children who received traditional strategy training or self-instructional training with an anticipation and a paraphrase strategy. Maintenance and generalisation tests were administered one and three weeks following training. On the maintenance tests no differences were found between the traditional and self-instructional groups and both were superior to the uninstructed control group. Thus, the children who were trained to use the strategies continued to maintain them three weeks later. However, there were no differences between the two strategy trained groups and the control group on the generalisation tasks. Kendall et al. (1980) concluded that repeated failures in generalisation would be difficult to explain by claiming simply that there were deficiencies in the training routine, such as amount or type of instruction.

The position that variations in the method of instruction fail to promote generalisation of trained strategies has lead to the hypothesis that it may be <u>content</u> as opposed to <u>method</u> of instruction that is responsible for failures in generalisation. Several authors (e.g., Brown, 1978; Flavell, 1979) have suggested that in order to generalise a strategy successfully, children must (1) be able to execute the strategy, and (2) know how, where, and why the strategy can be used. Traditionally, instruction has been directed solely at teaching children to execute strategies, with little or no attention paid to children's knowledge of the applicability and utility of the strategy. Thus, when young children were instructed in the use of strategies which they would not produce spontaneously until later in development, they probably did not possess a great deal of knowledge about these strategies, knowledge which may be necessary for generalisation.

Knowledge about a trained strategy constitutes one small aspect of a broader knowledge of memory. Memory knowledge or metamemory (Flavell, 1970) is assumed to be crucial for successful memory performance in general and generalisation in particular, in that its function is to inform and regulate mnemonic routines and strategies. Thus, failures in generalisation may reflect failures in metamemory in that the child, while he can execute the strategy, may lack the knowledge concerning when, how, and why it might be useful (Flavell & Wellman, 1977). The relationship between metamemory and generalisation can easily be investigated through the instructional research method. The instructability of memory knowledge is assumed and the research tactic is to determine if instruction in metamemory promotes generalisation of trained strategies. If it did, then the validity of the claim that metamemory regulates memory and particularly so during generalisation (e.g., Borkowski, in press) would receive additional support. That such additional validation of metamemory - memory behaviour connections is needed follows from the difficulty that researchers have had in elucidating such linkages. (For a review, see Schneider, Note 1.)

Metamemory and Memory Behaviour

Metamemory (Flavell, 1970) is a specialised form of metacognition. Metamemory refers to the individual's knowledge and awareness of memory and in addition, knowledge of any factors pertinent to information storage and retrieval (Flavell, 1971). Flavell and Wellman (1977) proposed the following taxonomy to classify the different types or contents of metamemory. According to this taxonomy, a distinction between two types of metamemory can be made: (1) the sensitivity category refers to the child's knowledge that some memory situations require intentional mnemonic behaviour and some do not, (2) the variables category refers to the knowledge that memory performance is influenced by a number of factors or variables. Within this category, three variables, person, task, and strategy, are differentiated. Briefly, the person category concerns knowledge about one's own memory limitations and capacities, as well as the ability to monitor concrete experiences in a memory task (here-and-now memory monitoring). Task variables refer to the awareness that task demands or properties of the input information can influence memory performance. Strategy variables correspond to the individual's knowledge of storage and retrieval strategies.

This taxonomy of metamemory (Flavell & Wellman, 1977) was not intended to be exhaustive and the authors pointed out that they did not attempt to define the concept precisely. However, the lack of precision in the original definition of the concept (Flavell & Wellman, 1977) seems to be responsible for some of the problems involved in the study of metamemory (Schneider, Note 1). There appears to be general agreement with regard to the central instances of the concept, however, disagreement of current approaches becomes obvious when detailed analyses of the phenomenon are considered (Schneider, Note 1). For example, a recurring question is whether or not the conceptualisation of metamemory should include use of memory knowledge, i.e., the translation of memory knowledge into efficient memory processes (Cavanaugh & Perlmutter, 1982). While more precise models of metamemory are anticipated, at present most authors agree that the fundamental components of metamemory include long term knowledge about task demands, strategies and person variables, as well as knowledge about current memory states.

The major hypothesised function of metamemory is to inform and regulate mnemonic routines and strategies (Brown, 1978). The mature memoriser is assumed to integrate metamnemonic knowledge with strategic behaviours in solving memory problems. Thus, this interchange enables the memoriser to select, modify, and invent strategies and also to modify the contents of metamemory through successful problem solving (Brown, 1978). It follows that there must be a close link between metamemory and memory behaviour (Brown, 1978; Borkowski & Cavanaugh, 1980). The possibility that metamemory is linked to memory behaviour is the most persuasive argument in favour of the study of metamemory. This hypothesised link has explanatory potential, particularly when considered in the context of memory development. For example, it may be the case that children do not appreciate the utility of certain strategic behaviours and thus, do not choose to engage in such behaviours. Similarly, if children could be made aware of the importance of using strategies which are already in their repertoires, then they could presumably choose to behave strategically. If this point of view is correct, then failures in generalisation may represent failures in metamemory. As outlined previously, even though children have the competence to execute certain strategies, they may lack the knowledge concerning when, how, and why, the strategies are useful - knowledge which may be essential for generalisation (Flavell & Wellman, 1977).

While these theoretical positions about metamemory as a directive force in cognition are plausible, there is a weak link in their empirical basis of support. The evidence relating metamemory to memory behaviour is at best ambiguous and in some instances almost nonexistent. Cavanaugh and Perlmutter (1982) reviewed the evidence supporting the metamemory - memory behaviour hypothesis. These authors focused their discussion on studies concerned with the relationship between metamemory and the development of organisational strategies (i.e., memory behaviour), such studies have typically been correlational in nature. For example, in some studies children were asked to decide which of two memory strategies would be the most effective learning aid on a particular memory task (metamemory assessment). Following this evaluation, the children were given the exact same memory task to perform themselves. Study behaviour was examined to determine whether or not the children had used the strategy which they had previously indicated would be most effective. Cavanaugh and Perlmutter (1982) concluded that studies based on such an approach (e.g., Cavanaugh & Borkowski, 1979; Ringel & Springer, 1980; Salatas & Flavell, 1976) have yielded only moderate to low correlations between metamemory and memory behaviour.

Wellman (in press) also reviewed the evidence supporting the metamemory - memory behaviour hypothesis. In contrast to Cavanaugh and Perlmutter (1982), Wellman (in press) concentrated his discussion on investigations concerned with the relationship between here-and-now memory-monitoring (metamemory) and memory behaviour. Here-and-now memory-monitoring is the ability to assess the transient processes of memory and to interpret the current state of memory. An example of a memory monitoring study is an assessment of children's knowledge of retrieval effort allocation. Most studies of this type have dealt with the tip-of-the-tongue experience and related feeling-of-knowing state. The tip-of-the-tongue experience reflects a subject's knowledge that an item he cannot currently recall is imminently recallable, while the feeling-of-knowing experience reflects the subject's knowledge that an unrecalled item is recognisable (Schneider, Note 1). It is assumed that metamemory (i.e., knowledge about the recallability or recognisability of items) is likely to influence the subject's strategic memory search behaviour, with increased retrieval effort allocated to those items perceived to be more retrievable (Wellman, 1977). Wellman (in press), in his review of studies concerned with the relationship between here-and-now memory-monitoring (i.e., metamemory) and memory behaviour, cited several studies in which substantial links between metamemory and memory behaviour were reported (e.g., Brown & Lawton. 1977; Posnansky, 1978; Wellman, 1977).

The results reviewed by Cavanaugh and Perlmutter (1982) and Wellman (in press) suggest that the relationship between metamemory and memory behaviour is rather task specific. The relationship appears to be modest in investigations analysing the use of organisational strategies, however a more substantial relationship is observed for a variety of memory-monitoring tasks even in young children (Schneider, Note 1). However, even in memory-monitoring tasks the connection between metamemory and memory behaviour in young children is generally observed only on tasks that require recall or recognition of either single items or small item sets. If the task involves recall of supraspan item lists, or complex strategies are required to cope with the task demands, then weak metamemory - memory behaviour relationships are usually observed (Schneider, Note 1).

Given that metamemory has not been closely linked to a variety of strategic behaviours on a variety of different tasks, then what evidence is there to suggest that metamemory may be critical for generalisation of trained strategies? Flavell (1978), in reviewing these failures to find links between metamemory and strategic behaviours, pointed out that researchers may have chosen the wrong context in which to examine such links, that is, contexts in which metamemory - memory behaviour connections are unlikely to be observed. Flavell (1978) discussed the types of mnemonic situations where metamemory - memory behaviour connections are most likely to be observed. His recommendations are outlined below and suggest that tasks which reflect the maintenance and generalisation of trained mnemonic strategies may represent the most likely context in which to obtain metamemory - memory behaviour links.

Flavell (1978) suggested that most authors have attempted to find empirical correlations between isolated aspects of metamemory (e.g., the knowledge that a set of categorised items is easier to remember than an uncategorised set) and isolated instances of memory behaviour (e.g., the execution of a categorisation strategy on a memory task). In pointing out that such a research strategy may be misguided, Flavell (1979) argued that it is first necessary to make a thorough conceptual analysis of the problem, pointing out that the probability of occurrence, nature, causal direction, and strength of the relationship between metamemory and memory behaviour is probably highly variable. In some cases, metamemory could not possibly influence behaviour because no metamemory "occurs" or is even necessary. An example of such a situation is incidental learning. In other memory situations, metamemory may simply occur too late to have any effect on behaviour. For instance, if one was using a rehearsal strategy to learn a list of paired associates and realised, just as the study period came to an end, that an elaboration strategy might have been a more effective study behaviour. Flavell (1978) further hypothesised that even when metamemory occurs in plenty of time to affect memory behaviour, it may not always do so, such as when one knows that a strategy would be helpful but, simply does not care whether the particular content is learned or not. Thus, different types of motivation or problems with the allocation of resources may prove to be obstacles to the influence of metamemory on memory behaviour.

Flavell (1978) concluded that metamemory is most likely to occur and influence memory behaviour directly: (1) when it is concerned with one's present memory state and the goal one wants to achieve, and (2) when motivational and resource allocation factors are favourable for the translation of memory knowledge into appropriate mnemonic action. Also, in the usual case when metamemory and memory are interlinked, the causal structure is likely to be one of bidirectional mediation (Flavell, 1978). That is, metamemory leads to memory behaviour which in turn leads to further memory behaviour, and so on.

In response to Flavell's (1978) analysis, much of the recent search for metamemory - memory behaviour connections has occurred in difficult memory situations. Thus, although much of the early search for metamemory - memory behaviour connections took place in the context of free recall learning, that context has been abandoned because even fairly young subjects automatically use strategies in that situation. Because these strategies may be activated automatically, metamemory should not be necessary in such situations (Borkowski, in press). Metamemory - memory behaviour linkages are more likely to occur in situations where the correct strategy is less "obvious". Borkowski (in press) further suggested that metamamory and memory behaviour may be most closely related in tests of maintenance and generalisation of trained strategies. This is because strategy generalisation requires that a subject decide whether or not to employ a previously learned rule and how to adapt it to the task at hand. Thus metamemory is required in order to accomplish generalisation. Indeed, the evidence is overwhelming that generalisation is anything but automatic (Royer, 1979).

Consistent with Borkowski's (in press) recommendations, recent investigators of the metamemory - memory behaviour connection have studied maintenance and generalisation of trained strategies. One approach to the problem has been to train children to use mnemonic strategies and to supplement this training with metamemorial information. The aim of such research from a metamemory perspective is to establish the link between metamemory and memory behaviour. From an instructional perspective such research provides the opportunity to examine the role that metamemory may play in the voluntary production of mediators.

The Effects of Metamemorial Instruction on Maintenance and Generalisation of Trained Strategies

Several investigators have attempted to manipulate metamemory in studies involving maintenance and generalisation of trained strategies. In these studies, children are first taught to execute a strategy and then they are provided with information (metamemory) about the strategy. Such information or feedback increases self-understanding about memory and cognitive processes (Borkowski, in press). The purpose of feedback in instructional research is to describe why a strategy is useful and to provide a rationale for its use. Feedback should describe the exact role that a strategy plays in improving accuracy on one or more tasks. Feedback should heighten metamemory by emphasising the match between task demands, strategic action, and successful performance (Flavell, 1978). Thus, in studies involving maintenance and generalisation of trained strategies, metamemorial feedback should be designed to provide children with the cognitive understanding necessary to guide efficient maintenance and generalisation of the strategy. However, metamemorial feedback in such studies has usually been restricted to providing information about the value of using a strategy to aid recall (e.g., Kennedy & Miller, 1976; Kramer & Engle, 1981; Ringel & Springer, 1980). It is doubtful whether feedback techniques that are focussed on only one aspect of metamemory (i.e., information about a strategy's utility) fulfill the requirement of providing children with the type of cognitive understanding that may be necessary to guide successful transfer of trained mnemonic strategies.

<u>Maintenance</u>

Kennedy and Miller (1976) were the first to examine the effects of metamnemonic feedback on maintenance of trained strategies. Kennedy and Miller (1976) predicted that if children were given strategy training supplemented with metamnemonic information (in this case information about the merits of using a strategy to facilitate recall), they would continue to use the strategy after training. Six and 7 year old children participated in a serial recall task in which subgroups of "rehearsers" and "nonrehearsers" were identified by means of direct observation and semi-overt verbalisations. The nonrehearsers were subdivided into two groups and both groups were given ten training trials in verbal rehearsal. In addition, one of these groups received feedback about the value of the rehearsal strategy. The feedback was very simple. The children were told that they had performed better when they had rehearsed versus when they had not rehearsed and that rehearsal had helped them to remember. Following training, all subjects were given three more test trials and were instructed to do whatever they wished during study.

Children who had received feedback about the strategy continued to rehearse following training while those who had not received feedback rehearsed less, and their recall performance dropped significantly. Thus, persistent use of a newly acquired rehearsal strategy may depend, at least in part, on having a rationale for its use. One component of production deficiency, as it refers to rehearsal behaviour in young children, may be the absence of knowledge about the value of rehearsal (i.e., metamemory). Kennedy and Miller (1976) speculated that while young children may have the ability to understand some cause-and-effect relationships, the ability to detect them may be a cognitive skill which does not develop until later in development. However, it seems in their study that such relationships may easily be made salient for children, and that knowledge of such relationships produces at least short-term maintenance of a trained rehearsal strategy.

The hypothesis that maintenance will be enhanced if children have a rationale for using a trained strategy was further investigated by Borkowski, Levers, and Gruenenfelder (1976). These authors examined the effects of feedback (metamemory) on young children's ability to maintain a mediational strategy (utilising prepositional relationship between paired associate objects) for at least two weeks following training. In addition, they compared the effects of metamemorial instruction with three other methods of instruction.

Nursery school and first-grade children received one of four types of instruction. In the Passive Observation condition, the experimenter supplied a prepositional mediator for each pair of objects on each trial, physically placed the objects in the appropriate prepositional relationship, and described the relationship verbally. The children observed the experimenter's actions and were told that the strategy would help them to learn. In the Active Manipulation condition, children were instructed to place each object pair in a prepositional relationship which was described by the experimenter, and they were told that the strategy would help them to learn. Children in the Active Film condition first viewed a film showing a 5 year old boy performing the paired associate task. The boy used prepositional mediators, physically manipulated the object pairs and subsequently recognised objects on a test trial with perfect accuracy. This film was defined as awareness inducing by Borkowski et al. (1976), in that it was designed to increase the children's awareness of the value of the strategy for successful memory performance. Following the film, children in this condition received the same strategy training as those in the Active Manipulation condition. In the Control group, no mediators were supplied during training.

Two weeks after training, a maintenance test and then a mediational probe test were administered. Children who had actively manipulated the object pairs during training demonstrated sizable nonprompted maintenance of the strategy on the posttest. Even greater maintenance was achieved by first graders who had seen the awareness-inducing film. Borkowski et al. (1976) concluded that strategy awareness, in terms of the child's knowledge of the strategy's utility, is an important factor for long term maintenance of trained strategies.

Several other authors have examined the effects of metamemorial feedback on children's ability to maintain trained strategies. Asnaron and Meichenbaum (1979) included a feedback component in a self-instructional training package designed to implement a repetitive rehearsal strategy. Impressive strategy maintenance was achieved and production deficiencies eliminated. Ringel and Springer (1980) gave third grade children strategy instructions about organisation in free recall learning. In addition, some of the subjects received feedback stating the reasons why the strategy improved performance. The children who received feedback in conjunction with strategy training demonstrated more organisation and better recall on a maintenance test, than children who received strategy training only.

It appears then that when strategy instruction is combined with feedback about the value of the strategy for recall, maintenance of the trained strategy is enhanced. However, the results of these studies designed to enhance maintenance through the use of feedback provide only indirect support for the hypothesis that feedback influences metamemory, which in turn influences memory behaviour. For this reason, several authors have combined strategy training involving the use of feedback with direct measures of children's knowledge of mnemonic strategies. For example, Paris, Newman, and McVey (in press) trained first and second grade children to use a sorting strategy to remember pictures in a sort recall task. Half of the children received strategy training only and the remaining children received strategy training and feedback about the value of the strategy for recall. Feedback involved a brief explanation of the reasons why and how the strategy could help them to remember the pictures. Multiple measures of metamemory were administered prior to training and following the maintenance task.

Children in Paris et al. (in press) who had received feedback about the strategy chose sorting as an effective study behaviour on the maintenance task and consequently, they recalled significantly more items than children who received strategy training only. Further, only children in the feedback condition demonstrated increases in metamnemonic awareness from the first to the second metamemory assessment, providing some support for the hypothesis that feedback influences metamemory, which in turn influences memory behaviour. Additional support for this hypothesis has been reported by Ringel and Springer (1980). Third graders who received instructions about organisation in free recall and feedback about the cause-and-effect relationship between strategy use and improved recall, demonstrated better recall on a maintenance test than children who received strategy training only. On a metamemory test administered following maintenance, children who had received feedback demonstrated a superior knowledge about the efficacy of strategy use than children who had not received feedback.

In summary, when children are given brief instructions about the value of strategic behaviour for recall, their ability to maintain trained strategies is enhanced. This type of study provides evidence suggesting that such metamnemonic information could be an important developmental acquisition, guiding spontaneous production of strategic behaviours. However, stronger support for both the hypothesised metamemory - memory behaviour link and the efficacy of the instructional method in promoting production of strategic behaviours, would be provided by a demonstration that metamemory instruction promotes generalisation - as opposed to maintenance of trained strategies. Recent studies have substantiated that strategy generalisation requires more metamemorial knowledge than strategy maintenance does (e.g., Black & Rollins, 1982; Kramer & Engle, 1981).

Generalisation

Successful generalisation of a trained strategy requires that the subject first think to use the strategy on the new task and then consider how to adapt it to meet the task demands. It is likely that the subject must activate metamemory in order to accomplish successful generalisation.

As previously mentioned, failures in generalisation may reflect failures in metamemory, in that children who can execute a trained strategy may not know how, where, and why that strategy can be used effectively. If this point of view is correct, then strategy training when supplemented with metamemory training should promote generalisation. To date, there have been few studies where the effects of metamemorial training on strategy generalisation have been examined. Researchers who have tested this hypothesis have reported either (1) little or no success in promoting generalisation through metamemory training, or (2) promotion of generalisation through the use of sophisticated training programmes, where metamemory instruction constituted one training component which was combined with several other components to form a package. The effects of metamemory alone could not be differentiated in such studies.

Kramer and Engle (1981) trained normal and retarded children of equivalent developmental age (M. A. 8) to rehearse relatively unrelated stimuli. The subjects received either rehearsal instruction alone or rehearsal training supplemented with strategy-awareness training. The awareness training consisted of feedback about the value of using rehearsal to enhance recall. Two days of training were followed by an immediate and a delayed posttest. Both posttests included a maintenance free recall task and two generalisation tasks (i.e., a serial position probe test and a picture recognition task). In addition, metamemory questions were administered to all the children following the training and the posttest sessions. Kramer and Engle (1981) analysed both recall and strategy use in the maintenance and generalisation tasks. On the maintenance task, strategy training but not strategy awareness training improved performance. With regard to the two generalisation tasks, no strategy generalisation was observed on the serial position probe test and only weak evidence for generalisation on the recognition task was obtained. Finally, metamemory was not significantly related to either memory behaviour (i.e., strategy use) or memory performance on the maintenance and generalisation tasks.

Kramer and Engle (1981) attributed their failure to induce generalisation to the fact that the subjects were made aware of the utility of the strategy but, were not trained in more general self-checking strategies (e.g., self-monitoring strategies). However, there are other potential explanations. First, the metamemory training may have been inadequate. Metamemorial feedback in this study simply consisted of telling the children about the value of rehearsal for recall. Thus, although the authors emphasised the match between strategic action and successful memory performance, the children were not given information concerning the type of memory task where this strategy would lead to successful performance. Given that knowledge of the match between task demands, strategic action and successful performance is probably necessary for successful generalisation, adequate metamemory training should probably include some instructions concerning the type of task where a strategy could be applied. Second, Schneider (Note 1) has suggested that the failure to observe generalisation in Kramer and Engle's (1981) study may have been due to the selection of inappropriate generalisation tasks. For example, he points out that the recognition task was inappropriate as a generalisation task due to the fact that ceiling effects were reported for all treatment groups..

Black and Rollins (1982) were slightly more successful than Kramer and Engle (1981) in promoting near generalisation of a trained strategy through metamemorial training. These authors trained first grade children to categorise pictures of common objects. The children in this study were assigned to one of five treatment groups. Children in the Control group did not receive any instruction in strategy use during training. Of the remaining children, half were given organisational instructions emphasising categorisation, for example, the experimenter said, "If I put the cards together that are similar, such as the animals, it will be easier to remember". These instructions were considered to highlight the match between strategic action and successful performance (metamemory). The other half of the children were given instructions emphasising individual objects, for example, the experimenter said, "I will put the dog next to the cat". Thus, children in this condition did not receive feedback about the value of the strategy for recall. Within each of these two groups half of the children were given detailed verbal instructions (e.g., the experimenter said, "If we put all the foods together they will be easier to remember") and encouraged to listen. The other half of the children were taught using a question type format (e.g., the experimenter said, "Why do we put all the foods together") that encouraged participation.

Following training an immediate maintenance test was administered. Two weeks later, two posttests were administered. The first posttest included new items from the conceptual categories used during training (i.e., maintenance test). The second posttest contained new categories and items (i.e., near generalisation test). Black and Rollins (1982) analysed organisation at study, clustering at recall, and recall performance. On the immediate maintenance test, children who had received organisational training emphasising categorisation (i.e., metamemory component in instruction), demonstrated more organisation during study and more clustering at recall than children who received instructions emphasising specific items. However, such organisation did not result in superior recall for children who received metamemory instruction. In fact, there were no differences in recall between the four experimental groups and none of these groups surpassed the Control group. Thus, it is difficult to conclude that these children adequately maintained the strategy, since use of such strategies is normally associated with higher recall for children in this age range. On the delayed maintenance and generalisation tasks children who had reveived organisational training continued to organise more at study and cluster more at recall than other groups. However, recall measures indicate that only those children who received organisational training through detailed explanation (as opposed to question and answer format) outperformed the Control group.

There are interpretive difficulties with the Black and Rollins (1982) study. On the immediate maintenance task, children in the experimental groups appeared to have used the categorisation strategy. However, they may have used it inefficiently or inappropriately, as suggested by their recall performance which was comparable to control recall. The absence of learning gains on the immediate maintenance task makes it difficult to interpret apparent delayed maintenance and near generalisation effects. Even without these interpretive difficulties, the effects of metamemory training on generalisation obtained in this study are not terribly impressive. Those children who received organisational training through detailed explanation evidenced minimal generalisation of the strategy (i.e., they recalled significantly more items on the generalisation test than children in the Control condition, but, did not outperform children in the other conditions that included some strategy training). However, this is not surprising given the nature of the metamemory instruction in this study. Black and

Rollins (1982) considered, as did Kramer and Engle (1981), that information about the value of the strategy for recall might be sufficient memory knowledge to guide generalisation and this was the only aspect of metamemory instructed in these studies. Thus, while the results of both these studies provide little support for the hypothesis that metamemory instruction can promote generalisation, it is possible that inadequate metamemory training is responsible for these results.

Several authors (e.g., Burger, Blackman, & Clarke, 1981; Hall & Madsen, 1978) have combined metamemory training with additional training components to promote generalisation. Unfortunately, whatever role metamemory may have played in successful generalisation is impossible to determine, given the multi-faceted nature of the instructional techniques used in these studies (e.g., self-evaluation, self-management, and metamemory training). To date, there has been no published report of training successful generalisation of a mnemonic strategy, through traditional strategy training supplemented solely by metamemory instruction. As previously outlined, it may be that inadequacies in metamemory instructional routines are primarily responsible for the failure of such programmes to promote successful generalisation. On reviewing the literature, it appears that researchers who have tried to manipulate metamemory through feedback, have chosen to address isolated properties of the trained strategies. For example, in every study where feedback was provided for the children, the only aspect of metamemory to be instructed was the value of the strategy for recall. Such feedback (i.e., having a rationale for using a strategy) may provide children with sufficient motivation to maintain a strategy on a task almost identical to the training task. However, on a generalisation task where children have to think to use the strategy and adapt it to the new task, metamemory about the value of a strategy would probably be insufficient to guide generalisation. Children may require knowledge about the type of task where the strategy can be employed. They may require information about the value of the trained strategy relative to that of other strategies for a particular type of task and they may need some knowledge about adapting the strategy to new tasks. The important point here is that the task demands on maintenance and generalisation tests require the activation of different types of metamemory. It appears that most researchers have not taken this point into consideration. Instead, they have tried to train generalisation with metamemory training identical to that used to train maintenance.

If metamemory is necessary for successful generalisation, then metamemory training programmes should be designed to incorporate instruction on all aspects of metamemory required for generalisation. This leads to the question of what exactly should be trained. One approach may be to train children to execute a particular strategy. Once children are familiar with the mechanics of strategy use, metamemorial training could be introduced. Metamemory instruction could include information about where, when, how, and why a strategy could be used (e.g., Flavell, 1979). In addition, children could be exposed to a number of different memory tasks and the appropriateness or inappropriateness of the strategy for each task demonstrated for them (Brown, 1978). Such training should provide a comprehensive set of metamemory principles concerning a certain strategy for children and also provide them with the opportunity to see these principles in action. If the metamemory - memory behaviour hypothesis is valid, then such training should promote generalisation and provide a demonstration of the metamemory - memory behaviour link. In addition, if such training is successful, the validity of metamemory as a factor affecting voluntary production of a mediator would receive support. Metamemory could then become a target for instruction, in a wide variety of training programmes designed to eliminate production deficiencies in children's learning processes.

The Present Study

The purpose of the present study was to assess the effects of comprehensive metamemory instruction on generalisation of trained mnemonic strategies. Metamemory instruction, as used here, refers to instruction on those aspects of memory knowledge considered to be important in promoting generalisation behaviour (i.e., information about how, where and why to use a trained strategy). Three specific issues were addressed in the present study: (1) does comprehensive metamemory instruction promote generalisation of trained strategies and how effective is such training relative to other instructional techniques; (2) does metamemory instruction promote maximal generalisation of trained strategies; and (3) what are the developmental effects of metamemory instruction on the promotion of generalisation behaviour. Three experiments were conducted to examine these issues. In each of these studies the mnemonic strategy selected for training was the keyword mnemonic technique.

The keyword technique was originally developed as a technique for learning foreign language vocabulary items (Atkinson, 1975). As conceptualised in most studies on the technique to date, in order to learn a foreign language vocabulary item using the keyword method - the learner engages in a two step mnemonic procedure.

> The first stage requires the student to associate the spoken (foreign word) to an English word that sounds like some part of the foreign word; the second stage requires the student to form a mental image of the keyword "interacting" with the English translation (Raugh, Schupbath, & Atkinson, 1975, p. 1).

This technique has proved useful in promoting the foreign language vocabulary learning of both adults and children (e.g., Atkinson & Raugh, 1975; Pressley & Levin, 1978; Pressley, Levin, & Dalaney, 1982). Variations of the keyword method have been developed for learning other types of information. For example, versions of the technique have been used to form associations between cities and their products (Pressley & Dennis-Rounds, 1980). In addition, Schriberg, Levin, McCormick & Pressley (1982) have developed prose - learning techniques based on the keyword method.

Despite the fact that the technique promotes learning in diverse situations, the available evidence suggests that people probably do not spontaneously acquire the strategy in the same manner as other strategies are acquired, such as rehearsal in free recall tasks (Pressley, Heisel, McCormick, & Nakamura, 1982). Even many skillful, mature, learners do not use the strategy spontaneously. Given that the strategy must be taught, a question of educational interest is whether or not learners will spontaneously generalise the strategy from a training task to a new task. Pressley and Dennis-Rounds (1980) addressed that problem. These investigators instructed 12- and 18-year-olds in the use of the keyword method to learn city - product pairs. Use of the technique resulted in significant learning gains for these subjects. However, on a subsequent generalisation task (i.e., Latin noun - English translation pairs) the younger subjects failed to generalise the strategy unless prompted to do so. The older subjects did generalise the strategy, however, they recalled fewer items than subjects completely reinstructed in the use of the keyword method to learn Latin - English pairs. Arguing that the limit of transfer is represented by the performance of subjects directly instructed in the use of a strategy on a generalisation task, Pressley and Dennis-rounds (1980) concluded that the older subjects who had generalised the strategy in their study had not achieved maximal generalisation.

The major purpose in the first experiment reported here, was to assess the effects of a strategy training programme that included metamemory instruction *versus* a traditional strategy training programme, on fifth and sixth graders generalisation of the keyword strategy. The training task (15 city - product pairs) and the generalisation task (21 Latin noun - English translation pairs) were derived from those used by Pressley and Dennis-Rounds (1980). In light of Pressley and Dennis-Rounds (1980) results, children who received instruction in the use of the keyword strategy to learn city - product pairs were not expected to generalise the technique successfully.

The provision of a metamemory component in instruction was, however, expected to promote generalisation. The purpose in including metamemory instruction was to provide children with information that might be necessary to guide generalisation. The information given to the children was derived from a rudimentary task analysis, that was conducted to determine the various aspects of memory knowledge which might be required to direct generalisation of the keyword strategy to the Latin - English task. The following types of information were considered to be important and were imparted to the children: (1) information about the value of using the strategy to facilitate recall; (2) information about how the technique actually works to aid learning and recall; (3) information about the general class of memory tasks for which the keyword strategy is or is not an effective learning aid and (4) a general rule for adapting the trained strategy to new tasks.

Thus, children who received metamemory instruction were provided with the type of comprehensive metamemory set which may be necessary to direct transfer and these children were expected to generalise the keyword strategy. Even if transfer occurred, however, the question would remain as to whether or not metamemory instruction would promote maximal generalisation of the strategy. This issue was addressed in the second experiment reported here. Following Pressley and Dennis-Rounds (1980) argument, that the limit of transfer is represented by the performance of children directly instructed in the use of the strategy on a generalisation task, the performance of children who received metamemory instruction was compared to that of children instructed in the use of the keyword method to learn Latin - English pairs. If failures in generalisation simply reflect failures in metamemory (e.g., Flavell & Wellman, 1977), then the inclusion of a metamemory component in training should be sufficient to promote maximal generalisation.

The first two experiments were conducted with upper elementary-school-age children. As children in this age range seldom engage in spontaneous elaboration activities (e.g., Pressley & Levin, 1977; Rowher & Bean, 1973), they probably do not have a great deal of knowledge about elaboration strategies - knowledge that would guide generalisation. Consequently, it would not be surprising to find that metamemory instruction would be more potent than traditional strategy training, in promoting generalisation of a complex elaboration-based technique such as the keyword method. However, as children progress through adolescence the propensity to elaborate increases dramatically (for a review, see Pressley, 1982). This development could presumably be accompanied by an increase in elaboration metamemory (cf., Flavell, 1979; Pressley & Levin, 1977). If this is the case, then late adolescents may have sufficient metamemory to direct generalisation of a trained strategy to a new task. This issue was addressed in the third experiment reported here.

In Experiment 3 the potency of strategy training combined with metamemory instruction, relative to that of traditional strategy training, in promoting maximal generalisation of the keyword method among late adolescents was assessed. Thus, the two issues addressed in Experiments

1 and 2 with younger children were readdressed for older subjects - both issues in a single experiment. Contrary to the results expected in the first two experiments, it was anticipated that the late adolescents might generalise the strategy following traditional strategy instruction.

EXPERIMENT 1

The major purpose in the first experiment reported here, was to assess the effects of metamemorial training on fifth and sixth graders generalisation of the keyword mnemonic strategy. As Pressley and Dennis-Rounds (1980) have demonstrated, children in this age range fail to generalise this strategy spontaneously following traditional strategy training in the use of the technique. Traditional training programmes such as that used by Pressley and Dennis-Rounds (1980) have concentrated on providing instruction in the mechanics of strategy usage. Information concerning when, how, and why a strategy might be used outside of the training situation is seldom, if ever, included in these instructional packages. However, such metamemorial knowledge may be needed to guide generalisation of trained strategies. The metamemorial training included in this study was specifically designed to provide children with information about the keyword method that might be relevant to generalisation. It was expected, therefore, that children who received metamemory instruction might generalise the technique, even though children who had received traditional strategy training might not be successful.

The second purpose in Experiment 1 was to assess the relative effectiveness of two different methods of metamemory instruction, on children's generalisation of the keyword method. The first method of metamemory instruction, as outlined above, is a direct type of training, in that children are provided with explicit information about a strategy's potential for use outside of the training situation. However, Brown (1978) argued that children can acquire metamemory about a strategy through experience with that strategy in a variety of situations. Such knowledge may then be instrumental in directing generalisation. In effect, Brown's (1978) position is that it may not be necessary to provide children with direct instruction in metamemory, rather, they may acquire metamemory themselves if they are given the opportunity, during training, to use the strategy on a variety of tasks. Brown's (1978) hypothesis is consistent with the general position that metamemory is accumulated through naturalistic learning experiences (e.g., Flavell, 1971).

To assess the effects on generalisation of direct metamemory training versus broad experience with a strategy, a condition involving experience with the keyword method on a variety of memory tasks was included in this experiment. While it was expected that children who received metamemory instruction would generalise the keyword technique, expectations about the performance of children who received experience with the strategy were less optimistic. There are certainly strong hints in previous research that children are not always sensitive to metamemorial information that can be acquired during strategy training (e.g., Kennedy & Miller, 1976). Moreover, in a recent series of studies, Pressley, Levin and Ghatala (Note 2) have shown that 11- to 13-year-old children can acquire a lot of metamemorial information and yet not employ it in subsequent memory tasks. In those studies where the experimenter provided the metamemorial information, children were more likely to use it in new situations. Thus, it was expected that direct metamemory training might be more potent than experience training in promoting generalisation. In other words, metamemory training was considered more likely to be sufficient for the promotion of generalisation.

Finally, to determine if experience training might increase the potency of metamemory instruction, one group of children was included that received both metamemory and experience training. Metamemory training was designed to include all the information that might be necessary for generalisation, therefore, even if children could acquire similar information through experience, such knowledge was not expected to increase the potency of metamemory training. Metamemory instruction was expected to be sufficient in and of itself to promote generalisation.

In the first experiment fifth and sixth grade children were asked to learn two lists of paired associates (15 city - product, 21 Latin noun - English translation). Before learning these lists, the children were given training in accordance with their experimental assignment. Children in the Control group were first given practice learning sample city - product pairs. Following practice they were asked to learn the city - product and then the Latin - English lists. Children assigned to the Strategy Training condition were first trained to use the keyword method to learn sample city - product pairs. Following this instruction, they were asked to learn the city - product and then the Latin - English list.

All the children in the remaining three conditions also received instruction in the use of the keyword method to learn sample city - product pairs. Following this instruction these children received supplementary training. Children in the Metamemory condition received metamemory training. Children in the Experience condition received experience with the strategy on a variety of different mnemonic tasks. Children in the Metamemory Plus Experience condition received both types of supplementary instruction. Following this instruction, the children in these groups were asked to learn the city - product and Latin - English lists.

All the children except those assigned to the Control condition, received identical instruction in the use of the keyword strategy with city - product pairs, and thus, it was expected that recall performance on the city - product task for Control children, would be significantly poorer than the performance of all other groups. No differences in recall performance on the city - product task were expected between the four groups of children who received strategy training. As supplementary training (i.e., metamemory and experience training) was designed to promote generalisation specifically, it was not expected to influence recall performance on the city - product task.

It was predicted that the effects of supplementary training would be observed on the generalisation task (Latin - English). It was anticipated that children who received metamemory training, alone or in conjunction with experience training, might generalise the keyword strategy and exhibit the highest recall performance of all the groups. No difference in recall performance between these two conditions was expected. Children who received strategy training only were not expected to generalise, and their recall performance was expected to be comparable to the performance of children in the Control condition (i.e., children who never received strategy instruction). This was based on the outcome in Pressley and Dennis-Rounds (1980) which contained both a Strategy Training and a Control condition. Predictions about the performance of children in the Experience condition were less clear, although it was not expected that they would perform at the level of those subjects who received metamemory training, because experience training was much less explicit than metamemory instruction.

Finally, it was necessary to include a measure of strategy use during learning, independent of recall, to validate conclusions about generalisation. To accomplish this purpose, a probe tapping the methods of study used by the subjects was inserted at the end of the Latin - English task. All the children were asked to report how they had tried to learn the paired items. These reports were than scored to determine which strategies the children had used. Pressley and Levin (1977) and Pressley, Levin, Kuiper, Bryant, and Michener (in press) among others, have validated the use of such probe techniques to measure strategy usage, reporting consistently high correlations between reports of strategy use and recall performance. It was expected that children who exhibited the highest recall scores (i.e., predicted to be those children who received metamemory training alone or in conjunction with experience) would report the most frequent and accurate use of the keyword technique on the generalisation task.

Method

Subjects

One hundred upper elementary-school-age children (fifth and sixth graders) participated in this study. The mean age of the children was 11 years, 0 months with a range of 8 years, 11 months to 13 years, 2 months. The children attended a public elementary school in London, Ontario. This school was situation in a middle class area. The children were randomly assigned to one of five experimental conditions with 10 children assigned to each condition.

General Procedure

As summarized in the introduction, the purpose of this study was to assess the effects of differential training procedures on children's ability to generalise the keyword mnemonic strategy, from a task on which they were instructed in its use (city - product pairs) to a second mnemonic task (Latin noun - English translation pairs). Subjects were randomly assigned to one of five conditions. The nature and extent of training in the use of the keyword strategy was manipulated across these conditions.

Children assigned to the Control condition did not receive any instruction in the use of the keyword strategy (see Table 1). Children assigned to the Strategy training condition were instructed in the use of the keyword strategy to learn city - product pairs. Strategy training was designed simply to acquaint children with the mechanics of strategy usage. The children who were assigned to the remaining three conditions were also instructed in the use of the keyword strategy to learn the city - product pairs. However, the children in these three conditions also received metamemorial training and/or additional strategy experience (see Table 1). Metamemorial training consisted of instruction concerning when, where, how, and why the strategy could be employed as an effective learning aid. In addition, the experimenter demonstrated the appropriateness and inappropriateness of the strategy as a learning aid on different mnemonic tasks. Additional strategy experience

Table 1

Sequence of Procedures in Each Experimental Condition

at Each Phase of the Experiment in Experiment 1

Experimental Phase	Experimental Condition				
	Control	Strategy	Metamemory	Experience	Metamemory Plus Experience
Phase 1	Exposure to sample city-product lists. Instructed to try hard to remember the pairs.	Exposure to sample city-product lists. Instructed in the use of the keyword method to learn city-product pairs.			
Phase 2			Metamemory training comprising 1) General information about the strategy. 2) Demonstration of its effectiveness and ineffectiveness on training tasks 1, 2, and 3.	Experience training comprising practice with the strategy on training tasks 1, 2, and 3.	Metamemory plus experience training. Procedures identical to metamemory only and experience only conditions.
Phase 3	Experimental Task one (15 city-product pairs). Instructed to try hard to remember the pairs.	Experimental Task one (15 city-product pairs). Instructed to use the keyword method during learning.			
Phase 4	Experimental Task two - Generalization (21 Latin nouns - English translations). Exposure to sample pairs. Instructed to try hard to remember the meaning of each noun.				
Phase 5	Probe for method of learning on generalization task. Five pairs probed for each subject.				

consisted of practice in the use of the keyword strategy on a variety of mnemonic tasks. The keyword strategy was considered to be an effective learning aid for some, but not all of these tasks. Metamemorial training and additional strategy experience were designed to increase children's awareness of the effectiveness of the strategy and to acquaint them with the variety of mnemonic tasks for which the strategy would be an appropriate learning aid. The main differences between these two training procedures was that children who received metamemorial training were given explicit general information about the effectiveness of the strategy, while in the Experience condition information about the strategy was presented in an implicit manner and children had to abstract it for themselves.

In summary, children in the strategy training (Strategy), metamemorial training (Metamemory), additional strategy experience (Experience), and metamemorial training plus additional strategy experience (Metamemory Plus Experience) conditions received identical instruction in the use of the keyword strategy with city - product pairs. During this phase of the procedure, children in the Control condition were exposed to the sample items employed during strategy training, but did not receive instruction in the keyword method. On completion of this phase of the procedure, subjects in the Control and Strategy conditions were asked to learn a list of 15 city - product pairs. Subjects in the Metamemory, Experience, and Metamemory Plus

Experience conditions received supplementary training based on their experimental assignment. On completion of supplementary training, the subjects in these three conditions were asked to learn the 15 city - product pairs.

Following recall on the city - product task, each subject was asked to learn a list of 21 Latin noun - English translation pairs (generalisation task). After recall of this task, each child was questioned concerning the methods which they had employed to learn the pairs. For each child, five of the 21 pairs were selected at random to be probed for the method of learning.

Materials

Each subject was asked to learn two lists of paired items. The first list consisted of 15 city names (real U.S. cities) and their respective products (see Appendix A). The second list was composed of 21 Latin nouns and their English translations (see Appendix A). Before learning the list of Latin items all subjects were exposed to two sample items: mannus which means pony, and cupa which means barrel. All of the items on both lists have been included as stimuli in previous keyword research (Pressley & Dennis-Rounds, 1980).

The items on both lists were selected according to four criteria: (1) They were not commonly known (i.e., obscure cities and Latin nouns which are not commonly known to English speakers). (2) City names and Latin nouns could not be longer than three syllables. (3) Some portion of each city name and Latin noun had to sound like a concrete (i.e., picturable) noun. These concrete nouns had to be words that fifth and sixth grade children would know. (4) A city name could not be similar in sound or spelling to its product (e.g., Appleton with apples as its product), and Latin nouns could not be similar in sound or spelling to their English translation (e.g., signum means sign). These criteria for keyword selection were similar to those used in earlier keyword research (Atkinson, 1975; Pressley, 1977; Pressley & Levin, 1978).

Strategy Training Materials

During instruction for the city - product task all participants were exposed to three sample lists. The first list consisted of three sample pairs of city names and their respective products: Lock Haven - paper, Springfield - Abraham Lincoln souvenirs, and Buffalo - electricity. In addition, subjects in the Strategy, Metamemory, Experience, and Metamemory Plus Experience conditions were shown interactive pictures for the Lock Haven - paper and Springfield - Abraham Lincoln pairs. For the Lock Haven - paper pair, the children were presented with a picture of a newspaper with a lock attached to it (see Appendix A). For the Springfield - Abraham Lincoln pair, the children were shown a picture of Abraham Lincoln bouncing on a spring (see Appendix A).

The second strategy training list consisted simply of the names of three cities: Long Beach, Harrisburg, and Needles. The third list employed during strategy training was composed of five city names and their respective products (see Appendix A). Items in this list were selected according to the criteria for keyword selection outlined earlier.

Metamemory and Experience Training Materials

Two lists of paired items and two short passages of prose were employed during metamemory and experience training. The first list consisted of the surnames of six ficticious men and their respective professions, for example, Mr. Hennessy - bartender (see Appendix A). The second list was composed of the names of six countries and the type of food which is popular in each country, for example, Iceland - cheese (see Appendix A). In addition, two short passages of prose (approximately 75 words each in length) were selected from the children's classic "The Water Babies" (Kingsley, 1886) for presentation during metamemory and experience training (see Appendix A).

For each subject in the Metamemory condition, three of the six pairs from the surnames - professions list, three of the six pairs from the countries - food list, and one of the two prose passages were randomly selected for presentation. Similarly, for each subject in the Experience condition, three surname - profession pairs, three country - food pairs, and one prose passage were selected for presentation. Subjects who received both metamemory and experience training were exposed to three pairs of items from each list and one prose passage during metamemory training. The remaining three pairs from each list and the second prose passage were presented during experience training. For half of the subjects in this condition paired items from each list and a prose passage were randomly selected for presentation during metamemory training and the remaining items and prose passage were employed during experience training. This procedure for item selection was reversed for the remaining subjects in this condition.

All of the materials used in this study were presented to the children on 10.0 x 15.0 cm. white cards. All of the items and the prose passages were typed on the cards. Each prose passage and each pair of items were presented on a separate card.

Procedure

All subjects were seen individually by the experimenter in a quiet room in the subject's school. Subjects were randomly assigned to one of five conditions: Control, Strategy, Experience, Metamemory, and Metamemory Plus Experience. This section on procedure has been divided into three parts. First, the procedures used to instruct all subjects to learn the city - product pairings will be outlined. Then, the procedures employed during supplementary training for subjects in the Experience, Metamemory, and Metamemory Plus Experience conditions will be detailed. In the third subsection, the procedures followed during the city - product and generalisation tasks will be described.

Instruction on City - Product Pairs

At the beginning of the session each child was informed that he/she would be required to learn a list of city - product pairings, but that they would first be given practice with city - product tasks. Subjects in the Strategy, Experience, Metamemory and Metamemory Plus Experience conditions were then instructed in the use of the keyword method to learn city - product pairings. Control subjects did not receive this instruction (see Table 1).

All subjects except those in the Control condition were first given explicit training in the use of the keyword method with the sample items Lock Haven - paper and Springfield - Abraham Lincoln souvenirs. For Lock Haven, the children were told to notice that the name Lock Haven contains the noun lock. (See Appendix B for verbatim instructions). They were further instructed that a good way to remember that Lock Haven is famous for paper is to construct an interactive image between a lock and paper. The children were requested to construct such an image and to describe it to the experimenter. Then the children were shown an interactive drawing of a lock attached to a newspaper. The experimenter explained to the children that their pictures did not have to be identical to the sample picture, provided that their picture contained a lock and paper doing something together. Then the children were informed that a good way to remember a city's product is first to find a part of the city name that sounds like an object and then to construct a mental picture of that object doing something with the city's product.

The second sample pair (Springfield - Abraham Lincoln souvenirs) was then shown to the subjects. This pair was presented in the same manner as the Lock Haven - paper pair. The children again received a detailed explanation of how to use the keyword method to remember what Springfield was famous for. In addition, subjects were shown an interactive drawing of Abraham Lincoln bouncing on a spring. For the third sample pair (Buffalo - electricity) children were instructed to use the keyword method, but were not shown an interactive picture. Thus, assistance from the experimenter was gradually withdrawn. Following presentation of these three sample pairs, all the children were asked to recall the products of Springfield, Buffalo and Lock Haven. On completion of this test on the sample items, the subjects were instructed to forget these practice pairs.

At this point, subjects were instructed to use the keyword method to learn the city - product pairings that would subsequently be presented. That is: (1) subjects were re-instructed that the first thing to do for each city name was to find part of the name that sounded like a familiar object. The children were then given practice generating keywords with the city names Long Beach, Harrisburg and Needles. After attempting to find keywords for each of these city names (an easy task for all the children) the participants were instructed to forget these sample cities. (2) Then the children were informed that they would be given more practice with the keyword method before learning the cities and their products. The subjects were told that they would be shown a short practice list of city - product pairs. The children were requested to generate a keyword for each city name and to tell it to the experimenter. They were also asked to construct an interactive image for each pair and to describe it to the experimenter. If subjects encountered any difficulty generating keywords or interactive pictures they received help from the experimenter. After completing these requirements for each of the five pairs, a short test was administered requiring recall of each city's product. This completed the instruction in the use of the keyword method to learn city - product pairs.

During instruction on the city - product task for Control subjects, the same three sample lists used for training the keyword strategy were presented. However, children in the Control condition did not receive instruction in the keyword method (see Table 1). The sample items Lock Haven, Springfield and Buffalo were presented to the Control children with the instruction to "try hard to remember what each city is famous for". Naturally, children in the Control condition were not shown the interactive pictures with the Lock Haven and Springfield pairs. Following presentation of these sample items, Control children were tested for recall of the products given each sample city name.

Next, Control children were shown the city names Long Beach, Harrisburg and Needles. They were told that all the city names they would see during the session would be presented on cards this way. Finally, the children in the Control group were presented with the third sample list composed of five city names and their respective products. These children were instructed to "try hard to remember what each city is famous for". The children were then given a recall test for each city's product. It was considered necessary to expose children in the Control condition to all of the sample lists, in order to insure that exposure to city names prior to experimental task one (i.e., 15 city - product pairs) was equivalent across conditions. This completed the instruction on city - product pairs for the children in the Control group.

The instruction on city - product pairs which has been detailed above comprised the first phase of training (see Table 1). There was no second phase of instruction for children in the Control and Strategy conditions (i.e., participants in these conditions were presented with experimental task one, composed of 15 city - product pairs, immediately following the first phase of instruction). The children in the remaining three conditions experienced a second phase of instruction. These subjects received metamemory training and/or additional experience with the strategy. On completion of this second phase of training, the children in these conditions were presented with experimental task one (see Table 1).

Metamemory Training

As outlined above, children assigned to the Metamemory condition received metamemory training when they had completed the first phase of instruction. Therefore, metamemory training was instituted following training in the use of the keyword method and prior to the execution of experimental task one (15 city - product pairs) (see Table 1). Metamemory training consisted of two distinct types of instruction. First, children were provided with general information about the keyword strategy. Next, the children viewed a demonstration of the appropriateness and inappropriateness of the strategy as a learning aid on different memory tasks.

General information about the strategy was provided in the following way. (See Appendix B for verbatim instruction.) First, the experimenter asked the children if they ever found it difficult to recall information (all the children indicated that they frequently encountered such difficulties). Then, the experimenter told the children that they could frequently do something during learning that would help them to recall information. The children were asked if they found it difficult to decide what to do while learning to insure maximum recall. (All subjects reported that these decisions were difficult for them.) The experimenter then pointed out that the memory "trick" (i.e., the keyword strategy) which they had learned during training was a very effective learning aid. The experimenter informed the children that the keyword method would facilitate recall and pointed out that they would recall more information if they used the strategy than if they did not. The children were then asked if they thought that the strategy was a good memory trick (all subjects agreed that it was).

The children were then informed that this strategy "only works well when you have to remember that two things go together". The experimenter then explained the reason for this statement in the following way. First, the children were asked to recall the way in which they had used the strategy to learn the sample city — product pairs. The experimenter reminded them that they had generated a keyword for each city name and constructed an interactive image with each keyword and that product. The experimenter then reminded the children that they had been presented with each city name during the recall test. It was pointed out, that all the children had to do during recall was to look for their keyword in each city name and to try to recall the picture which they had constructed containing that keyword. The experimenter then told the subjects that the other object in their picture with a keyword must be the city's product. The experimenter then informed the children that this was the reason that the keyword method worked well on paired associate tasks. The children were then told that this strategy "does not work well when you have to remember that more than two things go together". To demonstrate this principle the experimenter told the children that if each city which they had previously been shown had been famous for 20 products, there would have been so many objects in their interactive pictures that they probably would have forgotten some of them. All the children were then asked if they understood why the strategy only works well on paired associate tasks.

Finally, subjects were reminded to use the strategy whenever they had to remember that two things went together. The experimenter informed the children that these two things did not have to be cities and their products. Rather, it was pointed out to the children that they could use this method with any two words. The children were informed that whenever they had to remember that two words went together, they should first try to find a keyword for the first member of a pair. The experimenter told the children that if they tried hard they would always be able to find a keyword. The children were further instructed that once they had generated a keyword, they should construct an interactive image with that keyword and the second item in a pair. Finally, the children were reminded that if they followed this method they would find it easy to recall information on paired associate tasks.

After the children had been given this information about the strategy, the experimenter demonstrated the appropriateness and inappropriateness of the technique on different mnemonic tasks. First, the children were shown a short list composed of the surnames of three ficticious men and their respective professions. The experimenter then informed the children that if they had to try and remember each man's profession, they could use the keyword method to help them. The experimenter pointed out that the strategy would be an effective learning aid because the task required that they remember which two things went together. The experimenter then demonstrated the use of the strategy by generating a keyword and interactive image for each pair.

Next, the children were presented with a short prose passage. They were informed that if they had to learn this passage so that they could recite it verbatim, then the keyword method would not help them. The experimenter pointed out that the keyword strategy only works well on paired associate tasks and that there were too many words in the passage for the method to be effective. Finally, the children were shown a list of the names of three countries and the type of food which is popular in each. The subjects were informed that the keyword method would be an effective learning aid on this task, because it required that one remember which two things went together. The experimenter then demonstrated the use of the strategy by generating a keyword and an interactive image for each pair. This completed metamemory training and the children in this condition were then presented with experimental task one (see Table 1).

In summary, metamemory training consisted of two distinct types of instruction. First, children were provided with general metamnemonic information about the keyword strategy (i.e., where, when, how, and why they could use it, together with a rationale for its effectiveness on paired associate tasks). Next, the children were provided with a demonstration of the effectiveness and ineffectiveness of the strategy on different memory tasks. The purpose of this demonstration was to highlight the match between task demands and strategic action.

Experience Training

As outlined previously, children assigned to the Experience condition received experience training when they had completed the first phase of instruction. Therefore, experience training was instituted following training in the use of the keyword method and prior to the execution of experimental task one (15 city - product pairs) (see Table 1). Subjects assigned to the Experience condition were not given explicit general information about the strategy. Rather, experience training consisted of practice with the strategy on a variety of mnemonic tasks.

Experience training was provided in the following way. First, these children were shown a list composed of the surnames of three ficticious men and their respective professions. The children were asked to learn each man's profession and were instructed to use the keyword strategy during learning. If the children encountered any difficulty generating keywords or interactive images, they were helped by the experimenter. On completion of the learning trial the children's ability to recall the pairs was assessed. Each child successfully recalled all the items - highlighting the effectiveness of the strategy on this task. Finally, the experimenter pointed out that the keyword strategy was an effective learning aid for this task. The children were not given any additional information.

Next, the children were shown a short prose passage. They were asked to imagine that they had to learn this passage so that they could recite it verbatim. The experimenter asked the children to try and see if the keyword method would help them to learn the passage. The children were required to report whether or not the stratgey would be effective on this task. Regardless of the children's answers, the experimenter informed them that the strategy would not be an effective learning aid for this task. No additional information was provided.

Finally, the children were shown a list of the names of three countries and the type of food which is popular in each country. The children were asked to learn the pairs and instructed to use the keyword method during learning. The children's ability to recall the pairs was then assessed. Each child successfully recalled all the items -

highlighting the effectiveness of the strategy on this task. Finally, the experimenter pointed out that the keyword strategy was an effective learning aid for this task. This completed experience training and the children in this condition were then presented with experimental task one.

In summary, children who received experience training were required to use the keyword strategy to learn two paired associate lists. Following learning, they were asked to recall the pairs on each list. The experimenter then pointed out that the strategy was an effective learning aid on these tasks. These children were also asked to determine whether or not this strategy would help them to learn a short prose passage. They were then informed that it would not be an effective learning aid on this task. The procedures used during experience training were designed to highlight the match between task demands, strategic action and recall performance. However, this information was presented in an implicit manner, as opposed to the explicit information provided during metamemory training.

Metamemory Plus Experience Training.

The procedures used to instruct children in the Metamemory and Experience conditions have been outlined. Children assigned to the fifth condition received both Metamemory and Experience training. This training was instituted following instruction in the use of the keyword technique and prior to the execution of experimental task one (see Table 1).

The procedures used to instruct children in the Metamemory Plus Experience condition were identical to those used in the Metamemory only and Experience only conditions. Half of the children in the Metamemory Plus Experience condition received metamemory training prior to experience. This procedure was reversed for the remaining subjects in this condition. Recall that in the Metamemory only and Experience only conditions children were exposed to three pairs (out of a total of six pairs) from each of two paired associate lists and one of two prose passages. These items were randomly selected for each subject. In the Metamemory Plus Experience condition, three items from each list and one prose passage were randomly selected for presentation during one component (either Metamemory or Experience) of training. The remaining items from each list and the second prose passage were presented during the other component of training.

Experimental Tasks One and Two

Following training, all the children were asked to learn 15 city - product pairs which represented experimental task one. Subjects who had been instructed in the use of the keyword strategy during training (i.e., subjects in the Strategy, Experience, Metamemory, and Metamemory Plus Experience conditions) were reminded to use the strategy to learn these 15 pairs. Control children were instructed to try hard to remember what each city was famous for (see Table 1).

An anticipation procedure was employed during learning. The children were first shown the stimulus item and then the stimulus response pair for each of the 15 cities. Presentation was by the oral-visual method. For example, for the pair Swanton - maple syrup, the experimenter said "What is Swanton famous for?" (while the subject was viewing the test trial) and "Swanton is famous for maple syrup" (while the subject was viewing the study trial). Two anticipation cycles were used and items were presented at a rate of one pair every 10.0 secs. Children were allowed up to 10.0 secs to recall verbally the product that each city was famous for. To eliminate the confounding influence of serial-order effects, two different list orderings were used for presentation. To eliminate the confounding influence of short-term memory effects, a constraint was imposed on list orderings such that at least six items had to intervene between consecutive anticipation trials for a pair. For example, if Swanton - maple syrup was the last pair (i.e., fifteenth) on the first anticipation cycle, then it could not be the first, second, third, fourth, or fifth pair on the second anticipation cycle.

Following recall on the city - product task, all the children were asked to learn the list of 21 Latin nouns and their English translations which represented the generalisation task (experimental task two). The sample pairs: <u>mannus</u> - pony and <u>cupa</u> - barrel were used to illustrate the nature of the task to all the children. All subjects were simply instructed to try hard to remember what each Latin word meant.

Again, an anticipation procedure was employed during learning. The children were first shown the stimulus item and then the stimulus-response pair for each of the 21 Latin nouns. Presentation was by the oral-visual method. For example, for the pair pannus - rag, the experimenter said "What does pannus mean?" (while the subject was viewing the test) and pannus means rag (while the subject was viewing the study trial). Items were presented at a rate of one pair every 10.0 secs and subjects were allowed up to 10.0 secs to recall verbally the English translation of each Latin noun. Learning was continued for 10 anticipation cycles but was discontinued if a child was able to make two consecutive errorless passes through the list before completing ten ~~cycles~~. Again, two different list orderings were used for presentation and a constraint was imposed on list orderings such that at least 10 items had to intervene between consecutive anticipation trials for any one pair.

Following recall on this task, all the children were questioned about the methods which they had used to learn the pairs. The children were simply asked to report what they had done to try and learn the pairs. For example, for the pair pannus - rag the children were asked "Tell me what you did to try to remember that pannus means rag?" For each subject five of the 21 pairs were randomly selected to be probed with the constraint that each of the 21 pairs was probed at least four times in each experimental condition. The children's reports were recorded on tape.

Results and Discussion

To facilitate presentation, this section on results and discussion has been divided into the following parts: Recall on the city - product task, recall on the Latin - English task, and reports of study methods on the Latin - English task.

City - Product Recall

Two anticipation cycles were used during learning on the city - product task. The number of items recalled on each of the two trials was calculated for each subject (see Appendix C). The means and standard deviations of recall performance in each experimental condition[1] on both trials are displayed in Table 2. Recall performance in all five conditions was compared for Trial 1 and separately for Trial 2 using sets of Dunn's comparisons (Kirk, 1968). For each trial, a set of 10 Dunn's comparisons was used to compare performance (α = 0.10 for each set, α = 0.01 per comparison).

The results of these analyses are displayed in Table 3 (Trial 1) and Table 4 (Trial 2). On each trial, the pattern of results was the same. Children in the Control condition recalled significantly fewer items on each of the two trials than children in the other four conditions. There were no

Table 2

Recall of City-Product Pairs as a Function of Experimental Condition and Trial in Experiment 1

Experimental Condition	Trial 1	Trial 2
Control	$\bar{x}$ = 2.5 S.D. = 1.73	$\bar{x}$ = 4.15 S.D. = 2.41
Strategy	$\bar{x}$ = 7.3 S.D. = 3.01	$\bar{x}$ =10.85 S.D. = 2.71
Experience	$\bar{x}$ = 7.3 S.D. = 3.21	$\bar{x}$ =10.35 S.D. = 2.85
Metamemory Plus Experience	$\bar{x}$ = 6.5 S.D. = 3.25	$\bar{x}$ =10.6 S.D. = 3.06
Metamemory	$\bar{x}$ = 8.1 S.D. = 3.25	$\bar{x}$ =11.5 S.D. = 2.32

n = 20 for each condition

Maximum score = 15

Table 3

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the City-Product Task in Experiment 1

	Control	Metamemory Plus Experience	Strategy	Experience	Metamemory
Control = 2.5	--	4.0*	4.8*	4.8*	5.6*
Metamemory Plus Experience = 6.5		--	0.8	0.8	1.6
Strategy = 7.3			--	0.0	0.8
Experience = 7.3				--	0.8
Metamemory = 8.1					--

*Critical difference between means = 2.54 at $p < .01$.

Table 4

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the City-Product Task in Experiment 1

	Control	Experience	Metamemory Plus Experience	Strategy	Metamemory
Control = 4.15	--	6.20*	6.45*	6.70*	7.35*
Experience = 10.35		--	0.25	0.50	0.65
Metamemory Plus Experience = 10.60			--	0.25	0.90
Strategy = 10.85				--	0.65
Metamemory = 11.5					--

*Critical difference between means = 2.21 at $p < .01$.

significant differences in recall performance between the Strategy, Experience, Metamemory and Metamemory Plus Experience conditions on either trial.

As was expected, children who received instruction in the use of the keyword method with city - product pairs (i.e., all except the Control children), demonstrated significant learning gains relative to children who were not instructed in the use of the technique. These learning gains were maintained for both trials on the city - product task. It is not surprising that there were no significant differences in recall between the remaining four conditions, as children in all of these conditions received identical instruction in the use of the keyword method with city - product pairs. Thus, it appears that supplementary instruction, (i.e., metamemory and/or experience training) did not influence performance on this task. This result had been expected as supplementary training was specifically designed to influence performance on the generalisation task (i.e., Latin - English) only. It is important to bear in mind during the discussion that follows, that all of the children instructed in the mechanics of keyword strategy use, demonstrated comparable learning performance on the city - product task.

Latin - English Recall

On the Latin - English task, learning was continued for a maximum of 10 anticipation cycles, but was discontinued if children were able to make two consecutive errorless passes through the list before completing 10 cycles. The number of items recalled on each of the 10 trials was calculated for each subject (see Appendix C). The mean recall performance in each experimental condition[2] on each trial is shown in Figure 1. Recall performance in each condition was compared for Trial 1 and separately for Trial 2 (consistent with the analyses of recall performance on the city - product task). In addition, the mean number of items recalled across 10 trials in each condition was compared. Three sets of 10 Dunn's comparisons were used to compare performance on Trial 1, Trial 2 and across 10 trials ($\alpha = 0.1$ for each set; $\alpha = 0.01$ per comparison).

The means and standard deviations of recall performance on Trial 1, Trial 2 and across 10 trials are shown in Table 5. The pattern in these data demonstrates that the rank order of mean recall performance is invariant across the three measures. Thus, on the initial learning trials and across the entire learning phase, the following pattern emerges consistently: Metamemory $\geq$ Metamemory Plus Experience > Experience > Strategy > Control.

For the first trial, pairwise comparisons were conducted between recall performance in each condition (see Table 6). Children in the Metamemory, Metamemory Plus Experience, and Experience conditions significantly outperformed children in the Control condition. However, only the Metamemory condition significantly outperformed the Strategy condition. Thus, it appears that children who

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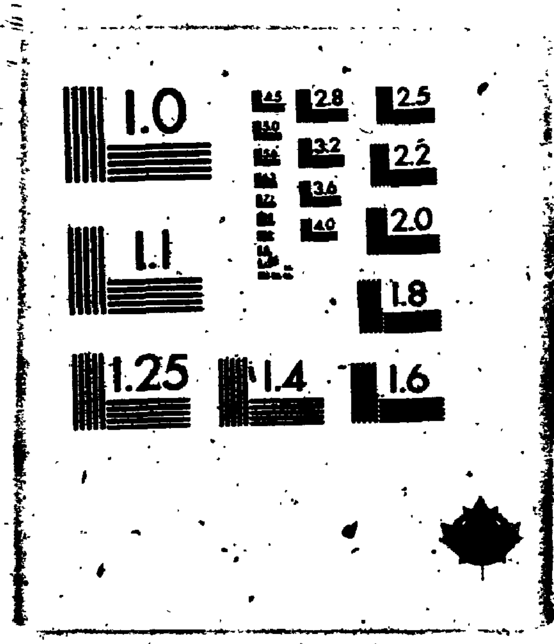

Table 5

Recall of Latin-English Pairs as a Function

of Experimental Condition and Trial in Experiment 1

Experimental Condition	Trial 1	Trial 2	Across 10 Trials
Control	$\bar{x}$ = 1.85	$\bar{x}$ = 5.05	$\bar{x}$ = 9.75
	S.D. = 1.49	S.D. = 2.62	S.D. = 3.81
Strategy	$\bar{x}$ = 5.20	$\bar{x}$ = 8.30	$\bar{x}$ = 12.09
	S.D. = 4.87	S.D. = 5.83	S.D. = 5.47
Experience	$\bar{x}$ = 5.85	$\bar{x}$ = 9.20	$\bar{x}$ = 12.99
	S.D. = 5.47	S.D. = 6.67	S.D. = 5.40
Metamemory Plus Experience	$\bar{x}$ = 7.45	$\bar{x}$ = 12.15	$\bar{x}$ = 16.07
	S.D. = 4.81	S.D. = 5.55	S.D. = 4.47
Metamemory	$\bar{x}$ = 9.50	$\bar{x}$ = 13.90	$\bar{x}$ = 16.67
	S.D. = 4.59	S.D. = 5.51	S.D. = 4.42

n = 20 for each condition

Maximum score = 21.

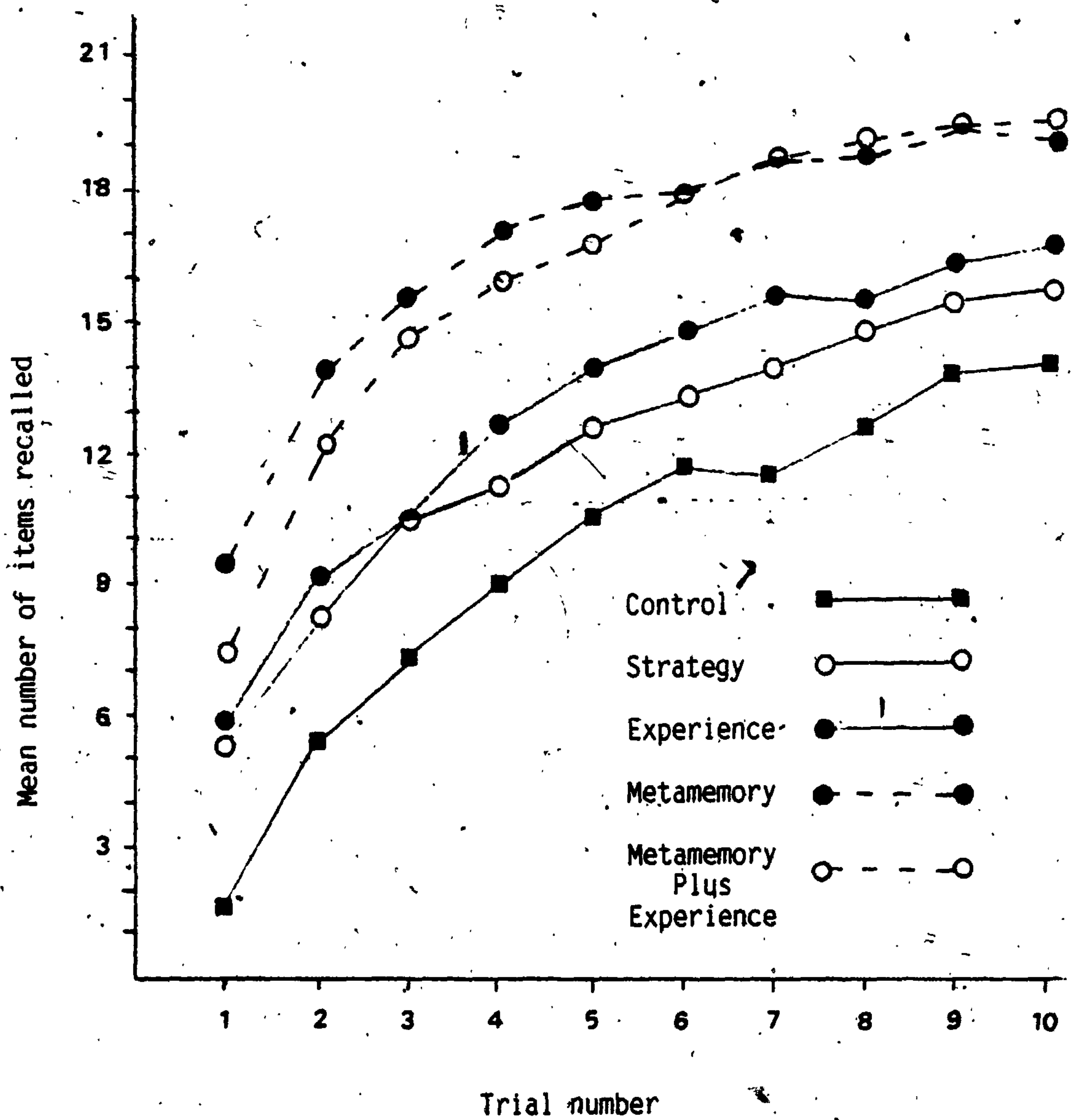

Figure 1. Mean Recall Performance in Each Experimental Condition on Each Trial on the Latin-English Task in Experiment 1.

Table 6

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the Latin-English Task in Experiment 1

	Control	Strategy	Experience	Metamemory Plus Experience	Metamemory
Control = 1.85	--	3.35	4.0*	5.60*	7.65*
Strategy = 5.20		--	0.65	2.25	4.30*
Experience = 5.85			--	1.60	3.65
Metamemory Plus Experience = 7.45				--	2.05
Metamemory = 9.50					--

*Critical difference between means = 3.73, $p < .01$.

received supplementary training, i.e., metamemory and/or experience training, generalised the keyword technique on the first trial of the Latin - English task. However, it is evident that children who received metamemory instruction alone or in conjunction with experience training, were more successful on this trial than those who received experience training only.

On the second trial, the rank order of recall performance was identical to that on Trial 1. When recall performance in each condition was compared, the following differences were obtained (see Table 7). Children in the Metamemory and Metamemory Plus Experience conditions significantly outperformed children in the Control condition. However, only those in the Metamemory condition significantly outperformed children in the Strategy and Experience conditions.

On the second trial then, children who had received a metamemory component in training continued to generalise the keyword technique. However, simple metamemory instruction appeared to promote more successful generalisation than metamemory instruction combined with experience training.

The analyses of recall performance on Trials 1 and 2 provide informative data concerning the effects of the different instructional programmes on generalisation behaviour on the initial learning trials. However, as Salatas and Flavell (1976) point out, significant relationships between variables may not become established until

Table 7

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the Latin-English Task in Experiment 1

	Control	Strategy	Experience	Metamemory Plus Experience	Metamemory
Control = 5.05	--	3.27	4.15	7.10*	8.85*
Strategy = 8.30		--	0.90	3.85	5.60*
Experience = 9.20			--	2.95	4.70*
Metamemory Plus Experience = 12.15				--	1.75
Metamemory = 13.90					--

*Critical difference between means = 4.505 at $p < .01$.

later trials in learning. For example, significant relationships between variables may not be revealed until children become familiar with a new task. Thus, such relationships might not be evident on the first learning trial as children may not yet be familiar with the task (Salatas & Flavell, 1976). Thus, to increase the likelihood of obtaining optimal learning, the children in this experiment were given a maximum of 10 learning trials. Consequently, mean recall performance across 10 trials was considered to be a more representative measure of performance than recall on Trial 1 or 2 alone.

The majority of children in the Metamemory and Metamemory Plus Experience conditions did not require 10 anticipation cycles to achieve successful recall of all the items on the Latin-English task. Consequently, mean recall performance across 10 trials is approaching a ceiling level in these two conditions. In the remaining three conditions, on the other hand, learning was continued for 10 anticipation cycles, for the majority of children. Nonetheless, when average recall performance across 10 trials in each condition was compared (see Table 8), the performance on this measure was identical to the sequence observed on Trials 1 and 2. In addition, the magnitude of the differences between these means was comparable to the magnitude of the differences in mean recall - performance observed on Trials 1 and 2. Children in the Metamemory and Metamemory Plus Experience conditions significantly

Table 8

Dunn's Comparisons of Recall Performance in Each Experimental Condition

Across 10 Trials on the Latin-English Task in Experiment 1

	Control	Strategy	Experience	Metamemory Plus Experience	Metamemory
Control = 9.75	--	2.34	3.24	6.32*	6.92*
Strategy = 12.09		--	0.90	3.98*	4.58*
Experience = 12.99			--	3.08	3.68
Metamemory Plus Experience = 16.07				--	0.60
Metamemory = 16.67					--

*Critical difference between means = 3.95 at $p < .01$.

outperformed children in the Strategy and Control conditions. Performance in the Experience condition was intermediate between (and not significantly different from) recall in the Control condition and recall in the two conditions that included metamemory instruction.

These data indicate that traditional strategy training combined with metamemory instruction promotes significantly more successful generalisation than strategy training alone. Further, the addition of the metamemory component to the training programme is sufficient to promote generalisation, as evidenced by the comparable recall performances in the Metamemory and Metamemory Plus Experience conditions. Finally, the performance of children in the Experience and Strategy conditions was not significantly different from performance in the Control condition (at $\alpha = 0.01$). Nonetheless, the performance in these two conditions was sufficiently different from control performance ($\alpha = 0.05$ for Experience, $\alpha = 0.1$ for Strategy) to suggest that children who received experience or strategy training may have tried to generalise the keyword technique on the Latin - English task.

When the data from Trials 1 and 2 and across the 10 trials are considered together, certain consistent patterns emerge. First, instruction which included a metamemory training component promoted the most successful generalisation on the initial learning trials and across the entire learning phase. Thus, children who received metamemory instruction demonstrated learning gains on the first trial and maintained those gains across the entire learning phase. Second, while recall performance in the Strategy and Experience conditions was not as successful as recall in the conditions that included metamemory instruction, this result should not be taken to indicate that children in the Strategy and Experience conditions did not attempt to generalise the strategy. Rather, the performance in these conditions, relative to that in the Control condition, suggests that these children may have tried, albeit with less than complete success, to adapt the strategy to the new task. This point will be readdressed, during the discussion of the children's reports of the study methods that they used to learn the Latin - English pairs.

While these data on recall performance indicate that the inclusion of a metamemory component in instruction promotes more successful generalisation than strategy and experience training, an analysis of covariance was conducted to determine if recall differences among these conditions would remain after adjusting for variation in recall performance on the city - product task (see Appendix D). As the data from the analysis of covariance were entirely consistent with the results of the analysis comparing unadjusted mean recall performance, they will simply be summarised here. When the effects of variation in recall performance on the city - product task were controlled for, children in the Metamemory and Metamemory Plus Experience conditions demonstrated comparable recall performance and significantly outperformed children in the Strategy condition. Recall performance in the Experience condition was intermediate between (and not significantly different from) recall in the Strategy condition and recall in the two conditions that included metamemory instruction.

In conclusion, when performance on the city - product task is compared to performance on the Latin - English task, striking differences emerge. On the city - product task, children who received instruction in the use of the keyword method with city - product pairs demonstrated comparable recall performances. These children significantly outperformed those in the Control condition who did not receive such instruction. The Latin - English task was administered directly following the city - product task. On the Latin - English task consistent differences in performance were observed between the conditions that had included keyword instruction. As expected (1) the inclusion of the metamemory component in training significantly incremented transfer over that observed in the traditional strategy training condition, and (2) metamemory instruction was <u>sufficient</u> to promote generalisation, as the potency of metamemory instruction was not increased by the addition of experience training.

<u>Reports of Study Methods</u>

On completion of recall on the Latin - English task, the children were questioned about the study methods they had used to learn the pairs. This procedure was included to obtain a measure of strategy use during learning - independent of recall. Five items were probed for each subject yielding a total of 100 probes per experimental condition (500 for the experiment).

Scoring

The following system was designed for use in scoring the children's responses. A score of 3 points was assigned for each response that reflected accurate use of the keyword strategy in a manner consistent with the original training. Thus, children were required to indicate that they had (1) generated an English keyword (concrete noun) from the Latin noun, and (2) constructed an interactive image with this keyword and the English translation of the Latin noun. An example of a 3 point response for the pair Nutrux - nurse would be a nurse eating a nut.

A score of 2 points was assigned to each response that reflected accurate use of the keyword method, but in a manner inconsistent with the original training. Three types of response met this criterion. (1) Responses that reflected generation of keywords that were verbs, adjectives, etc. as opposed to concrete nouns. For example, if to learn the pair Nutrux - nurse the child generated the elaboration - the nurse is a nut. (2) Responses that indicated that children had transformed the English translation of a Latin item from its original noun form to a verb, adjective, etc. An example of such a response for the pair Nutrux - nurse would be - I ate a nut while nursing a patient. (3) Responses that indicated that both the keyword and the English translation were represented as verbs, adjectives, etc. as opposed to concrete nouns. An example of such a response for the pair Nutrux - nurse would be - I was nursing a nutty patient.

A score of 1 point was assigned to responses that reflected incomplete use of the keyword method. Incomplete use of the strategy was defined as generation of a keyword in any form (i.e., noun, verb, adjective, etc.) but failure to construct an interactive image with the keyword and the English translation of the Latin item. An example of a 1 point response for the pair Nutrux - nurse would be nut - nurse. All other responses, (i.e., those that failed to indicate any attempt to use the keyword strategy) were assigned a score of Ø.

The responses were scored by two independent raters. Subjects were identified on the tape recordings by subject number only. Thus, the raters were unaware of each child's experimental assignment. The raters were unable to score four responses out of the total of 5ØØ. The quality of the tape recordings for these four responses rendered them incomprehensible and they were not included in subsequent analyses.

A problem developed during the scoring procedure that had not been anticipated. One of the criteria for assigning scores of 3 and 2 points for responses required that children indicate that they had constructed an interactive image with a keyword and the English translation of a Latin noun. However, only two children actually mentioned that they had constructed a picture. The remaining children who indicated accurate use of the strategy simply described their elaborations, without detailing the procedures involved in their construction. Thus, responses that indicated accurate use of the keyword method may have reflected the construction of either imaginal or verbal elaborations. As it was not possible to differentiate between imaginal and verbal elaborations on the basis of the children's responses, the criterion of indicating construction of an interactive image was relaxed. Thus, all responses that indicated the use of an elaboration involving a keyword and its target item were considered to reflect accurate use of the strategy. These responses were then assigned scores of 3 or 2 points depending on the form of the keyword and target item (i.e., 3 points = keyword and target item in noun form, 2 point = keyword and/or target item not in noun form).

On completion of scoring, a measure of interrater reliability was calculated. Percentage of exact agreement was chosen as the measure of interrater reliability because of the direct estimate of correspondence between raters which it provides. Agreement was defined as the number of times the raters' scores agreed compared to the total number of items scored (i.e., 476 items). The raters agreed on

91.8% of their scores. The discrepant scores were then discussed by the raters who resolved the discrepancies and achieved 100% agreement.

Analyses

The percentage of responses that were assigned scores of 3, 2, 1, and 0, respectively, was calculated for each subject (see Appendix C). The mean percentage and standard deviation of responses in each scoring category in each experimental condition are displayed in Table 9. Children in the Control condition reported little or no use of the keyword strategy in any form, with 89% of their responses assigned scores of 0. This is not surprising as these children were never instructed in the use of the strategy. In the remaining four conditions, the children reported the use of a variety of study methods, ranging from keyword strategy execution that was consistent with the original training, to no attempt to use the strategy at all. However, it is evident that in each of these four conditions, the majority of responses were assigned scores of 3 and/or 0.

Analyses of the probe scores were designed to investigate two questions. First, was increasingly successful recall performance on the Latin - English task associated with increasingly more frequent reports of accurate keyword strategy use - in a manner consistent with original training (i.e., 3 point responses). Second, what type of reported study methods were primarily associated

Table 9

Percentage of Probe Responses Assigned to Each Scoring Category in Each Experimental Condition in Experiment 1

	Scoring Category			
Experimental Condition	3 points	2 points	1 point	0 points
Control	$\bar{x}$ = 1.00 S.D. = 4.472	$\bar{x}$ = 0.00 S.D. = 0.00	$\bar{x}$ = 10.00 S.D. = 15.21	$\bar{x}$ = 89.00 S.D. = 16.51
Strategy	$\bar{x}$ = 34.60 S.D. = 32.50	$\bar{x}$ = 9.10 S.D. = 15.18	$\bar{x}$ = 15.30 S.D. = 20.39	$\bar{x}$ = 40.80 S.D. = 34.94
Experience	$\bar{x}$ = 48.00 S.D. = 33.96	$\bar{x}$ = 5.00 S.D. = 11.00	$\bar{x}$ = 16.00 S.D. = 17.88	$\bar{x}$ = 31.00 S.D. = 34.01
Metamemory	$\bar{x}$ = 62.60 S.D. = 31.72	$\bar{x}$ = 7.00 S.D. = 9.78	$\bar{x}$ = 12.10 S.D. = 11.96	$\bar{x}$ = 18.10 S.D. = 25.87
Metamemory Plus Experience	$\bar{x}$ = 68.60 S.D. = 28.58	$\bar{x}$ = 9.0 S.D. = 13.72	$\bar{x}$ = 12.10 S.D. = 17.65	$\bar{x}$ = 10.10 S.D. = 22.00

Note: 3 points = Accurate use of the keyword strategy
2 points = Use of the strategy in a manner inconsistent with training
1 point = Incomplete use of the strategy
0 points = No apparent attempt to use the strategy

with unsuccessful generalisation, for example, (1) accurate but infrequent use of the strategy, or (2) frequent use of the strategy in a manner inconsistent with training, or (3) failure to apply the strategy in any form.

To determine whether children who demonstrated the most successful recall performance also reported the most frequent and accurate use of the strategy, the percentage of responses assigned scores of 3 points was compared in each condition. A set of 10 Dunn's comparisons was used for this analysis (α = 0.1 for the set; α = 0.01 per comparison). The results of this analysis are shown in Table 10. Children in the Strategy, Experience, Metamemory and Metamemory Plus Experience conditions reported significantly more frequent use of the strategy than children in the Control condition. Subjects in the two conditions that included a metamemory component in training, reported significantly more frequent use of the technique than children who received traditional strategy training. Finally, reports from children in the Experience condition indicate that they used the strategy with a frequency that was intermediate between (and not significantly different from) the frequency in the Strategy condition and the two conditions involving metamemory instruction.

These data are entirely consistent with the data on recall performance on the Latin - English task. First, children who received a metamemory component in instruction recalled significantly more items and reported significantly

Table 10

Dunn's Comparisons of the Frequency of Accurate Keyword Strategy Use in Each Experimental Condition in Experiment 1

	Control	Strategy	Experience	Metamemory	Metamemory Plus Experience
Control = 1.00	--	33.60*	47.00*	61.60*	67.60*
Strategy = 34.60		--	13.40	28.00*	34.00*
Experience = 48.00			--	14.60	20.60
Metamemory = 62.60				--	6.00
Metamemory Plus Experience = 68.60					--

*Critical difference between means = 23.94 at $p < .01$.

more frequent use of the keyword strategy than children who received traditional strategy training. Second, children who received experience training did report that they had used the keyword method on the Latin - English task. However, they did not use it as frequently, nor did they recall as successfully, as children who received metamemory instruction. Finally, children in the Strategy condition reported that they too had used the keyword method to learn some of the items. As previously mentioned, there were no significant differences in recall performance between the Strategy and Control conditions, although it was pointed out that the differences were sufficient to suggest that children in the Strategy condition may have tried to generalise the keyword method. This suggestion receives some support from the children's reports of keyword use. Thus, while these children reported some use of the strategy, it appears that they may not have used it often enough to affect recall performance significantly.

In summary, the data on both recall performance and reports of accurate keyword method use - in a manner consistent with training, indicate that instructional routines that included a metamemory component promoted the most successful generalisation of the trained strategy. Further, the performance of the children in the Strategy and Experience conditions indicates that they were able to adapt the trained strategy to the new task. Thus, the failure of these children to generalise the strategy successfully reflects, at least in part, accurate but inconsistent use of the strategy on the generalisation task.

To determine whether unsuccessful generalisation also reflected (1) frequent use of the strategy in a manner inconsistent with training, and/or (2) frequent but incomplete attempts to use the strategy, the percentage of responses assigned scores of 2 and 1, respectively, were compared separately in each of the experimental conditions. Two sets of 10 Dunn's comparisons were used for the analyses ($\alpha = 0.1$ for each set; $\alpha = 0.01$ per comparison). There were no significant differences in the frequency of responses assigned a score of 2 points between conditions (critical difference between means = 9.37 at $p < .01$). Thus, the frequency with which children used the strategy in a manner inconsistent with original training was comparable in all the conditions. Further, the overall incidence of this type of response was quite low, with these responses constituting only 6% of the total number of responses.

There were no significant differences between conditions in the frequency of responses assigned scores of 1 point (critical difference between means = 14.022 at $p < .01$). Thus, the reported number of items that children tried to learn using incomplete keyword strategy methods was comparable across conditions. The overall frequency of type 1 responses was quite low, constituting 13% of the total number of responses.

When considered together, the data on the frequency of the various types of probe responses indicate some possible reasons for failures in successful generalisation. The study methods reported by the unsuccessful generalisers (i.e., children in the Strategy and Experience conditions) demonstrate that these children were in fact able to adapt the trained strategy accurately to the new task. Unsuccessful generalisation does not appear to reflect frequent use of keyword strategies that represent variations of the trained method but, rather, reflects accurate but inconsistent use of the trained strategy on the generalisation task.

To a certain extent the reports of strategy use in all the conditions that included strategy training with city - product pairs, demonstrate an all or none type of phenomenon. For the majority of items the children reported either accurate use of the strategy or failure to apply it in any form. Children who received simple strategy training, with or without supplementary training, reported accurate adaptation of the trained strategy to the new task. Thus, the main affect of the metamemory training component seems to have been the promotion of the consistent application of the keyword method on the generalisation task.

While the data on reports of study methods conform to the same qualitative pattern as the data on recall performance, a correlational analysis was performed to determine the degree of the relationship between these two measures. For each subject five items had been probed for method of learning. The scores assigned for reports of study methods were summed across the five probed items for each subject. This procedure yielded a composite probe score for each child and a possible range of scores from 0 to 15 points across subjects, with increasing scores associated with increasing reports of keyword strategy use. The number of times (out of a total of 10 trials) that each child correctly recalled each probed item was calculated. These recall scores were then summed across probed items to yield a composite recall score for each subject and a possible range of scores from 0 to 50 across subjects. The correlation was then performed between composite probe scores and composite recall scores for probed items. A Pearson product-moment correlational analysis was performed for each Experimental condition and the resulting coefficients were: Control $\underline{r}(18) = 0.50$, $p < .05$; Strategy $\underline{r}(18) = 0.61$, $p < .01$; Experience $\underline{r}(18) = 0.55$, $p < .02$; Metamemory $\underline{r}(18) = 0.69$, $p < .01$; Metamemory Plus Experience $\underline{r}(18) = 0.54$, $p < .02$.

The relationship between reports of study methods and recall performance is quite impressive, given that the children were not questioned about study methods until they had completed several (with a maximum of 10) study - recall trials. Thus, it is possible that children could have adopted their reported study methods at various points during the learning procedure. For example, children could have used study method X on the initial learning trial and continued to use it on all subsequent trials. Alternatively, they could have begun with method X and switched to method Y on later trials. Naturally, there are several other possible variations in study methods. Despite the fact that the probe was not used to determine the frequency of reported study methods across trials, the relationship between reports of study methods and recall performance is strong. Thus, the correlational data lend further support to the conclusion that the more successful children's recall performance, the more likely they were to report accurate use of the keyword strategy.

Summary

Children in all the conditions that included instruction in the use of the keyword strategy with city - product pairs, demonstrated comparable recall performance on the city - product task and significantly outperformed children who did not receive strategy instruction. On the Latin - English task, however, striking differences in recall performance emerged between those groups that had received strategy training. Children who received metamemory instruction in addition to strategy training achieved the most successful strategy generalisation, recalling significantly more items and reporting significantly more frequent use of the keyword technique, than children who received traditional strategy instruction.

Children in the Strategy and Experience conditions reported that they had used the keyword method to learn some of the items on the Latin - English task. However, they did not use the strategy as frequently nor did they recall with the same degree of success as those who received metamemory instruction. Thus, the inclusion of a metamemory component in training promoted the most successful generalisation of the technique. Unsuccessful generalisation cannot really be attributed to an inability to adapt the trained strategy to a new task. As evidenced by the children's reports of study methods, unsuccessful generalisers were able to apply the strategy accurately on the Latin - English task and seldom reported the use of strategies that represented less efficient variations of the trained technique. Thus, one of the main effects of metamemory instruction would seem to be the promotion of accurate and consistent application of the trained strategy on a generalisation task.

EXPERIMENT 2

The results of the first experiment indicate that strategy instruction combined with metamemory training is sufficient to promote generalisation of the keyword technique. These results support the hypothesis that failures in generalisation reflect failures in metamemory (Flavell & Wellman, 1977). However, successful generalisation may not be a simple all or none phenomenon. For example, a child may generalise a trained strategy and yet fail to employ it with maximum efficiency on a new task. While the child would benefit from strategy use on a generalisation task, maximum benefits might not be achieved. The aim in instructional research is to promote generalisation, such that children transfer trained strategies at a level of efficiency that results in maximum learning gains. Therefore, the ultimate test for an instructional programme is to determine whether or not it promotes maximal generalisation of a trained strategy.

The aim in the second experiment reported here was to determine the degree of generalisation achieved by children who received metamemory instruction. Following Pressley and Dennis-Rounds (1980) analyses, it could be the case that even if children generalise a strategy to a new task, they may not use it as effectively as children who are instructed in its use on the new task. Therefore, in Experiment 2 of this thesis, the degree of generalisation achieved by children who received metamemory training was compared to the performance of children who were instructed in the use of the keyword method on a generalisation task. If failures in generalisation simply reflect failures in metamemory, then strategy training combined with metamemory instruction should be sufficient to promote maximal generalisation of that strategy. It was expected, therefore, that on the generalisation task, children who received metamemory instruction would exhibit learning gains comparable to those achieved by children who were instructed in the use of the strategy on the generalisation task.

In the second experiment, fifth and sixth graders were assigned to one of three conditioins and asked to learn the two lists of paired items used in Experiment 1 (i.e., 15 city - product, 21 Latin - English translations). Children in all three conditions first received identical instructions in the use of the keyword method to learn city - product pairs. Following this instruction, children in the Strategy training and Reinstruction conditions were asked to learn the city - product list. Children in the Metamemory condition received metamemory instruction before learning the city - product list. Following recall on the city - product list, all the children were asked to learn the list of Latin - English pairs. At this point, children in the Reinstruction condition were given detailed instruction in the use of the keyword technique to learn Latin - English pairs. Children in the Strategy training and Metamemory conditions received no such instructions. Following recall on this list, probes were inserted to determine the study methods that the children had used to learn the pairs.

It was expected that there would be no differences in recall performance between the conditions on the city - product task, as all the children received identical instruction with the keyword method on this task. On the Latin - English task, it was expected that metamemory instruction would promote maximal generalisation of the keyword strategy. Therefore, no differences in recall performance or reports of strategy use were expected between the Metamemory and Reinstruction conditions. Children in the Strategy Training condition were not expected to generalise the strategy successfully.

Method

Subjects

Sixty upper elementary-school-age children (fifth and sixth graders) participated in this experiment. The mean age of the children was 11 years, 4 months with a range of 10 years, 4 months to 12 years, 3 months. The children attended a public elementary school in London, Ontario. This school was situated in a middle class community. The children were randomly assigned to one of three experimental conditions with 20 children assigned to each condition.

Materials

All the children were asked to learn the two lists of paired items used in Experiment 1 (i.e., 15 city - product, 21 Latin - English translations). On the Latin - English task the children were exposed to the sample items (i.e., mannus means pony, and cupa which means barrel) used in the first experiment. However, in this second study children in the Reinstruction condition were shown interactive pictures for the mannus - pony and cupa - barrel pairs. For the Mannus - pony pair, the children were presented with a picture of a man riding a pony (see Appendix A). For the cupa - barrel pair, the children were shown a picture of a cup on a barrel (see Appendix A).

The materials used during instruction on the city - product task (i.e., three sample city - product lists) were identical to those used for strategy instruction in the first experiment. Similarly, the materials used during metamemory instruction (i.e., two lists of paired items and two prose passages) were identical to those used in the corresponding condition in Experiment 1.

Procedure

All subjects were seen individually by the experimenter in a quiet room in the subject's school. The children were randomly assigned to one of three conditions: Strategy Training, Metamemory Training and Reinstruction. This section on procedure has been divided into three parts. First, the procedures used to instruct children in the

Strategy and Metamemory conditions will be outlined. Then, the procedures used to instruct subjects in the Reinstruction condition will be detailed. Finally, the procedures followed during the city - product and generalisation tasks will be described.

Strategy Training and Metamemory Training

The procedures used in the Strategy Training and Metamemory Training conditions were identical to the corresponding conditions in Experiment 1 (see Table 11). Briefly, the children in these conditions were first instructed in the use of the keyword technique to learn the sample city - product pairs. Following instruction, children in the Strategy Training condition were asked to learn the list of 15 city - product pairs and were instructed to use the keyword strategy during learning. Children in the Metamemory Training condition received instruction in metamemory before they were asked to learn the 15 city - product pairs. Following recall on this task, the children in both of these conditions were asked to learn the Latin - English list. The children were simply instructed to try hard to remember what each Latin word meant.

Reinstruction

Children in the Reinstruction condition first received instruction in the use of the keyword strategy to learn sample city - product pairs (see Table 2). This instruction was identical to that given to children in the Strategy

Table 11

Sequence of Procedures in Each Experimental Condition

at Each Phase of the Experiment in Experiment 2

Experimental Phase	Experimental Condition		
	Reinstruction	Strategy	Metamemory
Phase 1	Exposure to sample city-product lists. Instructed in the use of the keyword method to learn city-product pairs.		
Phase 2	↓	↓	Metamemory training comprising 1) General information about the strategy. 2) Demonstration of its effectiveness on training tasks 1, 2, and 3.
Phase 3	Experimental task one (15 city product pairs) instructed to use the keyword method during learning.		
Phase 4	Experimental task-Generalization (21 Latin-English pairs).		
	Exposure to sample pairs. Instructed in the use of the keyword method to learn Latin-English pairs.	Exposure to sample pairs. Instructed to try hard to remember the meaning of each noun.	
Phase 5	Probe for method of learning on generalization task. Six pairs probed for each subject.		

Training and Metamemory Training conditions. Next, children in the Reinstruction condition were asked to learn the 15 city - product pairs. Following recall on this task, these children received instruction in the use of the keyword method to learn Latin - English pairs. The procedures used during this instruction are outlined below.

Children in the Reinstruction condition were informed that they would be required to learn a list of Latin - English pairs, but that they would first be given practice with Latin - English pairs. The children were then given explicit training in the use of the keyword method with the sample items mannus - pony and cupa - barrel. For mannus - pony, the children were told to notice that the Latin word mannus contains the English word man. They were further instructed that a good way to remember that mannus means pony is to construct an interactive image between a man and a pony. The children were requested to construct such an image and to describe it to the experimenter. Then the children were shown an interactive drawing of a man riding a pony. The experimenter explained to the children that their pictures did not have to be identical to the sample picture, provided that their picture contained a man and a pony doing something together. Then the children were instructed that a good way to remember a Latin noun's translation is first to find a part of the Latin noun that sounds like an English object and then to construct a mental picture of that object doing something with the Latin noun's translation.

The second sample pair cupa - barrel was then shown to the subjects. This pair was presented in the same manner as the mannus - pony pair. The children again received a detailed explanation of how to use the keyword method to remember what cupa meant. In addition, the children were shown an interactive drawing of a cup on top of a barrel. Following presentation of these sample pairs, the children were asked to recall the English translations of mannus and cupa. Following recall the subjects were instructed to forget these practice items.

At this point the children were instructed to use the keyword method to learn the Latin - English pairs that would subsequently be presented. That is, the children were (1) reinstructed that the first thing to do for each Latin noun was to find part of the noun that sounded like an English object, and (2) reminded to generate an interactive image for each pair depicting the keyword doing something with the English translation. This completed the instruction in the use of the keyword method to learn Latin - English pairs. Children in the Reinstruction condition were then asked to learn the list of 21 Latin noun - English translation pairs.

Experimental Tasks One and Two

Anticipation procedures identical to those used in Experiment 1 were employed during learning on the city - product and Latin - English tasks. Two anticipation cycles were used for the city - product task and 10 anticipation cycles for the Latin - English task. Following recall on the Latin - English task, the children were questioned about the methods which they had used to learn the pairs. The procedures used to probe for methods of learning were identical to those used in Experiment 1, except that six items (as opposed to five in the first experiment) were probed for each subject. Each of the 21 items was probed at least five times in each experimental condition.

Results and Discussion

Three aspects of the data will be reported and discussed: Recall on the city - product task, recall on the Latin - English task, and reports of study methods on the Latin - English task.

City - Product Recall

The number of items recalled on each of the two trials on the city - product task was calculated for each subject (see Appendix C). The means and standard deviations of recall performance in each experimental condition, on both trials, are shown in Table 12. Recall performance in all three conditions was compared for Trial 1 and separately for Trial 2 using sets of Dunn's comparisons. For each trial a set of three Dunn's comparisons was used to compare performance ($\alpha = 0.03$ for each set; $\alpha = 0.01$ per comparison).

The results of these analyses are displayed in Table 13 (Trial 1) and Table 14 (Trial 2). There were no significant

Table 12

Recall of City-Product Pairs as a Function of Experimental Condition and Trial in Experiment 2

Experimental Condition	Trial 1	Trial 2
Strategy	$\bar{x}$ = 8.85 S.D. = 2.73	$\bar{x}$ = 11.75 S.D. = 2.51
Metamemory	$\bar{x}$ = 8.50 S.D. = 3.39	$\bar{x}$ = 11.35 S.D. = 2.51
Reinstruction	$\bar{x}$ = 8.15 S.D. = 2.68	$\bar{x}$ = 11.55 S.D. = 2.92

N = 20 for each condition.

Maximum score = 15.

Table 13

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the City-Product Task in Experiment 2

	Reinstruction	Metamemory	Strategy
Reinstruction = 8.15	--	0.35	0.70
Metamemory = 8.50		--	0.35
Strategy = 8.85			--

*Critical difference between means = 2.484 at $p < .01$.

Table 14

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the City-Product Task in Experiment 2

	Metamemory	Reinstruction	Strategy
Metamemory = 11.35	--	0.20	0.40
Reinstruction = 11.55		--	0.20
Strategy = 11.75			--

*Critical difference between means = 2.234 at $p < .01$.

differences in recall performance between the three conditions on either trial. This result had been expected, as the children in these conditions received identical training in the use of the keyword method to learn city - product pairs. The performance of the children in the Metamemory condition indicates that metamemory training did not influence performance on the city - product task. This result replicates the findings in Experiment 1. Thus, children in all three conditions demonstrated comparable learning performance on the city - product task.

Latin - English Recall

The number of items recalled on each of the 10 trials of the Latin - English task was calculated for each subject (see Appendix C). The mean recall performance in each of the three experimental conditions on each trial is shown in Figure 2. Mean recall performance in each condition on Trial 1, Trial 2, and across 10 trials was compared (consistent with the analyses of recall performance on the Latin - English task in Experiment 1). Sets of three Dunn's comparisons were used to compare performance on each of these three measures ($\alpha = 0.03$ for each set, $\alpha = 0.01$ per comparison).

The means and standard deviations of recall performance on Trial 1, Trial 2, and across 10 trials are shown in Table 15. The pattern of recall performance on each of these three measures is the same, i.e., Reinstruction = Metamemory > Strategy. When recall performance in each condition was

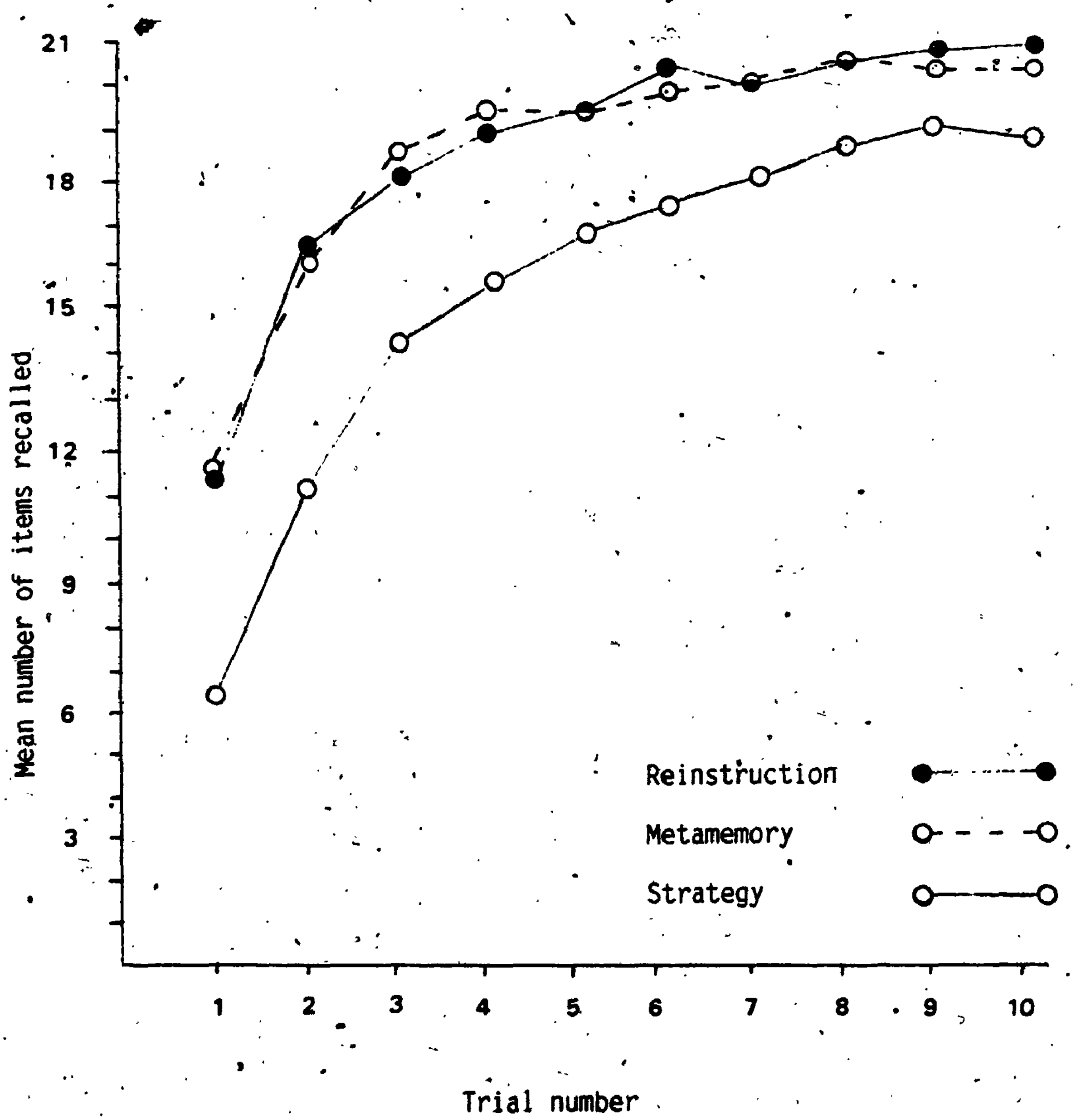

Figure 2. Mean Recall Performance in Each Experimental Condition on Each Trial on the Latin-English Task in Experiment 2.

Table 15

Recall of Latin-English Pairs as a Function of Experimental Condition and Trial in Experiment 2

Experimental Condition	Trial 1	Trial 2	Across 10 Trials
Strategy	$\bar{x}$ = 6.65 S.D. = 5.12	$\bar{x}$ = 11.10 S.D. = 5.56	$\bar{x}$ = 15.64 S.D. = 4.17
Metamemory	$\bar{x}$ = 11.50 S.D. = 5.58	$\bar{x}$ = 16.20 S.D. = 5.67	$\bar{x}$ = 18.60 S.D. = 3.27
Reinstruction	$\bar{x}$ = 11.45 S.D. = 4.85	$\bar{x}$ = 16.60 S.D. = 4.01	$\bar{x}$ = 18.56 S.D. = 2.38

N = 20 in each condition.

Maximum score = 21.

compared for Trial 1 (see Table 16), Trial 2 (see Table 17), and across 10 trials (see Table 18) consistent results were obtained. Children who received Reinstruction or Metamemory Training demonstrated comparable recall performances on Trial 1, Trial 2, and across 10 trials. Further, children in these two conditions significantly outperformed children in the Strategy condition on each of these three measures. It is evident that the majority of children in the Metamemory and Reinstruction conditions did not require 10 anticipation cycles to achieve successful recall of all the items on the Latin - English task (see Appendix C). Consequently, in these two conditions mean recall performance across 10 trials is approaching a ceiling level and a comparison of these means does not provide an entirely satisfactory test of performance differences between these conditions. However, it should be pointed out that the results of the analysis comparing mean recall across 10 trials is at least consistent with the results of the analyses comparing performance on Trials 1 and 2.

Taken together these data indicate that children who received metamemory instruction generalised the keyword technique and demonstrated learning gains comparable to those demonstrated by children directly instructed to use the keyword method with Latin - English pairs. Following Pressley and Dennis-Rounds (1980) argument that the limit of transfer is represented by the performance of subjects directly instructed in the use of a strategy on the

Table 16

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the Latin-English Task in Experiment 2

	Strategy	Reinstruction	Metamemory
Strategy = 6.65	--	4.80*	4.85*
Reinstruction = 11.45		--	0.05
Metamemory = 11.50			--

*Critical difference between means = 4.367 at $p < .01$.

Table 17

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the Latin-English Task in Experiment 2

	Strategy	Metamemory	Reinstruction
Strategy = 11.10	--	5.10*	5.50*
Metamemory = 16.20		--	0.40
Reinstruction = 16.60			--

*Critical difference between means = 4.322 at $p < .01$.

Table 18

Dunn's Comparisons of Recall Performance in Each Experimental Condition Across 10 Trials on the Latin-English Task in Experiment 2

	Strategy	Reinstruction	Metamemory
Strategy = 15.64	--	2.92*	2.96*
Reinstruction = 18.56		--	0.04
Metamemory = 18.60			--

*Critical difference between means = 2.823 at $p < .01$.

generalisation task, it appears that metamemory instruction promoted maximal generalisation. Finally, metamemory instruction combined with simple strategy training promoted more successful generalisation than traditional strategy training. This result replicates the findings in the first experiment.

An analysis of covariance was then conducted to determine whether recall differences among these conditions on the Latin - English task would remain, after variations in recall performance on the city - product task were adjusted for (see Appendix D). The data from the analysis of covariance were entirely consistent with the results of the analysis comparing unadjusted mean recall performance and consequently will simply be summarised here. When the effects of variation in recall performance on the city - product task were controlled for, children in the Metamemory and Reinstruction conditions demonstrated comparable recall performance and significantly outperformed children in the Strategy condition.

In conclusion, when performance on the city - product and Latin - English tasks is compared, a simple pattern emerges. All the children had received identical instruction in the use of the keyword method with city - product pairs and subsequently demonstrated comparable learning performance on the city - product task. However, on the Latin - English task, only the children who had received metamemory training performed at the level of those instructed in the use of the strategy with Latin - English pairs. Thus, not only did metamemory instruction promote ~~more~~ successful generalisation than traditional strategy instruction, but it was sufficient to promote maximal generalisation of the keyword technique.

<u>Reports of Study Methods</u>

On completion of recall on the Latin - English task the children were questioned about the study methods they had used to learn the pairs. Six items were probed for each subject, yielding a total of 120 probes for experimental condition (360 for the experiment).

<u>Scoring</u>

The children's responses were scored according to the scoring system used in the first experiment (see Experiment 1). Briefly, a score of 3 points was assigned for each response that reflected accurate use of the keyword method, in a manner consistent with the original training. A score of 2 points was assigned for each response that reflected accurate use of the keyword strategy, but in a manner inconsistent with original training. A score of 1 point was assigned to responses that reflected incomplete use of the keyword strategy. Responses that failed to indicate any attempt to use the keyword strategy were assigned scores of 0.

The responses were scored by the two independent raters who had scored the protocols in Experiment 1. On completion of scoring, a measure of interrater reliability was calculated. The measure of interrater reliability was percentage of exact agreement between the raters' scores (consistent with the interrater reliability measure adopted in Experiment 1). The raters agreed on 94.7% of their scores. The discrepant scores were then discussed by the raters who subsequently achieved 100% agreement.

Analyses

The percentage of responses that were assigned scores of 3, 2, 1, and 0, respectively was calculated for each subject (see Appendix C). The mean percentage and standard deviation of responses in each scoring category in each experimental condition are shown in Table 19. Children in each of the three experimental conditions reported using a variety of methods to study the items, ranging from accurate use of the keyword strategy to no attempt to apply the strategy in any form. However, it is obvious that in each experimental condition, the majority of responses were assigned scores of 3 points.

As in the first experiment, the purpose of the analysis of the probe scores here was (1) to determine whether children who achieved the most successful recall performance also reported the most frequent use of the keyword technique - in a manner consistent with training, and (2) to determine which types of reported study methods may have been implicated in failures in successful generalisation. To this end, the percentage of responses assigned scores of 3, 2, and 1, respectively, were compared separately in each of

Table 19

Percentage of Probe Responses Assigned to Each Scoring Category in Each Experimental Condition in Experiment 2

Experimental Condition	Scoring Category: 3 points	2 points	1 point	0 points
Strategy	$\bar{x}$ = 43.32 S.D. = 28.30	$\bar{x}$ = 11.66 S.D. = 16.30	$\bar{x}$ = 9.99 S.D. = 14.70	$\bar{x}$ = 34.99 S.D. = 26.43
Metamemory	$\bar{x}$ = 67.48 S.D. = 29.84	$\bar{x}$ = 10.82 S.D. = 12.41	$\bar{x}$ = 5.83 S.D. = 9.78	$\bar{x}$ = 15.82 S.D. = 28.33
Reinstruction	$\bar{x}$ = 74.97 S.D. = 22.62	$\bar{x}$ = 6.66 S.D. = 11.33	$\bar{x}$ = 9.99 S.D. = 16.57	$\bar{x}$ = 8.33 S.D. = 11.46

Note: 3 points = Accurate use of the keyword strategy.
2 points = Use of the strategy in a manner inconsistent with training.
1 point = Incomplete use of the strategy.
0 points = No apparent attempt to use the strategy.

the three conditions. Three sets of 3 Dunn's comparisons were used in the analyses (α = 0.03 for each set; α = 0.01 per comparison).

The results of the analysis on the frequency of 3 point responses are shown in Table 20. The frequency of reported use of accurate keyword strategies is comparable for the Metamemory and Reinstruction conditions. The children in these two conditions reported significantly more frequent use of the technique than children in the Strategy Training condition. These data are entirely consistent with the data on recall performance on the Latin - English task. Children in the Metamemory and Reinstruction conditions demonstrated comparable recall performance and reported using the keyword technique for a comparable percentage of items on the generalisation task. Thus, children in the Metamemory condition who were not instructed in the use of the keyword method with Latin - English pairs, reported that they had used the technique as often as those children who were directly instructed in the use of the strategy on this task.

Finally, children in the Strategy condition recalled significantly fewer items and reported significantly less frequent use of the strategy than children in the other two conditions. The reports of the children in the Strategy condition indicate that they did try to generalise the keyword method, although they may not have used it frequently enough to achieve maximal generalisation. This result replicates the findings in Experiment 1, in that

Table 20

Dunn's Comparisons of the Frequency of Accurate Keyword Strategy Use in Each Experimental Condition in Experiment 2

	Strategy	Metamemory	Reinstruction
Strategy = 43.32	--	24.16*	31.75*
Metamemory = 67.48		--	7.49
Reinstruction = 74.97			--

*Critical difference between means = 22.79 at $p < .01$.

failure in successful generalisation reflects, at least in part, accurate but inconsistent use of the keyword technique.

The frequency of 2 and 1 point scores were compared, separately in each condition, to determine the role that strategies which represented variations on the trained strategy might have played in unsuccessful generalisation. There were no significant differences between conditions in the frequency of responses assigned scores of 2 points (critical difference between means = 11.37 at $p < .01$) or 1 point (critical difference between means = 11.76 at $p < .01$). Thus, the frequency with which children reported using the keyword strategy, either in a manner inconsistent with training or in an incomplete manner was comparable in all conditions. Indeed, the overall frequency of 2 and 1 point responses was quite low, 9.7% and 8.6%, respectively.

When the data on the frequency of the various types of probe response in the Strategy condition are considered together, the study methods which may be implicated in unsuccessful generalisation are quite clear. The children's reports indicate that unsuccessful generalisation cannot really be attributed to the frequent use of keyword strategies which deviate from the trained strategy. Rather, their reports indicate that they were able to adapt the trained strategy to the new task, although they did not use it as consistently as children who achieved maximal generalisation. This result replicates the findings in Experiment 1.

In summary, children in the Metamemory and Reinstruction conditions recalled significantly more items and reported significantly more frequent use of the strategy than children in the Strategy condition. Thus, according to the reports of study methods, children who received metamemory training generalised the keyword strategy accurately and used it as often as children who were directly instructed in keyword method use with Latin - English pairs. As in Experiment 1, metamemory instruction appeared to be far more potent than traditional strategy training in promoting generalisation and the primary affect of metamemory instruction appeared to be the promotion of the consistent application of the trained strategy on the new task.

Finally, a correlational analysis was conducted to determine the degree of the relationship between recall performance and reports of study methods. For each subject the scores assigned for reports of study methods were summed across the six probed items. This procedure yielded a composite probe score for each child and a possible range of scores from 0 to 18 across subjects. The number of times that each child correctly recalled each probed item was then calculated. These recall scores were then summed across probed items, to obtain a composite recall score for each subject and a possible range of scores from 0 to 60 across subjects. The correlation was then performed between composite probe scores and composite recall scores for probed items. Pearson's product-moment correlation was used for the analysis. A correlation was determined for each experimental condition and the resulting coefficients were: Strategy $r(18) = 0.62$, $p < .01$; Metamemory $r(18) = 0.89$, $p < .01$; Reinstruction $r(18) = 0.47$, $p < .05$. Thus, there is a significant positive relationship between the two measures in each experimental condition, lending further support to the conclusion that increasingly successful recall performance is associated with increasingly more frequent reports of accurate strategy use.

Summary

All the children in this experiment received identical instruction in the use of the keyword strategy to learn city - product pairs and subsequently demonstrated comparable recall performance on the city - product task. However, on the Latin - English task, only those children who received strategy training supplemented by metamemory instruction achieved maximal generalisation of the keyword technique. Children in the Matemamory condition recalled a comparable number of items and reported using the keyword technique on this task as often as children who were directly instructed in the use of the method with Latin - English pairs. Children who received traditional strategy training did not achieve maximal generalisation. However, these children reported that they too had used the keyword technique to learn some of the Latin - English pairs and seldom reported the use of less effective variations on the trained strategy. Thus, unsuccessful generalisation would seem to reflect the accurate but infrequent use of the trained strategy on the new task, with consistent application evidenced following metamemory instruction.

EXPERIMENT 3

The results of the first two experiments indicate that strategy training combined with metamemory instruction is sufficient to promote maximal generalisation of the keyword strategy. The addition of metamemory instruction to a strategy training programme seems to provide young children with the metacognitive set necessary to guide successful generalisation. Thus, young children's failure to generalise the keyword strategy following traditional strategy training, may reflect deficiencies in metamemory for the keyword technique in particular and perhaps for elaborative strategies in general.

It is not surprising that fifth and sixth graders may have little knowledge about elaboration strategies. Children in this age range seldom engage in spontaneous elaboration activities (e.g., Pressley, 1982; Pressley & Levin, 1977; Rohwer & Bean, 1973). Consequently, they probably do not have a great deal of knowledge about such strategies - knowledge that might guide generalisation. The keyword strategy in particular is quite a complex elaboration based technique which would presumably require considerable metamemory to direct generalisation. Consequently, it is not at all surprising to discover the potency of metamemory instruction on young children's generalisation.

Spontaneous elaboration increases dramatically during adolescence (for a review, see Pressley, 1982). While there are individual differences in spontaneous elaboration usage in adolescence (Pressley & Levin, 1977; Rohwer, Raines, Eoff, & Wagner, 1973), increasing use of elaboration strategies is nonetheless always associated with increasing age from childhood to adolescence (Pressley & Levin, 1977; Rohwer et al., 1973). Also, elaborative usage has consistently been associated with higher learning performance. This increase in spontaneous elaborative activity during adolescence may reflect an increase in metamemory during this period. If metamemory directs strategy usage (e.g., Campione & Brown, 1977), then those who know about elaboration strategies (i.e., how, when, and why to use them) should be more likely to use them. Indeed, Beuhring (Note 3) has recently demonstrated a relationship between the increasing propensity to elaborate and associative metamemory development in adolescence.

If older adolescents possess more metamemory about elaboration than younger children, then these older subjects might utilise this knowledge to guide generalisation of a newly acquired elaboration strategy. Pressley and Dennis-Rounds (1980) provide some preliminary evidence on this point. The 18 year-old high school subjects in their study generalised the keyword technique following traditional strategy training. However, generalisation was not maximal, that is, those subjects recalled fewer items than subjects completely reinstructed in the use of the technique to learn the generalisation list. Thus, those subjects may have had sufficient metamemory to generalise the technique, yet insufficient metamemory to generalise with maximum effectiveness. This interpretation is consistent with Beuhring's (Note 3) finding that metamemory pertinent to associative tasks, while fairly well developed in 17-year-olds, is nonetheless incomplete.

Given that 17-year-olds are able to generalise the keyword technique, albeit with less than maximal effectiveness, perhaps metamemory has developed sufficiently by the end of the adolescent period (i.e., 19 - 20 years) to direct maximal generalisation. If this in fact is the case, then traditional strategy instruction should be sufficient to promote maximal generalisation. Consequently, the inclusion of metamemory instruction in the training programme should have no significant effect on the degree of generalisation achieved. Similarly, it should not be necessary to provide subjects with the opportunity to acquire metamemory themselves through experience with a strategy. Presumably, they should already have such knowledge in their possession.

The purpose in the third experiment reported here was to assess the effects of metamemory instruction and experience training on late adolescents' generalisation of the keyword strategy. To accomplish this goal, all of the five conditions of Experiment 1 and the Reinstruction condition of Experiment 2 were included in this experiment. In this way, (1) the comparisons made in Experiment 1 for young children could be made for adolescents and (2) the issue of maximal generalisation could be addressed with both issues covered in a single experiment.

Late adolescent university students participated in this experiment. All the subjects were asked to learn two lists of paired items: 25 city - product and 31 Latin noun - English translation. All the participants except those in the Control condition first received instruction in the use of the keyword method to learn city - product pairs. Following this instruction, subjects in the Control, Strategy, and Reinstruction conditions were asked to learn the list of 25 city - product pairs. Subjects in the remaining three conditions received metamemory and/or experience training before learning the city - product list. Following recall on this task, all the participants were asked to learn the list of 31 Latin - English pairs. At this point, subjects in the Reinstruction condition were given detailed instruction in the use of the keyword method with Latin - English pairs. Subjects in the remaining five conditions did not receive such instruction. Following recall on this task, the subjects were questioned about the study methods they had used to learn the Latin - English pairs.

As all the subjects except those in the Control condition received identical instruction in keyword method use with city - product pairs, it was again expected that recall performance in the Control condition would be significantly poorer than performance in all the other groups on the city - product task. It was predicted that subjects in each condition that included strategy training with city - product pairs, would have sufficient metamemory to direct maximal generalisation of the technique. Therefore, on the Latin - English task, no differences in recall performance or reports of frequency of keyword strategy use were expected between conditions that included traditional strategy training with or without supplementary instruction. Control subjects were expected to recall significantly fewer items and report significantly less frequent use of the keyword strategy than subjects in all the other conditions.

Method

Subjects

The participants were 120 students enrolled in introductory psychology at The University of Western Ontario. The average age of the subjects was 19 years, 6 months with a range of 18 years, 3 months to 21 years, 0 months. The participants were assigned to one of six experimental conditions with 20 subjects in each condition.

Materials

All the subjects were asked to learn two lists of paired items: 25 city - product, 31 Latin noun - English translation. The city - product list included the 15 pairs used in the first two experiments and 10 additional pairs (see Appendix A). Similarly, the Latin - English list was composed of the 21 Latin - English pairs used in Experiments 1 and 2 with 10 new pairs added (see Appendix A). The additional pairs in each list were chosen according to the criteria for keyword selection outlined in the first experiment. The two lists of paired items were lengthened in this experiment; in an attempt to equate list difficulty across age groups (i.e., elementary school age children in Experiments 1 and 2 and late adolescents in Experiment 3).

The materials used for (1) keyword strategy instruction with city - product pairs, (2) metamemory instruction, (3) experience training, and (4) keyword strategy instruction with Latin - English pairs, were identical to those used in the corresponding conditions of Experiments 1 and 2.

Procedure

All the participants were seen individually by the experimenter in a quiet room in the university. Subjects were randomly assigned to one of six conditions: Control, Strategy, Experience, Metamemory, Metamemory Plus Experience, and Reinstruction. The procedures used to instruct subjects in each condition were identical to those used in the corresponding conditions of Experiments 1 and 2 (see Table 21). Briefly, all participants, except those in the Control condition, first received instruction in the use of the keyword strategy to learn city - product pairs. In

Table 21

Sequence of Procedures in Each Experimental Condition

at Each Phase of the Experiment in Experiment 3

Experimental Phase	Experimental Condition: Control	Strategy	Metamemory	Experience	Metamemory Plus Experience	Reinstruction
Phase 1	Exposure to sample city-products lists. Instructed to try hard to remember the pairs.	Exposure to sample city-product lists. Instructed in the use of the keyword method to learn city-product pairs.				
Phase 2			Metamemory training comprising 1) General information about the strategy. 2) Demonstration of its effectiveness and ineffectiveness on training tasks 1, 2, and 3.	Experience training comprising practice with the strategy on training tasks 1, 2, and 3.	Metamemory Plus experience training. Procedures identical to metamemory only and experience only conditions.	
Phase 3	Experimental Task one (15 city-product pairs). Instructed to try hard to remember the pairs.	Experimental task one (25 city-product pairs). Instructed to use the keyword method during learning.				
Phase 4	Experimental task two--Generalization (31 Latin-English pairs). Exposure to sample pairs. Instructed to try hard to remember the meaning of each noun.					Exposure to sample pairs. Instructed in the use of the keyword method to learn Latin-English pairs.
Phase 5	Probe for method of learning on generalization task. Nine pairs probed for each subject.					

the Control condition at this point, subjects were simply asked to learn sample city - product pairs.

Following this instruction, subjects in the Control, Strategy and Reinstruction conditions were asked to learn the list of 25 city - product pairs. Participants in the remaining three conditions received metamemory and/or experience training before learning the city - product list. In the condition that included metamemory plus experience training, half of the subjects received metamemory instruction prior to experience. This procedure was reversed for the remaining participants in this condition.

Following recall on the city - product task, all the subjects were asked to learn the Latin - English list. For this task, participants in the Reinstruction condition received detailed instruction in the use of the keyword strategy to learn Latin - English pairs. Subjects in the remaining five conditions did not receive this instruction and were simply asked to try to remember the meaning of each Latin word.

As in Experiments 1 and 2, two anticipation cycles were used during learning on the city - product task and 10 anticipation cycles on the Latin - English task. Two different list orderings were used for presentation on each task. A constraint was imposed on list orderings such that, on the city - product task at least 9 items and on the Latin - English task at least 12 items had to intervene between consecutive anticipation cycles for each pair. Following recall on the Latin - English task, subjects were questioned about the study methods that they had used to learn the pairs. For each subject 9 items were selected to be probed with the constraint that each of the 31 pairs was probed at least five times in each experimental condition.

Results and Discussion

Three aspects of the data will be reported and discussed: recall on the city - product task, recall on the Latin - English task, and reports of study methods on the Latin - English task.

City - Product Recall

The number of items recalled by each subject on each of the two trials on the city - product task was calculated (see Appendix C). The means and standard deviations of recall performance in each of the six experimental conditions[3], on both trials are displayed in Table 22. Recall performance in all conditions was compared for Trial 1 and separately for Trial 2 using sets of Dunn's comparisons[4]. For each trial, a set of 15 Dunn's comparisons was used to compare performance ($\alpha = 0.15$ for each set; $\alpha = 0.01$ per comparison).

The results of these analyses are shown in Table 23 (Trial 1) and Table 24 (Trial 2). On each trial the pattern of results was the same. Subjects in the Control condition recalled significantly fewer items on each of the two trials than subjects in the remaining five conditions. There were

Table 22

Recall of City-Product Pairs

as a Function of Experimental Condition and Trial

in Experiment 3

Experimental Condition	Trial 1	Trial 2
Control	$\bar{x}$ = 8.50 S.D. = 5.26	$\bar{x}$ = 12.25 S.D. = 6.18
Strategy	$\bar{x}$ = 13.85 S.D. = 5.37	$\bar{x}$ = 19.80 S.D. = 4.93
Experience	$\bar{x}$ = 13.80 S.D. = 4.95	$\bar{x}$ = 19.60 S.D. = 3.74
Reinstruction	$\bar{x}$ = 13.80 S.D. = 5.06	$\bar{x}$ = 19.25 S.D. = 3.05
Metamemory Plus Experience	$\bar{x}$ = 14.00 S.D. = 4.30	$\bar{x}$ = 20.15 S.D. = 3.42
Metamemory	$\bar{x}$ = 14.25 S.D. = 5.05	$\bar{x}$ = 19.95 S.D. = 3.05

N = 20 in each condition.

Maximum score = 25.

Table 23

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the City-Product Task in Experiment 3

	Control	Experience	Reinstruction	Strategy	Metamemory Plus Experience	Metamemory
Control = 8.50	--	5.30*	5.30*	5.35*	5.50*	5.75*
Experience = 13.80		--	0.00	0.05	0.20	0.45
Reinstruction = 13.80			--	0.05	0.20	0.45
Strategy = 13.85				--	0.15	0.40
Metamemory Plus Experience = 14.00					--	0.25
Metamemory = 14.25						--

*Critical difference between means = 4.154 at $p < .01$.

Table 24

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the City-Product Task in Experiment 3

	Control	Reinstruction	Experience	Strategy	Metamemory	Metamemory Plus Experience
Control = 12.25	--	7.00*	7.35*	7.55*	7.70*	7.90*
Reinstruction = 19.25		--	0.35	0.55	0.70	0.90
Experience = 19.60			--	0.20	0.35	0.55
Strategy = 19.80				--	0.15	0.35
Metamemory = 19.95					--	0.20
Metamemory Plus Experience = 20.15						--

*Critical difference between means = 3.53 at $p < .01$.

no significant differences in recall performance between the Strategy, Experience, Metamemory, Metamemory Plus Experience, and Reinstruction conditions on either trial.

Thus, subjects who received identical instruction in the use of the keyword technique with city - product pairs (i.e., all except those in the Control condition) demonstrated significant learning gains, relative to subjects who did not receive this instruction. Clearly, the late adolescent subjects in this experiment benefitted from instruction in keyword use, just as younger children in the first two experiments had benefitted. It appears that supplementary training, that is, metamemory and/or experience training did not influence performance on the city - product task. Therefore, all of the participants instructed in the mechanics of keyword strategy use demonstrated comparable learning performance with city - product pairs.

Latin - English Recall

The number of items recalled on each of the 10 trials on the Latin - English task was calculated for each subject (see Appendix C). The mean recall performance in each of the six experimental conditions[5] on each trial is shown in Figure 3. Mean recall performance in each condition was compared separately for Trial 1, Trial 2, and across 10 trials (consistent with the analyses of recall performance on the Latin - English task in Experiments 1 and 2)[6]. Sets of 15 Dunn's comparisons were used to compare performance on

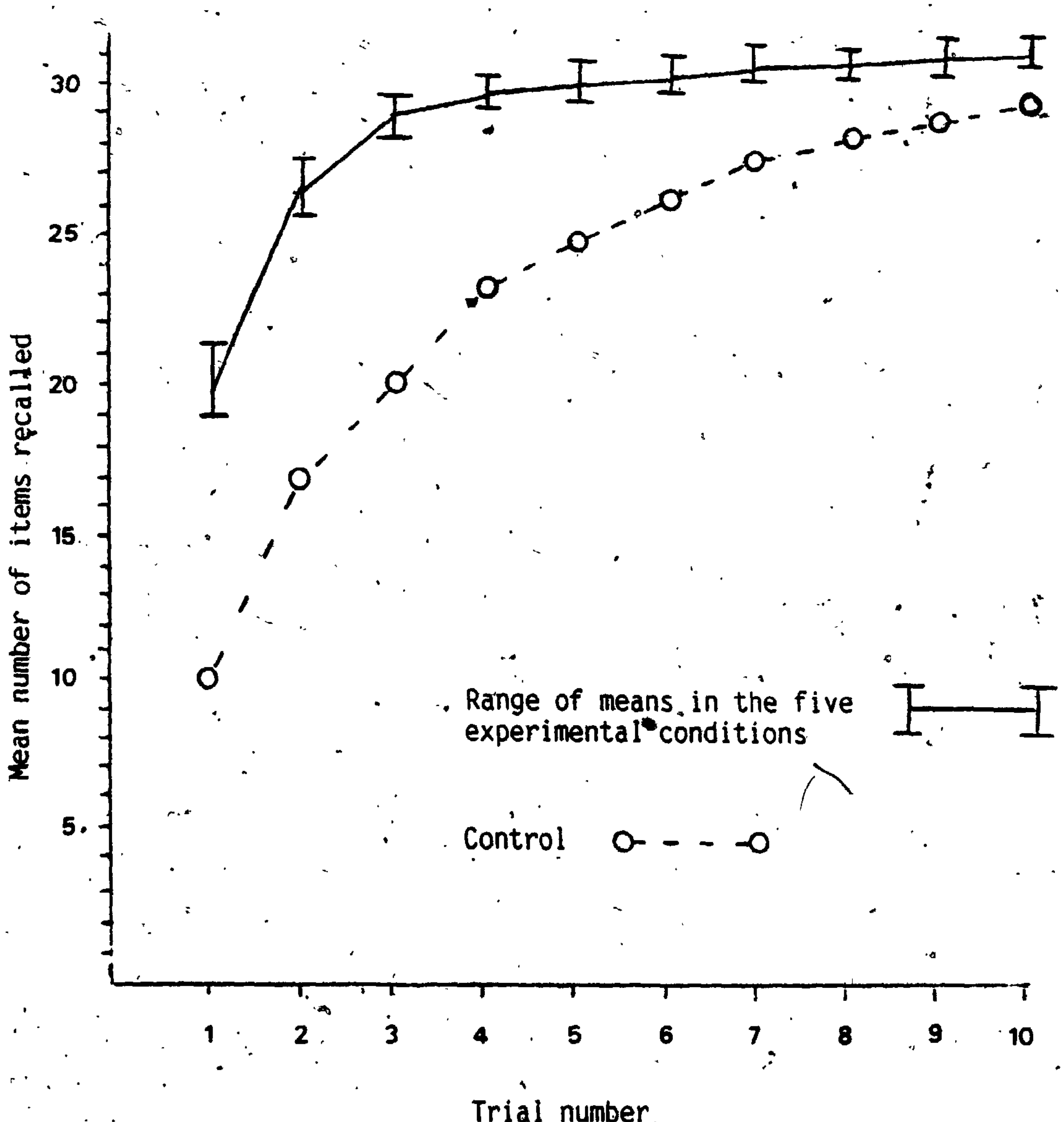

Figure 3. Mean Recall Performance in Each Experimental Condition on Each Trial on the Latin-English Task in Experiment 3.

each of these three measures ($\alpha = 0.15$ for each set; $\alpha = 0.01$ per comparison).

The means and standard deviations of recall performance on Trial 1, Trial 2 and across 10 trials are shown in Table 25. The pattern of recall performance on each of these three measures is statistically comparable, that is, Strategy = Experience = Metamemory = Metamemory Plus Experience = Reinstruction > Control. When recall performance in each condition was compared for Trial 1 (see Table 26), Trial 2 (see Table 27), and across 10 trials (see Table 28), results consistent with this general pattern were obtained. Subjects in the Control condition recalled significantly fewer items on Trial 1, Trial 2, and across 10 trials than subjects in the remaining five conditions. There were no significant differences in recall performance between the Strategy, Experience, Metamemory, Metamemory Plus Experience, and Reinstruction conditions on Trial 1 or on Trial 2. The majority of subjects in these five conditions achieved successful recall of all the Latin - English pairs by the fifth trial. Mean recall performance across 10 trials in each of these conditions is, consequently, approaching a ceiling level and between-condition comparison that are based on this measure are not completely sensitive. However, it should be noted that the results of this analysis are, at least, consistent with the results of the analyses comparing recall performance on Trials 1 and 2.

Table 25

Recall of Latin-English Pairs as a Function of Experimental Condition and Trial in Experiment 3

Experimental Condition	Trial 1	Trial 2	Across 10 Trials
Control	$\bar{x}$ = 10.05 S.D. = 5.87	$\bar{x}$ = 17.10 S.D. = 8.06	$\bar{x}$ = 23.42 S.D. = 5.34
Strategy	$\bar{x}$ = 19.65 S.D. = 8.29	$\bar{x}$ = 26.05 S.D. = 6.95	$\bar{x}$ = 28.58 S.D. = 3.24
Experience	$\bar{x}$ = 19.30 S.D. = 5.79	$\bar{x}$ = 27.70 S.D. = 4.21	$\bar{x}$ = 29.06 S.D. = 1.46
Reinstruction	$\bar{x}$ = 19.90 S.D. = 5.44	$\bar{x}$ = 26.55 S.D. = 4.24	$\bar{x}$ = 28.90 S.D. = 2.18
Metamemory	$\bar{x}$ = 21.30 S.D. = 6.36	$\bar{x}$ = 27.50 S.D. = 4.21	$\bar{x}$ = 28.99 S.D. = 2.48
Metamemory Plus Experience	$\bar{x}$ = 19.15 S.D. = 5.86	$\bar{x}$ = 27.30 S.D. = 3.79	$\bar{x}$ = 29.15 S.D. = 1.36

N = 20 in each condition.

Maximum score = 31.

Table 26

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the Latin-English Task in Experiment 3

	Control	Metamemory Plus Experience	Experience	Strategy	Reinstruction	Metamemory
Control = 10.05	--	9.10*	9.25*	9.60*	9.85*	11.25*
Metamemory Plus Experience = 19.15		--	0.15	0.50	0.75	2.15
Experience = 19.30			--	0.35	0.60	2.00
Strategy = 19.65				--	0.25	1.65
Reinstruction = 19.90					--	1.40
Metamemory = 21.30						--

*Critical difference between means = 5.255 at $p < .01$.

Table 27

Dunn's Comparisons of Recall Performance

in Each Experimental Condition on Trial 2

of the Latin-English Task in Experiment 3

	Control	Strategy	Reinstruction	Metamemory Plus Experience	Metamemory	Experience
Control = 17.10	--	8.95*	9.45*	10.20*	10.40*	10.60*
Strategy = 26.05		--	0.50	1.25	1.45	1.65
Reinstruction = 26.55			--	0.75	0.95	1.15
Metamemory Plus Experience = 27.30				--	0.20	0.40
Metamemory = 27.50					--	0.20
Experience = 27.70						--

*Critical difference between means = 4.555 at $p < .01$.

Table 28

Dunn's Comparisons of Recall Performance in Each Experimental Condition Across 10 Trials on the Latin-English Task in Experiment 3

	Control	Strategy	Reinstruction	Metamemory	Experience	Metamemory Plus Experience
Control = 23.42	--	5.16*	5.48*	5.57*	5.64*	5.73*
Strategy = 28.58		--	0.32	0.41	0.48	0.57
Reinstruction = 28.90			--	0.09	0.16	0.25
Metamemory = 28.99				--	0.07	0.16
Experience = 29.06					--	0.09
Metamemory Plus Experience = 29.15						--

*Critical difference between means = 2.482 at $p < .01$.

Thus, it appears that simple strategy training was sufficient to promote maximal generalisation, as subjects in the Strategy condition performed at the level of those directly instructed in the use of the strategy with Latin - English pairs. While subjects who received metamemory and/or experience training also achieved maximal generalisation, it is obvious that simple strategy training was as effective as supplementary instruction in promoting generalisation.

While these data indicate that recall performance in all conditions that included strategy training was comparable, an analysis of covariance was conducted to determine whether differences in recall among these conditions might result, when variations in recall performance on the city - product task were adjusted for (see Appendix D). The pattern of significance in the analysis of covariance is entirely consistent with the results of the analysis comparing unadjusted mean recall performance and can be summarised as follows. When the effects of variation in recall performance on the city - product task were adjusted for, subjects in the Strategy, Experience, Metamemory, Metamemory Plus Experience, and Reinstruction conditions demonstrated comparable recall performance on the Latin - English task.

In conclusion, the pattern of recall performance on the city - product and Latin - English tasks was equivalent. On the city - product task, subjects who received instruction in the use of the keyword method with city - product pairs, demonstrated significant learning gains relative to subjects who did not receive this instruction. Similarly, on the Latin - English task, subjects who had received strategy training, with or without supplementary training, significantly outperformed subjects in the Control condition. Thus, instruction in the use of the keyword strategy with city - product pairs was sufficient to promote maximal generalisation of the trained strategy to the new task. The inclusion of supplementary instruction in the training programme did not appear to increase generalisation.

The results in this experiment are in sharp contrast to the results obtained in Experiments 1 and 2. Both 12- and 19-year-olds benefitted from instruction in keyword method use with city - product pairs. On the generalisation task, however, younger subjects who had received simple strategy training did not generalise the strategy very successfully. On the other hand, metamemory instruction combined with strategy training promoted maximal generalisation. For older subjects, simple strategy training was as effective as metamemory instruction and was sufficient to direct maximal generalisation of the technique.

<u>Reports of Study Methods</u>

Following recall on the Latin - English task, the subjects were questioned about the methods they had used to study the pairs. Nine items were probed for each participant yielding a total of 180 probes per experimental condition (1080 for the experiment).

Scoring

Responses were scored according to the same scoring system used in the first two experiments (see Experiment 1). The responses were scored by the two independent raters who had previously scored the probe responses in the first two experiments. The raters agreed on 93.2% of their scores. The discrepant scores were then discussed and a final interrater reliability of 100% achieved.

Analyses

The percentage of responses that were assigned scores of 3, 2, 1, and 0, respectively, was calculated for each subject (see Appendix C). The mean percentage and standard deviation of responses in each scoring category, in each experimental condition are displayed in Table 29. These data indicate that participants in each experimental condition reported using a variety of study methods to learn the items. In the Control condition more responses were assigned to the 0 scoring category than to any other single category. However, Control subjects did report that they used the keyword strategy accurately for 17.60% of the items. These reports indicate some spontaneous production of the keyword method among subjects who were not instructed in the use of the technique. In the remaining five experimental conditions, the majority of responses were assigned scores of 3 points.

Table 29

Percentage of Probe Responses Assigned to Each Scoring Category in Each Experimental Condition in Experiment 3

Experimental Control		Scoring Category		
	3 points	2 points	1 point	0 points
Control	$\bar{x}$ = 17.60 S.D. = 17.62	$\bar{x}$ = 7.70 S.D. = 10.76	$\bar{x}$ = 25.85 S.D. = 11.98	$\bar{x}$ = 47.30 S.D. = 25.51
Strategy	$\bar{x}$ = 62.90 S.D. = 27.94	$\bar{x}$ = 6.05 S.D. = 7.54	$\bar{x}$ = 15.95 S.D. = 16.53	$\bar{x}$ = 14.30 S.D. = 17.15
Experience	$\bar{x}$ = 79.45 S.D. = 22.41	$\bar{x}$ = 8.25 S.D. = 10.63	$\bar{x}$ = 8.25 S.D. = 12.29	$\bar{x}$ = 3.30 S.D. = 6.28
Reinstruction	$\bar{x}$ = 71.00 S.D. = 16.62	$\bar{x}$ = 8.80 S.D. = 8.44	$\bar{x}$ = 11.03 S.D. = 11.28	$\bar{x}$ = 8.25 S.D. = 10.63
Metamemory	$\bar{x}$ = 76.60 S.D. = 18.21	$\bar{x}$ = 9.90 S.D. = 11.22	$\bar{x}$ = 8.80 S.D. = 9.83	$\bar{x}$ = 3.85 S.D. = 7.37
Metamemory Plus Experience	$\bar{x}$ = 76.00 S.D. = 18.29	$\bar{x}$ = 11.55 S.D. = 9.75	$\bar{x}$ = 8.25 S.D. = 8.65	$\bar{x}$ = 3.30 S.D. = 6.28

Note: 3 points = Accurate use of the keyword strategy.
2 points = Use of the strategy in a manner inconsistent with training.
1 point = Incomplete use of the strategy.
0 points = No apparent attempt to use the strategy.

The purpose of the analysis of the probe scores was to determine whether increasingly successful recall performance was associated with increasingly more frequent reports of accurate keyword strategy use. In addition, while there were no significant differences in recall performance between groups that received keyword strategy instruction with city - product pairs, the probe scores were examined to determine whether the subjects in these conditions reported having used comparable study methods to achieve such comparable levels of recall. Consequently, the percentage of responses assigned scores of 3, 2, and 1, respectively, were compared separately in each of the six experimental conditions. Three sets of 15 Dunn's comparisons were used for the analysis ($\alpha = 0.15$ for each set; $\alpha = 0.01$ per comparison).

The results of the analysis on frequency of 3 point responses are shown in Table 30. Participants in the Control condition reported significantly less frequent use of the keyword strategy than subjects in each of the other conditions. There were no significant differences in the frequency of keyword method use reported in the remaining five conditions. These data are consistent with the data on recall performance on the Latin - English task. All subjects who received instruction in the use of the keyword method to learn city - product pairs demonstrated comparable recall performance and reported using the strategy accurately for comparable numbers of items on the Latin -

Table 30

Dunn's Comparisons of Frequency of Accurate Keyword Strategy Use in Each Experimental Condition in Experiment 3

	Control	Strategy	Reinstruction	Metamemory Plus Experience	Metamemory	Experience
Control = 17.60	--	45.30*	53.40*	58.40*	59.00*	61.85*
Strategy = 62.90		--	8.10	13.10	13.70	16.55
Reinstruction = 71.00			--	5.00	5.60	8.45
Metamemory Plus Experience = 76.00				--	0.60	3.45
Metamemory = 76.60					--	2.85
Experience = 79.45						--

*Critical difference between means = 17.036 at $p < .01$.

English task. The reports of accurate keyword strategy use by participants in the Control condition are interesting. As previously mentioned, such reports reflect spontaneous production of the strategy. The frequency of such responses, (i.e., 17.60%) when compared to the frequency of occurrence of such responses among Control children in Experiment 1 (i.e., 1.0%), reflects perhaps an increasing propensity for elaboration with increasing age, consistent with other reports in the literature (c.f. Pressley, 1982).

The frequency of 2 and 1 point responses were then compared separately in each experimental condition to determine whether the reported incidence of (1) strategies inconsistent with training, and (2) incomplete keyword strategies was comparable across conditions. There were no significant differences between conditions in the frequency of responses assigned scores of 2 points (critical difference between means = 9.641 at $p < .01$). Thus, subjects in all conditions reported the use of the keyword strategy in a manner inconsistent with training for comparable numbers of items. Indeed, the overall reported incidence of such study methods was low, constituting only 8.79% of the total number of responses.

The results of the analysis on the frequency of 1 point responses are shown in Table 31. Subjects in the Control condition reported significantly more frequent use of incomplete keyword strategies than subjects in the Experience, Reinstruction, Metamemory and Metamemory Plus

Table 31

Dunn's Comparisons of Frequency of Incomplete Keyword Strategy Use in Each Experimental Condition in Experiment 3

	Experience	Metamemory Plus Experience	Metamemory	Reinstruction	Strategy	Control
Experience = 8.25	--	0.00	0.57	2.78	7.70	17.60*
Metamemory Plus Experience = 8.25		--	0.57	2.78	7.70	17.60*
Metamemory = 8.82			--	2.21	7.13	17.03*
Reinstruction = 11.03				--	6.92	14.82*
Strategy = 15.95					--	9.90
Control = 25.85						--

*Critical difference between means = 10.113 at $p < .01$.

Experience conditions. Subjects in the Strategy condition reported using the incomplete strategy, with a frequency that was intermediate between (and not significantly different from) the frequency in the Control condition and the frequency in the remaining four conditions.

Incomplete use of the keyword strategy was defined as generation of a keyword but failure to construct an elaboration with that keyword and its target item. However, it should be pointed out that several of these responses, while scored as incomplete use of the strategy, may have represented association strategies linking semantically similar keywords and target items. For example, for the pair <u>soccus</u> - slipper, several subjects responded that sock (keyword) goes with slipper. Other items , for example, <u>saccus</u> - wallet (keyword = sack) and vesti - robe (keyword = vest) were, according to subjects' reports, also studied in this manner. In the case of Control subjects, 1 point responses are more likely to be indicative of the use of association strategies rather than incomplete use of a strategy which they have never been instructed to use in the first place. If this is the case, then the frequency of 1 point responses for the Control group in this study (i.e., 26.1%), when compared to the corresponding frequency in the Control condition in Experiment 1 (i.e., 10.0%), suggests an increasing propensity for strategic behaviour with increasing age.

When considered together, the data on the frequency of the various types of probe response indicate that subjects, in all except the Control condition, reported using the keyword strategy accurately and more frequently than other study methods, for comparable numbers of items. As all these groups demonstrated comparable levels of recall on this task, it would appear that they used similar study methods to achieve that goal. However, the pattern of probe responses in the strategy condition hints that these subjects may have been a little more likely to use an incomplete keyword strategy and a little less likely to use an accurate keyword strategy than subjects in the remaining conditions that included strategy training. Control subjects on the other hand recalled significantly fewer items and reported significantly less frequent use of the keyword technique than subjects in all other conditions. Nevertheless, Control subjects appear to have approached the task in a generally strategic manner, reporting spontaneous keyword strategy production and association strategies for several items.

Finally, to determine the degree of the relationship between recall performance and reports of study methods, a correlational analysis was conducted. For each subject, the scores assigned for reports of study methods were summed across the nine probed items to obtain a composite probe score. The number of times that each subject correctly recalled each probed item was then calculated. These recall scores were then summed across probed items to yield a composite recall score for each subject. These procedures resulted in a possible range of composite probe scores from 0 to 36 and a possible range of composite recall scores from 0 to 90 across subjects. The correlation was then performed between these two measures. Pearson's product-moment correlation was determined for each experimental condition and the following coefficients were obtained: Control $r(18) = 0.25$, $p > .10$; Strategy $r(18) = 0.72$, $p < .01$; Experience $r(18) = 0.75$, $p < .01$; Metamemory $r(18) = 0.36$, $p > .10$; Metamemory Plus Experience $r(18) = 0.28$, $p > .10$; Reinstruction $r(18) = 0.15$, $p > .10$. While only two of these correlation coefficients achieved statistical significance, they do, nonetheless, indicate a positive relationship between reports of study methods and recall performance in each condition.

Summary

Subjects in all conditions that included instruction in the use of the keyword strategy with city - product pairs demonstrated comparable recall performance on the city - product task and significantly outperformed subjects who did not receive strategy instruction. Similarly, on the Latin - English task, subjects who had received strategy training, with or without supplementary instruction, achieved maximal generalisation of the keyword technique. Further, subjects in all except the Control condition reported using comparable study methods to learn the Latin - English pairs, with reports of accurate keyword strategy use occurring for most of the items. Thus, traditional strategy training was sufficient to promote maximal generalisation of the keyword method among late adolescents. The inclusion of metamemory and/or experience training components in instruction did not significantly affect subjects' performance on the generalisation task.

GENERAL DISCUSSION

The three experiments reported in this paper were designed to determine whether an instructional programme, consisting of strategy training supplemented by metamemorial instruction, would promote successful generalisation of the keyword mnemonic technique. The effectiveness of this programme relative to that of (1) a traditional strategy training routine, and (2) a programme composed of strategy training supplemented by experience with the strategy on a variety of mnemonic tasks was determined. The relative potency of each of these programmes in promoting generalisation of the keyword technique was assessed with both upper elementary school age children and late adolescent subjects. The overall pattern of results from the three experiments reported here provide convincing evidence that (1) for young children, successful generalisation of the keyword method was only achieved following instruction that included a metamemory component, and (2) for late adolescent subjects simple strategy training was sufficient to promote successful generalisation.

The demonstrated potency of metamemory instruction with young children provides some support for the hypothesis that failures in generalisation reflect failures in metamemory for children in this age range (Flavell & Wellman, 1977). In addition, the potency of simple strategy training with late adolescent subjects suggests that subjects in this age range, either may possess prior to training and/or acquire during training sufficient metamemory to direct spontaneous generalisation of a newly acquired strategy. Discussion of these data will be grouped under three headings: (1) results that are pertinent to the relative ineffectiveness of strategy and experience training programmes in promoting generalisation with young children; (2) results that are pertinent to the potency of metamemory instruction in promoting generalisation with young children; and (3) results that are pertinent to the comparable effectiveness of diverse training routines in promoting generalisation with adolescents.

Strategy and Experience Training Programmes

In the first experiment, children who received strategy, experience or metamemory training were given identical instruction in the use of the keyword strategy to learn city - product pairs. In addition, children in the Experience and Metamemory conditions received supplementary instruction in accordance with their experimental assignment. Supplemental instruction did not appear to influence recall performance on a subsequent city - product task, with comparable performance obtained in the Strategy, Experience, and Metamemory conditions on this task. Thus, children in all conditions that included instruction in the mechanics of keyword method use demonstrated comparable facility with the strategy for items similar to those used during training. When the generalisation task was administered, however, children who had received strategy or experience training recalled fewer items and reported using the keyword strategy less frequently than those who received metamemory instruction. Thus, the strategy and experience training programmes were less effective than metamemory instruction in promoting successful generalisation.

The performance of children in the Strategy condition in Experiments 1 and 2 demonstrates what has become by now a well documented phenomenon. That is, focussing training simply on the mechanics of strategy use is insufficient to promote successful transfer of a newly acquired strategy from a training task to a generalisation task (e.g., Kendall, Borkowski, & Cavanaugh, 1980; Pressley & Dennis-Rounds, 1980). It seems that teaching children a strategy is one thing, but teaching children a strategy so that they can use that strategy broadly is quite another. What can account for researchers' repeated failure to promote successful generalisation through thorough strategy instruction? Logically, it makes very good sense to assume that an individual must have knowledge about a strategy in order to use that strategy appropriately in a generalised way. Indeed, if metamemory includes information about how, why, when, and where, to use a strategy, then it does not seem possible that a subject could deploy a strategy outside of the training situation without some of these metamemory components.

If generalisation requires metamemory, then young children who receive strategy instruction would either (1) have to have sufficient metamemory upon entering the experimental situation, and/or (2) acquire sufficient metamemory during training to direct successful generalisation. It is unlikely that children would know very much about trained strategies prior to receiving instruction, as these strategies are not usually part of their repertoire and would not be used spontaneously until later in development. It is also unlikely that children could acquire sufficient metamemory during training as they are not always sensitive to metacognitive experiences and/or their importance (Pressley et al., Note 2). Thus, it would seem that children who receive strategy instruction are unlikely to have sufficient metamemory for generalisation. One method of overcoming this problem is to provide metamnemonic information directly during training. In the present study, the inclusion of metamemory instruction increased transfer performance dramatically and the importance of including metamemory instruction is obvious, given the replicated finding of inferior generalisation in the Strategy condition relative to the Metamemory condition. The demonstrated potency of metamemory instruction suggests that traditional strategy training may be ineffective in promoting generalisation because strategy knowledge may not be acquired, and/or used during such training.

Children who received experience training in addition to strategy instruction, were slightly more successful on the generalisation task than those who received strategy training only. However, in comparison to performance in conditions that included metamemory instruction, experience training was relatively ineffective in promoting successful generalisation. The experience training programme had been designed following Brown's (1978) suggestion that if children were given experience with a strategy on a variety of mnemonic tasks during training, they might acquire sufficient metamemory to direct successful generalisation of that strategy. Obviously, as there was no direct assessment of metamemory included in this study, it is not possible to conclude what metamemory, if any, was acquired by the children in this condition. However, the main point in including this condition in the present study was simply to assess the effectiveness of this type of instruction, relative to that of direct metamemory instruction in promoting generalisation. From this perspective, the conclusion is quite clear, that is metamemory instruction was far more effective than experience training in promoting efficient keyword strategy use and successful recall performance on the generalisation task.

Children who received experience training did, nonetheless, achieve slightly more successful generalisation than those who received simple strategy training.

There are several possible interpretations of this effect. For example, children who received experience training might have acquired more knowledge about the keyword strategy than those who received strategy training. While the amount and/or type of such knowledge may have been sufficient to increment performance over that observed in the Strategy condition, it may have been insufficient to promote a level of generalisation comparable to the level achieved by children who received direct metamemory instruction. Alternatively, children who received experience training might have acquired considerable knowledge about the strategy yet failed to make sufficient use of that knowledge in directing generalisation, resulting in a performance that was intermediate between performance in the Strategy and Metamemory conditions. It is also possible that the slight improvement in performance in the Experience condition represents a practice effect. The very nature of experience training guaranteed that children in this condition received more practice using the keyword strategy than children in the Strategy condition. Thus, children who received additional practice may have known more about the mechanics of strategy use. This additional practice may not have been associated with increases in other aspects of metamemory, for example, knowledge about where or why to use the strategy. Additional research involving the direct assessment of various components of metamemory, both prior to and following training, would be required to determine the nature and extent of the experience training effects. It cannot be concluded that children fail to acquire sufficient metamemory through experience with a strategy to direct successful generalisation of that strategy. The experience training routine used in the present study represents an extremely limited example of the naturalistic learning experiences children could have with mnemonic strategies. Experience training in the present study required approximately 10 mins. to deliver and the children were exposed to only three memory tasks. Naturalistic learning experiences, however, may occur over extended time periods and children may encounter a wide variety of memory tasks in diverse situations. While metamemory may very well be accumulated through such naturalistic experiences, it may be difficult to translate such experiences into efficient instructional programmes. Indeed, the results of the present study suggest that the provision of direct metamemory training is a far more efficient <u>instructional</u> procedure than experience training. This result is consistent with Pressley et al.'s (Note 2) conclusion that <u>explicit</u> metamemorial interventions improve young children's performance on a subsequent memory task.

One of the most interesting findings in the present study was the observation that children in the Strategy and Experience conditions adapted the strategy accurately to the generalisation task, and yet failed to use it frequently enough to effect recall performance significantly. The children's reports of accurate use of the strategy on the new task indicate that unsuccessful generalisation in the present study cannot really be attributed to insufficient knowledge about how to use the strategy. Indeed, these unsuccessful generalisers appear to have had considerable procedural metamemory (Chi, in press), that is, knowledge about the mechanics of keyword strategy use. Given that these children demonstrated that they knew how to apply the strategy, then how can their inconsistent application of the technique be accounted for? The inconsistent application of the strategy may reflect a disorganised, haphazard approach to the task, indicative perhaps of children who do not have a definite strategic "plan of attack" for the task. Thus, while children can use the strategy appropriately, they may lack an organised system for directing application of the strategy, with the result that it is applied in a rather random as opposed to systematic manner. While further research would be required to test the validity of this hypothesis, there is some anecdotal evidence available in the present study which tends to support this interpretation.

When the children had reported their study methods thereby completing their participation in the study, the experimenter asked them why they had or had not used the keyword strategy on the generalisation task. While most of the children in the Strategy and Experience conditions who had not indicated any attempt to use the strategy reported that it would not be used to learn Latin words and only worked with English material (i.e., an incorrect metamnemonic assumption), several children who had reported accurate use of the technique denied that they had used it at all. Thus, children who used the technique did not necessarily demonstrate an awareness that they had done so. Often, these children did not seem to understand - even when it was pointed out by the experimenter - that while the city - product and Latin - English tasks differed, the strategy which they had used on both tasks was essentially the same. These observations lend some support to the hypothesis that unsuccessful generalisers who reported accurate but infrequent keyword strategy use, may not have had a definite strategic plan directing study behaviour, resulting in the somewhat automatic and in some instances, perhaps unconscious application of the strategy to isolated items. This point will be readdressed during the discussion of the potency of metamemory instruction, where it will be argued that the primary effect of such instruction was the promotion of a systematic strategic approach to the generalisation task, resulting in the consistent application of the keyword strategy to the items on that task.

Before concluding this section, it should be pointed out that while unsuccessful generalisation is a recurring finding in instructional research, relatively little is known about the processes involved in unsuccessful generalisation. Given that the aim in instructional research is to design programmes that will lead to the elimination of production deficiencies, then, surely, knowledge concerning the mechanisms involved in transfer failure would be of paramount interest and utility to those engaged in designing such programmes. The approach in the present study was to determine the type of study methods associated with unsuccessful generalisation, as it was considered that information about how children fail can be useful in determining why they fail. In the present study, for example, unsuccessful generalisation was associated with a low frequency of keyword strategy use as opposed to failure to employ the strategy at all on the new task. This observation concerning how children failed suggests that deficiencies in procedural metamemory cannot really account for unsuccessful generalisation and that other factors, for example, aspects of metamemory other than procedural, may be instrumental in transfer failure and could, therefore, constitute targets for instruction.

A simple measure of strategy use can, therefore, be used to provide informative data relating to transfer failure. In addition, children's reports of their study methods on the generalisation task can be used to validate conclusions about generalisation based on recall performance. However, in many instructional studies (e.g., Pressley & Dennis-Rounds, 1980) recall performance is the only dependent measure included and conclusions about generalisation are based entirely on these data. As recall performance is an outcome measure, it cannot be used to determine the study processes involved in that outcome. In the present study, an analysis of recall performance alone might have led to the conclusion that children in the Strategy condition failed to generalise the keyword technique to the new task, while the children's reports indicate that this was not the case. The important point here is that instructional researchers might be well advised to include a measure of strategy use - independent of recall in their studies, in order to appreciate more fully the processes involved in transfer failure and success.

Metamemory Instruction

The beneficial effects of metamemory instruction obtained in this study are in sharp contrast to previous reports of the relative ineffectiveness of such instruction in promoting generalisation of trained mnemonic strategies (e.g., Black & Rollins, 1982; Kramer & Engle, 1981). There would appear to be at least one major reason for this discrepancy. As outlined in the Introduction, researchers to date who have attempted to promote generalisation of mnemonic strategies through metamemory instruction, have focussed that instruction on only one aspect of metamemory, that is, knowledge about the value of using a strategy to aid recall (e.g., Black & Rollins, 1982;

Kramer & Engle, 1981). While knowledge about a strategy's utility has been demonstrated to enhance maintenance of trained strategies (e.g., Kennedy & Miller, 1976; Borkowski et al., 1976), there is no evidence to suggest that this one component of memory knowledge should be the critical metamnemonic factor directing generalisation. On the contrary, the preponderance of the evidence suggests that strategy generalisation requires considerably more metamemory than strategy maintenance does (e.g., Black & Rollins, 1982; Kramer & Engle, 1981). While several authors (e.g., Brown, 1978; Borkowski & Cavanaugh, 1979) have called on instructional researchers to conduct task analyses to determine those aspects of memory knowledge that might be necessary for generalisation and thereby constitute targets for instruction - no such task analyses have been reported. Instead, researchers continue to focus their attentions on providing children with information about a strategy's utility and when such instruction fails to promote generalisation, reports appear in the literature (e.g., Kramer & Engle, 1981) advocating that such instruction should be supplemented with training in memory-monitoring strategies, if successful generalisation is to be achieved.

The approach adopted in the present study was that instruction on one aspect of memory knowledge does not exhaust the range of possible metamnemonic targets for training. Indeed, it would seem to be extremely premature to abandon the idea of promoting generalisation through metamemory instruction, as the effects of such instruction have only begun to be investigated. Following Brown's (1978) suggestion, a rudimentary task analysis was conducted to determine the type of memory knowledge that might be necessary for generalisation of the keyword strategy, from the city - product to the Latin - English task used in the present study. Each aspect of metamemory that was implicated as important for generalisation was given equal weight and included as a target for training. The resulting instructional programme was easily administered and required approximately 10 mins. to deliver in the experimental situation. The performance of children who received this instruction demonstrates that an economical training routine can easily be used to induce children to adapt and apply a trained strategy, in an uninstructed learning situation with difficulty task requirements. Hopefully, these data will promote a more optimistic view of the role of metamemory instruction in strategy training, leading to further development and refinement of such interventions.

The major effect of metamemory instruction as mentioned previously, appeared to be the promotion of the consistent application of the trained strategy to items on the generalisation task. While children who received strategy or experience training reported the application of the strategy on the generalisation task, only those who received metamemory instruction reported consistent application of the technique. It was suggested earlier that children who used the strategy infrequently may have lacked a systematic strategic approach to the task, a suggestion supported by the observation that many of these subjects were apparently unaware that they had used the strategy at all. However, most of the children who received metamemory instruction appeared to adopt a definite strategic approach to the task, as evidenced by their reports to the experimenter following completion of their participation in the study.

When the experimenter asked children who had received metamemory instruction why they had or had not used the strategy to study the items, the children's responses were extremely similar. The majority of children reported that as soon as they realised that the task required that they remember which two words went together, they knew that they could use the strategy to facilitate recall. Further, most of the children reported that they knew that if they tried hard enough, they could find a keyword in each Latin word. They told the experimenter that they had tried to do this for the majority of the Latin words and had succeeded in finding a keyword for most of them. These reports represent a restatement of the metamemory principles taught to the children during metamemory instruction. In addition, they do indicate a systematic strategic approach to the task on the part of

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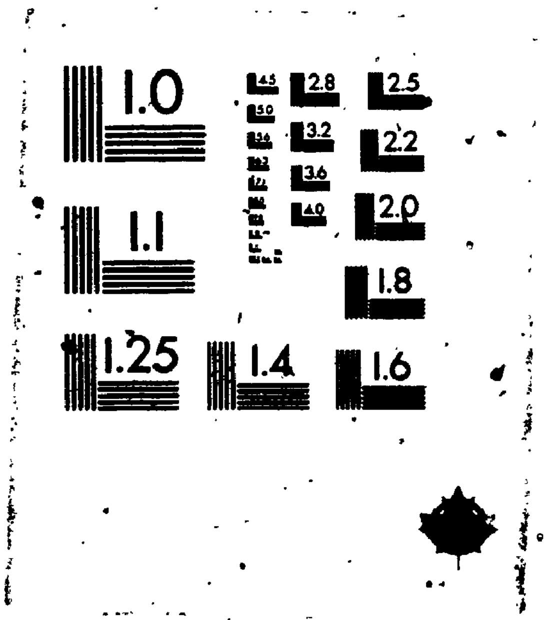

these subjects - an approach which is quite in contrast to that evidenced by unsuccessful generalisers. It may be the case then, that the effect of metamemory training was the promotion of a set of comprehensive principles which provided a relevant framework from which to direct the selection and application of the keyword strategy.

Chi (in press) and Pressley, Borkowski, and O'Sullivan (Note 4) have distinguished between two types of strategy metamemory, that is, procedural knowledge and declarative knowledge. While procedural knowledge is knowledge about how to execute a strategy, declarative knowledge is factual knowledge about a strategy, for example, knowledge about where and why it can be used. Following this distinction, it appears that both the successful and unsuccessful generalisers in the present study demonstrated procedural knowledge, while only those who received metamemory instruction seemed to know about other aspects of the strategy (i.e., declarative knowledge), for example, that it was possible to generate a keyword from each Latin noun. It may be the case, then, that metamemory instruction provided children with sufficient factual knowledge about the keyword technique to promote a comprehensive, organised, metamnemonic set that directed the consistent application of the strategy on the new task. Unsuccessful generalisers may not have had sufficient declarative metamemory to direct a systematic strategic approach to the task. If this hypothesis is valid, then it seems that in the present study, unsuccessful generalisation reflected a failure not only in metamemory, but in a specific component of metamemory, that is, factual knowledge about the keyword strategy.

Promoting Generalisation with Late Adolescents

In Experiment 3, late adolescent subjects who received strategy training, with or without supplementary instruction, demonstrated comparable recall performance and significantly outperformed Control subjects on both the city - product and Latin - English tasks. Thus, these older subjects benefitted from instruction in the use of the keyword strategy, just as younger children had benefitted. However, these adolescents achieved maximal generalisation of the strategy following simple strategy training, while younger children only achieved this criterion following instruction that included a metamemory component.

The performance of subjects in Experiment 3 who received simple strategy training can be contrasted with that of subjects who received similar training in Pressley and Dennis-Rounds (1980). In that study, adolescents who received instruction in the use of the keyword strategy with city - product pairs generalised the strategy from a city - product to a Latin - English task. However, those subjects did not achieve maximal generalisation, as evidenced by their inferior recall performance relative to that of subjects completely reinstructed in the use of the strategy with Latin - English pairs. Thus, subjects in the present study achieved more successful generalisation following simple strategy training than subjects in a corresponding condition in Pressley and Dennis-Rounds (1980). There are two major differences between these studies that may account for the difference in obtained results.

First, the subjects in Experiment 3 reported here were on average 18 months older than those who participated in Pressley and Dennis-Rounds (1980) and they were drawn from a population of university students as opposed to high school students. These differences between samples in the two studies could have been associated with differences in a number of variables that could account for the superior performance of the older subjects in the present study. For example, the older, university students may have been more competent, more experienced in participating in laboratory research, and may have had more advanced memory abilities than the younger, high school students in Pressley and Dennis-Rounds (1980).

Second, the procedures used to instruct subjects in the Strategy condition in Experiment 3 were more extensive than those used by Pressley and Dennis-Rounds (1980). In the present study, for example, subjects performed three training tasks and received two study-test cycles on the city - product task, whereas subjects in Pressley and Dennis-Rounds (1980) performed two training tasks and received one study-test cycle on the city - product task. Thus, subjects who received strategy training in the present study had more training and more practise in using the strategy in a learning situation than subjects in the corresponding condition in Pressley and Dennis-Rounds (1980). Undoubtedly, these differences in procedure, together with differences between the samples in the two studies, contributed to the superior performance of subjects who received strategy training in the present study.

The results obtained in Experiment 3 indicate that training in the mechanics of strategy use is sufficient to promote maximal generalisation of the keyword technique among late adolescents. The inclusion of experience or metamemory components in instruction did not appear to increase the potency of simple strategy training. How can the developmental difference in the effectiveness of simple strategy training in promoting generalisation be accounted for? First, as outlined in the Introduction, 19-year-olds are much more likely to engage in spontaneous elaboration than younger subjects (e.g., Pressley, 1982) and this increased propensity to elaborate is associated with increased metamemory for elaboration in older adolescents (Beuring, Note 3). If, as according to Campione and Brown (1977) those who know about elaboration strategies are more likely to engage in them, then older adolescents may have sufficient metamemory to direct generalisation of a newly acquired elaboration strategy following simple strategy training.

Second, while older adolescents may have known more about elaboration strategies than younger children, these older subjects were nonetheless unfamiliar with the keyword technique prior to participating in the study. Thus, it is possible that they acquired metamemory for this strategy during training. As there was no direct assessment of metamemory included in the present study, it is not possible to determine whether or not such acquisitions occurred. However, the subjects' reports to the experimenter, concerning why they had or had not used the keyword strategy on the generalisation task, indicate that they knew quite a lot about the strategy and some of this knowledge may have been acquired during training.

Most of the subjects in Experiment 3 who had reported using the strategy told the experimenter that when the Latin - English task was introduced, they had realised that the keyword strategy would be an appropriate learning aid. They further reported that they had tried to generate a keyword for most of the Latin items. These reports represent a restatement of the information provided to subjects who received metamemory instruction. However, subjects in the Strategy and Experience conditions had never received such instruction, which suggests that they acquired this information for themselves.

Thus, late adolescent subjects who received strategy or experience training demonstrated both procedural and declarative metamemory for the keyword strategy, whereas younger children in these conditions in Experiment 1 demonstrated procedural metamemory only. While it appears that declarative metamemory had to be provided by the experimenter to younger children, older adolescents can apparently acquire this information for themselves. This observation complements the conclusions of Pressley et al. (Note 2) that adults acquire relevant metacognition and applied it on their own, while younger children require more explicit metacognitive interventions to improve performance on a subsequent memory task. It may be the case then that simple strategy training was sufficient to promote maximal generalisation among older adolescents because (1) they knew more about elaboration than younger children, and (2) they could acquire more metamemory for the strategy during training than younger children.

Conclusion

One aim of instructional research is to teach subjects to use a cognitive strategy such that they will continue to deploy that strategy in a generalised manner following training. To date, however, instructional researchers have had little success in promoting generalisation of trained strategies. The most common approach to instruction has been to focus training solely on the mechanics of strategy use. Arguing that knowledge about strategies may be necessary to promote generalisation, Borkowski (in press) suggested that strategy training should be supplemented by metamemorial instruction. To the extent that such an instructional approach has been tried, it has been unsuccessful in promoting generalisation. However, metamemory instruction has been focussed on providing information about one aspect of trained strategies, that is, utility. There is no evidence to suggest that knowledge of a strategy's utility is the critical metamnemonic component involved in generalisation. Rather, it appears that generalisation may require several metamemory components and thus, comprehensive metamemory instruction may be sufficient to promote generalisation.

In the present study, a comprehensive metamnemonic instructional routine was combined with strategy training to promote generalisation of the keyword mnemonic strategy. This programme was sufficient to promote maximal generalisation among elementary school age children and was far more effective than traditional strategy training. In addition, it appears that generalisation of the keyword strategy is more successful when an external agent provides metamnemonic information to children, than when they are given the opportunity to acquire such information themselves. These results provide some support for the hypothesis that failures in generalisation in young children reflect failures in metamemory (Flavell & Wellman, 1977).

Further, the data in the present study suggest that unsuccessful generalisation, following thorough training in strategy use, may be associated with a deficit in factual as opposed to procedural knowledge about a strategy, a deficit that can apparently be overcome through direct instruction in metamemory.

In concluding that metamemory instruction can increase generalisation of the keyword technique, it cannot be concluded that such instruction is necessary. The performance of late adolescent subjects in the third experiment reported here, demonstrates that subjects in this age range can achieve maximal generalisation following simple strategy training. These older subjects appear to have generated considerable metamemory, both procedural and factual, for the keyword strategy during training. Thus, while metamemory may have directed generalisation for these subjects, they did not have to rely on an external agent to supply them with this information.

Finally, there are several important questions about the effects of metamemory instruction that were not addressed in the present study. First, the metamemory instructional component in the present study was quite broad in scope. It may be the case that certain components in metamemory are more important than others in promoting generalisation among young children. A component analysis of the instructional routine used in the present study would be required to test the sufficiency of different aspects of metamemory to promote generalisation. Second, the effectiveness of metamemory instruction in promoting long-term generalisation of trained strategies among young children should be assessed. If such instruction directed the continued use of a trained strategy, then the importance of including a metamemory component in instruction would be increased considerably.

Third, in the present study the trained strategy (i.e., keyword technique) represented an appropriate learning aid on the generalisation task. However, intelligent use of a mnemonic strategy requires that children discriminate between tasks where use of a particular strategy would be appropriate or inappropriate. The effectiveness of metamemory instruction in promoting such discriminative, generalised use of trained strategies should be assessed. Finally, the present study did not include a direct measure of subjects' metamemory. The inclusion of such a measure was considered to be beyond the scope of this research as it would have required: (1) the development of an appropriate assessment technique designed to measure subjects' knowledge of the keyword strategy and other aspects of metamemory considered to be pertinent to the experimental situation and (2) administration of such a measure at various points in the procedure in each experimental condition. Thus, to control for the effects of metamemory assessment on subsequent memory performance, it would have been necessary to include several additional experimental conditions in the present study. However, if a reliable metamemory assessment tool could be developed and administered, both prior to and following training, it might yield valuable information concerning the effects of different instructional routines on subjects' memory knowledge. In addition, the appropriate use of such a technique could provide data relevant to the directionality of the metamemory - memory behaviour connection (e.g., does metamemory lead to memory behaviour which in turn leads to more metamemory and so on).

Considerable research will no doubt be required to document fully the nature and extent of the effects of metamemory instruction on strategy usage. Hopefully, the present study will contribute to a more optimistic view of the benefits of metamemory instruction, on the part of instructional researchers. Workers in this area have been fixated on the problem of strategy utility and it would appear that it is more fruitful to investigate other aspects of strategy metamemory. Additional instructional interventions based on metamemory, if developed and tested, would probably lead to theoretical refinement and technological advancement.

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FOOTNOTES

1. Two orders of presentation were used to instruct children in the Metamemory Plus Experience condition. Dunn's comparisons revealed that order of presentation of training did not significantly affect recall performance, on either trial of the city - product task, for children in the Metamemory Plus Experience condition.
2. Two orders of presentation were used to instruct children in the Metamemory Plus Experience condition. Dunn's comparisons revealed that order of presentation of training did not significantly affect recall performance in this condition, on any trial on the Latin - English task.
3. In Experiment 3, two orders of presentation were used to instruct subjects in the Metamemory Plus Experience condition. Dunn's comparisons revealed that order of presentation of training did not significantly affect recall performance in this condition, on either trial on the city - product task.
4. The city - product list contained 25 pairs, 15 of these pairs had been used in Experiments 1 and 2 and 10 new pairs were added for Experiment 3. In order to compare recall on the city - product task across experiments, an analysis of recall performance, involving only those 15 pairs presented in all experiments, was conducted in Experiment 3. Recall

performance (involving only those 15 pairs) in all conditions was compared for Trial 1 and separately for Trial 2 using sets of Dunn's comparisons (see Appendix D). The results of these analyses were entirely consistent with the results of the analysis comparing recall performance for the 25 city - product pairs.

5. Two orders of presentation were used to instruct subjects in the Metamemory Plus Experience condition. Dunn's comparisons revealed that order of presentation of training did not significantly affect recall performance in this condition, on any trial on the Latin - English task.

6. The Latin - English list contained 31 pairs, 21 of these pairs had been used in Experiments 1 and 2 and 10 new pairs were added for Experiment 3. In order to compare recall performance across experiments, an analysis of recall performance, involving only those 21 pairs presented in all experiments, was conducted in Experiment 3. Recall performance (involving only those 21 pairs) in all conditions was compared for Trial 1, Trial 2, and across 10 trials using sets of Dunn's comparisons (see Appendix D). The results of these analyses were entirely consistent with the results of the analysis comparing recall performance for the 31 Latin - English pairs.

APPENDIX A

Stimulus Materials

City - Product Pairs Included in Experimental Task 1
in Experiments 1 and 2

Dover - submarines	Hatfield - tobacco
Belleville - stones	Beddington - blueberries
Threeforks - honey	Swanton - maple syrup
Tombstone - cattle	Rosebank - paint
Appleton - flour	Rockland - fishing
Kettle - chickens	Deerfield - wheat
Armstrong - celery	Batavia - televisions

Keystone - pottery

Latin - English Pairs Included in Experimental Task 2 in Experiments 1 and 2

Testa - jug

Pila - ball

Ratis - ship

Saltus - forest

Pannus - rag

Nutrux - nurse

Fistula - pipe

Ramulus - twig

Lapis - rock

Barrus - elephant

Vesti - robe

Artopta - baker

Pegma - bookcase

Caseus - cheese

Mappa - napkin

Truncus - block

Lillea - sausage

Anima - breath

Bruma - winter

Capra - goat

Posticum - door

City - Product Pairs Included in Sample List 3 in Experiments 1, 2, and 3

Ashland - iron

Waterbury - wood

Bakersfield - oil

Huntsville - corn

Milford - oysters

Surname - Profession Pairs Included in the First List Presented During Metamemory and Experience Training

Mr. Hazelwood - busdriver

Mr. Levinson - professor

Mr. Sawyer - judge

Mr. Berryman - soldier

Mr. Hennessy - bartender

Mr. Carruthers - doctor

Country - Food Pairs Included in the Second List Presented During Metamemory and Experience Training

Greenland - chickens

Japan - hot dogs

Spain - carrots

Scotland - jelly

Canada - pizza

Iceland - cheese

Prose Passages Presented During

Metamemory and Experience Training

So the salmon went up, after Tom had warned them of the wicked old otter; and Tom went down, but slowly and cautiously, coasting along the shore. He was many days about it for it was miles down to the sea; and perhaps he would never have found his way, if the fairies had not guided him, without his seeing their fair faces or feeling their gentle hands.

And she had on a black bonnet, and a black shawl, and no crinoline at all; and a pair of large green spectacles, and a great hooked nose, hooked so much that the bridge of it stood quite up above her eyebrows; and under her arm she carried a great birch-rod. Indeed, she was so ugle that Tom was tempted to make faces at her but did not; for he did not admire the look of the birch-rod under her arm.

City - Product Pairs Included in Experimental Task One in Experiment 3

Dover - submarines

Windham - thread

Hatfield - tobacco

Farmington - apples

Belleville - stones

Redwood - salt

Keystone - pottery

Livermore - nuclear weapons

Beddington - blueberries

Threeforks - honey

Swanton - maple syrup

Riverside - oranges

Tombstone - cattle

Appleton - flour

Topeka - farming

Rockland - fishing

Kettle - chickens

Yarmouth - vegetables

Deerfield - wheat

Taylor - sheep

Rosebank - paint

Coldwater - clothing

Armstrong - celery

Batavia - televisions

Foxboro - tape recorders

Latin - English Pairs Included in Experimental Task Two in Experiment 3

Testa - jug

Vesti - robe

Camella - goblet

Fanum - temple

Pila - ball

Artopta - baker

Platea - street

Ratis - ship

Pegma - bookcase

Potor - drunkard

Saltus - forest

Caseus - cheese

Saccus - wallet

pannus - rag

Scriptor - writer

Mappa - napkin

Nutrux - nurse

Soccus - slipper

Truncus - block

Fistula - pipe

Storea - mat

Hillea - sausage

Çardo - pole

Ramulus - twig

Anima - breath

Lapis - rock

Cornix - crow

Bruma - winter

Barrus - elephant

Capra - goat

Posticum - door

APPENDIX B

Verbatim Instructions Delivered During Strategy and Metamemory Training

Instructions Provided During Training in the Use of the Keyword Strategy with City - Product Pairs

In a few minutes I will show you names of cities and I will tell you what each city is famous for. You will have to try to remember what each city is famous for. Before we do that, I am going to show you a memory trick that will make it easy for you to remember what the cities are famous for. Here is the city of Lock Haven and it is famous because they make a lot of paper there. Now look at the name Lock Haven, it has the word lock in it. You know what a lock is, don't you? Well, a good way to remember that Lock Haven is famous for paper is to make a picture in your head of a lock and paper doing something together. Can you make one? What does your picture look like? Here is my picture (picture presented) it is a lock around a newspaper. Your picture does not have to be the same as mine, so long as you have a lock and paper in it. Now, a good way to remember what a city is famous for is first, to find part of the city's name that sounds like an object and then to make a picture in your head, with that object doing something with whatever the city is famous for.

Here is the city Springfield and it is famous for Abraham Lincoln souvenirs. Now, to remember what Springfield is famous for, you need to find part of Springfield that sounds like an object. Can you find an object? Good. Now you need to make a picture with that object doing something with Abraham Lincoln souvenirs. What does your picture look like? Here is mine (picture presented). It is Abraham Lincoln bouncing on a spring. Let's try one more. Here is Buffalo, it is famous for electricity. Now, to remember that Buffalo is famous for electricity, you need to find part of Buffalo that sounds like an object. Can you find an object? Can you make a picture with that object doing something with electricity? I don't have a picture; will you tell me what your picture looks like? Good. Now let's see if you can remember what Lock Haven, Springfield and Buffalo are famous for (recall test followed). Now you can forget those cities because you won't see them again.

Soon I will show you a long list of cities and ask you to learn what each one is famous for. I want you to use the trick to learn the cities so we will practise a little more. Remember the first thing to do what you see a city name is to find part of that name that sounds like an object. Let's practise that. Here are three city names, try and find an object in each name. What part of Long Beach sounds like an object? Good. Can you find an object in Harrisburg? Good. Now try Needles. Good. You can forget those cities because we won't use them again.

Now we will do one more practise before I show you the long list of city names. I am going to show you five city names and tell you what each one is famous for. For each city, I want you to find part of the name that sounds like an object and tell it to me. Then, I want you to make a picture in your head with that object doing something with whatever the city is famous for. I will ask you to tell me what your pictures look like. Ready? Here is Ashland. It is famous for iron. Can you find an object in Ashland? Good. Can you make a picture with that object and iron? What does it look like? Good. (This procedure was repeated for four more city - product pairs.) Now, let's see if you can remember what each city is famous for. (Recall test followed.) Good. Now, you can forget those cities because we won't use them again. Now, I am going to show you the long list of cities and ask you to try and remember what each one is famous for.

Instructions Provided During

Metamemory Training

Is it hard for you to remember things sometimes? Everyone finds it hard to remember things but did you know that often you can do something when you are learning to make sure that you will remember everything? Is it easy for you to decide what to do to make sure you remember everything? Well, one thing you can do is to use the memory trick that I just showed you. If you use that trick, it will help you to remember a lot. You would remember more if you used this trick than if you did not use it. Do you think that it is a good memory trick? It is a good trick and I am going to tell you more about it.

There are two things that you should know about the trick. First, this trick only works well when you have to remember that two things go together. Now, I will tell you why it only works well when two things go together. Remember how you learned what each city was famous for? First, you found part of the city's name that sounded like an object. Then, you make a picture in your head with that object doing something with whatever the city was famous for. Well, when I asked you what a city was famous for, all you had to do was to look in the city's name and find the object that you had chosen earlier. Then, you had to try and remember the picture you had made with that object. The other thing in the picture had to be what that city was famous for. That is why the trick worked well when you had to remember that two things went together. You had only two things in your picture. When I showed you a city's name you could easily find one of those two things and once you remembered your picture, you could find the other one. This trick does not work well if you have to remember that more than two things go together. Pretend that each city that I showed you was famous for 20 things. Then, you would have had a picture with the object from the city's name doing something with 20 things. There would have been so many things in your picture that you would probably have forgotten some of them. So, the trick only works well when you have to remember that two things go together. Do you understand why?

There is another thing that you should know about this memory trick. It works well whenever you have to remember that any two things go together. We just used it to learn what cities were famous for but you can use it to remember that any two things go together. Whenever you want to remember that two words go together, here is how you use the trick. First, look in the first word and try to find part of that word that sounds like an object. If you look hard enough, you will always be able to find part of a word that sounds like an object. Once you find the object, then all you have to do is make a picture in your head with that object doing something with the second word. If you do this, you will remember more than if you use any other memory trick. So, whenever you have to learn that two words go together, use this trick and you will remember a lot.

APPENDIX C

Raw Data from Experiments 1, 2, and 3

Recall Performance in the Control Condition in Experiment 1 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	5	6
2**	1	0
3**	3	8
4*	6	8
5**	2	3
6**	4	5
7*	2	2
8*	4	9
9**	2	3
10*	0	2
11**	1	3
12*	1	2
13*	1	4
14*	1	4
15*	2	3
16**	1	2
17**	2	2
18**	3	7
19*	3	6
20*	6	5

Maximum Score = 15

*Female

**Male

Recall Performance in the Control Condition in Experiment 1 on the Latin - English Task by Subject and By Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	4	6	10	12	17	16	16	18	20	20
2**	1	1	1	1	2	5	3	4	4	5
3**	0	2	3	8	9	10	11	13	14	14
4*	2	6	7	10	10	11	12	11	15	15
5**	1	4	8	6	10	10	7	10	8	10
6**	4	6	8	9	9	13	12	12	16	16
7*	1	3	5	7	7	10	11	10	14	13
8*	6	9	10	12	14	15	14	16	16	16
9**	1	4	6	11	8	10	4	10	8	10
10*	0	1	5	4	5	4	5	5	6	6
11**	3	4	5	7	8	8	10	9	14	11
12*	2	4	7	5	7	7	6	9	6	8
13*	1	5	6	8	10	9	11	12	11	11
14*	1	7	10	14	16	18	18	19	20	19
15*	2	3	1	4	5	6	7	7	8	10
16**	1	5	8	9	11	15	13	15	17	18
17**	1	4	9	8	14	17	16	17	19	17
18**	1	10	12	17	17	16	19	18	21	21
19*	3	7	10	12	14	15	18	16	20	18
20*	2	10	14	17	18	19	20	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Control Condition

in Experiment 1 by Subject

Subject Number	Probe Number				
	1	2	3	4	5
1*	0	0	1	0	0
2**	0	0	0	0	0
3**	0	0	1	0	0
4*	1	0	0	0	0
5**	0	0	0	0	1
6**	0	0	0	0	0
7*	0	0	0	0	0
8*	0	0	0	0	0
9**	0	0	0	0	0
10*	0	0	0	0	0
11**	1	0	0	0	0
12*	0	0	0	0	0
13*	0	0	0	0	0
14*	0	1	0	0	3
15*	0	0	0	0	0
16**	0	0	0	0	0
17**	0	0	0	0	0
18**	0	1	0	1	1
19*	1	0	0	0	0
20*	0	0	0	0	0

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Strategy Condition in Experiment 1 on the City - Product Task By Subject and By Trial

Subject Number	Trial 1	Trial 2
1*	11	14
2*	5	7
3**	7	10
4*	6	11
5**	8	13
6*	8	10
7*	9	12
8*	14	15
9**	3	6
10**	6	8
11**	9	13
12*	2	10
13**	4	11
14*	9	12
15**	10	12
16**	3	5
17**	6	8
18**	10	13
19**	9	14
20**	7	12

Maximum Score = 15

* Female

** Male

Recall Performance in the Strategy Condition in Experiment 1 on the Latin - English Task by Subject and By Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	16	19	21	21	21	21	21	21	21	21
2*	[illegible]	3	4	4	6	7	7	7	8	8
3**	9	15	16	16	17	17	19	19	20	20
4*	2	2	6	8	10	9	12	13	13	14
5**	4	10	10	10	13	16	17	16	19	21
6*	0	1	4	4	3	4	3	4	6	6
7*	0	3	2	2	6	7	6	9	5	10
8*	13	19	20	21	21	21	21	21	21	21
9**	1	4	6	7	8	12	8	12	12	10
10**	1	4	5	7	8	8	7	8	9	8
11**	9	14	17	19	21	21	21	21	21	21
12*	1	4	10	10	15	17	18	18	18	17
13**	2	4	7	6	7	9	8	10	10	10
14*	6	8	10	12	11	11	14	17	17	17
15**	5	10	11	17	17	17	17	17	18	18
16**	1	4	4	6	5	6	8	7	9	10
17**	4	5	10	10	12	11	13	16	14	15
18**	14	16	20	18	20	20	20	21	21	21
19**	6	8	9	12	17	17	17	17	20	20
20**	8	13	17	18	18	20	19	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Strategy Condition

in Experiment 1 by Subject

Subject Number	Probe Number				
	1	2	3	4	5
1*	2	3	0	3	INCOM.
2*	2	3	3	0	INCOM.
3**	2	3	3	3	3
4*	1	0	0	0	0
5**	0	3	3	0	3
6*	0	0	0	0	0
7*	0	0	0	0	0
8*	3	3	3	3	3
9**	0	0	0	0	1
10**	0	0	0	3	3
11**	1	1	3	3	2
12*	1	1	1	3	1
13**	1	0	2	3	3
14*	1	0	1	0	0
15**	0	3	3	3	3
16**	0	0	1	0	0
17**	0	1	0	2	0
18**	1	3	3	3	3
19**	0	0	3	1	3
20**	2	2	3	0	2

INCOM. = Recorded Response was Incomprehensible

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Experience Condition in Experiment 1 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	7	8
2*	3	12
3*	8	10
4*	11	11
5**	5	9
6**	9	8
7**	9	11
8*	3	12
9**	9	12
10*	4	8
11*	11	15
12*	12	11
13*	6	12
14*	7	11
15*	9	12
16*	5	5
17*	1	3
18*	8	12
19**	6	11
20*	13	14

Maximum Score = 15

* Female

** Male

Recall Performance in the Experience Condition in Experiment 1 on the Latin - English Task by Subject and By Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	5	4	6	4	9	7	11	9	9	9
2*	0	0	3	5	7	8	11	10	11	13
3*	6	9	8	10	12	14	15	14	20	20
4*	16	18	17	20	21	21	21	21	21	21
5**	1	0	2	5	2	4	5	7	6	10
6**	6	11	7	13	12	15	15	15	15	15
7**	3	9	9	15	15	19	19	19	19	19
8*	1	3	7	8	10	11	16	14	14	13
9**	11	14	14	19	17	17	18	18	18	17
10*	5	8	10	12	13	13	13	14	16	14
11*	15	21	21	21	21	21	21	21	21	21
12*	5	12	15	17	19	20	21	20	21	21
13*	7	18	19	18	21	21	21	21	21	21
14*	2	8	12	19	18	21	21	21	21	21
15*	8	13	20	21	21	21	21	21	21	21
16*	3	4	6	8	8	8	9	9	10	11
17*	1	2	2	4	4	7	7	6	6	7
18*	1	3	5	7	9	11	12	11	14	15
19**	2	6	8	12	13	11	14	14	13	13
20*	19	21	21	21	21	21	21	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Experience Condition

in Experiment 1 by Subject

Subject Number	Probe Number				
	1	2	3	4	5
1*	3	3	0	3	3
2*	0	0	0	0	0
3*	3	3	0	3	3
4*	3	3	1	3	0
5**	0	1	0	0	1
6**	3	1	1	3	3
7**	0	3	3	3	3
8*	3	2	1	3	3
9**	3	3	0	3	3
10*	3	1	3	2	3
11*	2	3	2	3	0
12*	3	2	3	3	3
13*	1	0	3	3	3
14*	1	3	3	3	3
15*	3	3	3	0	3
16*	1	0	0	1	1
17*	0	0	0	1	0
18*	0	0	0	0	1
19**	0	0	0	0	0
20*	1	3	1	3	3

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Metamemory Condition in Experiment 1 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	10	12
2*	7	7
3**	10	14
4**	3	9
5*	10	14
6**	12	13
7*	4	10
8*	8	10
9*	3	10
10**	12	13
11*	6	10
12*	4	12
13**	13	14
14*	3	8
15*	7	10
16*	14	15
17**	10	13
18*	7	10
19*	14	15
20**	6	11

Maximum Score = 15

* Female

** Male

Recall Performance in the Metamemory Condition in Experiment 1 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	16	20	21	21	21	21	21	21	21	21
2*	10	14	13	15	14	18	20	17	21	18
3**	5	12	12	14	15	16	15	16	19	20
4**	10	18	18	20	21	21	21	21	21	21
5*	15	16	19	21	21	21	21	21	21	21
6**	6	6	9	12	11	11	11	13	11	12
7*	10	16	19	19	20	21	21	21	21	21
8*	7	13	15	16	18	16	19	19	20	21
9*	1	5	5	10	8	13	12	12	11	10
10**	14	16	16	18	20	20	20	21	21	21
11*	9	15	18	21	21	21	21	21	21	21
12*	13	16	19	21	21	21	21	21	21	21
13**	12	20	21	21	21	21	21	21	21	21
14*	1	2	2	5	5	5	5	5	7	7
15*	6	9	13	15	17	17	18	19	20	19
16*	13	19	21	21	21	21	21	21	21	21
17**	15	19	20	21	21	21	21	21	21	21
18*	4	6	11	11	14	14	19	20	21	21
19*	14	20	20	21	21	21	21	21	21	21
20**	9	16	18	20	21	21	21	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Metamemory Condition

in Experiment 1 by Subject

Subject Number	Probe Number				
	1	2	3	4	5
1*	3	3	3	3	3
2*	3	3	2	3	1
3**	3	3	3	3	3
4**	3	3	1	3	3
5*	2	3	3	3	3
6**	0	0	0	0	1
7*	0	3	2	3	3
8*	1	3	0	0	3
9*	0	3	0	0	0
10**	3	3	3	3	3
11*	3	3	2	3	3
12*	1	0	3	3	3
13**	1	0	1	2	INCOM
14*	3	3	0	1	0
15*	3	1	0	2	3
16*	3	3	3	3	3
17**	3	1	3	3	3
18*	1	0	0	3	3
19*	2	3	3	3	3
20**	3	1	3	3	3

INCOM = Recorded Response was Incomprehensible

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Metamemory Plus Experience Condition in Experiment 1 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	1	7
2*	4	5
3**	9	12
4**	9	11
5**	8	12
6**	11	14
7**	5	12
8**	11	14
9*	7	8
10*	6	7
11*	6	9
12*	9	14
13*	6	10
14*	10	12
15*	3	5
16**	7	11
17**	10	13
18**	2	9
19**	0	14
20**	6	10

Maximum Score = 15

* Female

** Male

Recall Performance in the Metamemory Plus Experience Condition in Experiment 1 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	5	11	14	16	18	18	19	20	19	21
2*	0	1	0	4	4	4	7	9	9	12
3**	1	3	3	7	7	8	9	8	8	11
4**	16	17	18	21	21	21	21	21	21	21
5**	10	15	19	18	20	21	21	21	21	21
6**	15	20	21	21	21	21	21	21	21	21
7**	11	18	21	21	21	21	21	21	21	21
8**	11	17	19	21	21	21	21	21	21	21
9*	14	17	19	19	20	21	21	21	21	21
10*	13	16	19	21	21	21	21	21	21	21
11*	6	13	14	15	15	17	18	18	19	19
12*	3	6	8	12	14	15	19	19	19	20
13*	4	12	20	19	19	20	21	21	21	21
14*	3	6	8	12	16	20	18	21	21	21
15*	6	14	18	20	20	21	21	21	21	21
16**	7	12	12	13	16	20	21	21	21	21
17**	1	3	4	7	9	8	13	13	16	15
18**	8	12	12	13	14	17	18	19	19	19
19**	9	17	19	21	21	21	21	21	21	21
20**	6	13	16	19	21	21	21	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Metamemory Plus Experience Condition in Experiment 1 by Subject

Subject Number	Probe Number				
	1	2	3	4	5
1*	3	3	3	3	3
2*	3	2	2	2	0
3**	2	3	3	3	3
4**	3	2	2	3	INCOM.
5**	1	3	3	2	3
6**	3	3	3	0	3
7**	1	3	3	3	3
8**	3	1	3	3	3
9*	1	3	1	3	3
10*	3	3	3	3	3
11*	1	1	3	1	3
12*	0	3	3	3	3
13*	2	3	3	3	3
14*	3	3	3	3	3
15*	3	3	3	3	3
16**	0	1	0	1	0
17**	0	0	3	0	0
18**	3	2	2	3	1
19**	3	3	3	3	3
20**	2	3	1	3	3

INCOM. = Recorded Responses was Incomprehensible

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Strategy Condition in Experiment 2 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1**	6	9
2*	9	12
3**	9	10
4**	5	12
5*	8	11
6**	12	14
7*	10	14
8*	3	8
9**	8	11
10*	8	15
11*	10	12
12**	8	7
13*	7	12
14**	9	7
15**	9	13
16**	14	14
17*	7	12
18**	14	15
19*	12	15
20*	9	12

Maximum Score = 15

* Female

** Male

Recall Performance in the Strategy Condition in Experiment 2 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1**	4	10	12	14	15	15	17	19	19	19
2*	10	14	19	20	19	20	21	21	21	21
3**	3	6	7	13	12	17	17	18	19	15
4**	4	8	10	12	10	11	15	16	18	19
5*	0	3	3	7	9	11	8	10	9	11
6**	13	18	21	21	21	21	21	21	21	21
7*	19	21	21	21	21	21	21	21	21	21
8*	5	6	9	10	17	17	17	19	20	18
9**	2	8	16	19	21	21	21	21	21	21
10*	6	12	17	17	21	18	21	21	21	21
11*	10	13	21	20	2[illegible]	21	21	21	21	21
12**	2	2	5	6	9	8	10	11	12	13
13*	8	16	18	18	21	20	21	21	21	21
14**	2	6	9	10	13	16	18	18	20	20
15**	8	18	19	21	21	21	21	21	21	21
16**	13	16	19	20	21	21	21	21	21	21
17*	3	10	14	15	19	18	19	19	21	21
18**	14	18	20	21	21	21	21	21	21	21
19*	6	12	17	18	18	19	19	19	21	21
20*	1	5	7	5	9	10	13	15	13	14

Maximum Score = 21

* Female

** Male

Probe Scores in the Strategy Condition

in Experiment 2 by Subject

Subject Number	Probe Number 1	2	3	4	5	6
1**	0	1	3	3	3	3
2*	3	3	3	0	0	3
3**	0	0	0	1	3	3
4**	3	0	0	3	1	0
5*	0	0	0	0	0	0
6**	3	3	3	0	2	2
7*	3	3	3	3	3	3
8*	0	0	3	0	3	0
9**	3	0	0	2	0	3
10*	2	2	0	2	3	3
11*	1	3	0	1	0	1
12**	3	0	0	1	0	1
13*	3	3	3	3	2	3
14**	0	1	0	0	3	3
15**	1	1	0	2	0	0
16**	3	3	3	3	2	3
17*	0	3	2	2	3	3
18**	3	2	3	2	3	0
19*	2	0	3	3	3	2
20*	0	1	0	3	0	0

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Metamemory Condition in Experiment 2 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	11	12
2**	10	9
3*	9	11
4*	12	14
5*	8	13
6*	9	11
7*	12	14
8**	3	5
9*	6	11
10*	7	11
11**	13	14
12*	13	13
13**	7	11
14*	11	14
15**	2	7
16*	12	14
17*	5	11
18*	8	13
19*	9	11
20*	3	8

Maximum Score = 15

* Female

** Male

Recall Performance in the Metamemory Condition in Experiment 2 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	16	19	21	21	21	21	21	21	21	21
2**	6	12	18	20	19	21	21	21	21	21
3*	15	20	21	21	21	21	21	21	21	21
4*	18	19	21	21	21	21	21	21	21	21
5*	15	18	20	21	21	21	21	21	21	21
6*	4	6	20	20	21	21	21	21	21	21
7*	16	21	21	21	21	21	21	21	21	21
8**	2	2	4	6	6	12	11	15	10	11
9*	7	18	20	21	21	21	21	21	21	21
10*	17	20	21	21	21	21	21	21	21	21
11**	11	16	20	20	21	21	21	21	21	21
12*	12	20	21	21	21	21	21	21	21	21
13**	14	20	21	21	21	21	21	21	21	21
14*	19	21	21	21	21	21	21	21	21	21
15**	7	8	14	16	17	18	20	21	21	21
16*	18	21	21	21	21	21	21	21	21	21
17*	12	17	21	21	21	21	21	21	21	21
18*	3	7	9	11	10	17	16	14	17	16
19*	13	21	21	21	21	21	21	21	21	21
20*	4	8	17	17	20	20	21	21	21	21

Maximum Score = 21

* Female

** Male

Probe Scores in the Metamemory Condition

in Experiment 2 by Subject

Subject Number	Probe Number					
	1	2	3	4	5	6
1*	2	3	2	3	3	3
2**	3	3	3	3	3	0
3*	3	3	3	3	2	3
4*	3	3	2	3	3	3
5*	2	3	3	3	3	3
6*	3	0	2	3	3	3
7*	3	3	3	3	3	3
8**	0	1	0	0	0	0
9*	1	3	3	1	0	3
10*	3	3	3	3	3	3
11**	3	2	3	1	3	3
12*	3	3	3	3	3	3
13**	3	3	3	3	2	3
14*	3	0	0	3	1	3
15**	0	3	2	3	0	3
16*	3	3	2	3	3	3
17*	1	3	3	3	3	3
18*	0	0	0	0	0	0
19*	2	3	3	3	3	3
20*	0	1	2	2	3	3

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Reinstruction Condition in Experiment 2 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	12	13
2**	9	14
3*	7	11
4**	9	11
5**	4	12
6**	7	14
7**	12	14
8*	9	11
9**	7	12
10**	7	10
11*	8	13
12*	9	13
13**	6	9
14**	9	15
15*	10	12
16**	13	15
17**	6	5
18*	11	14
19*	3	5
20*	5	8

Maximum Score = 15

* Female

** Male

Recall Performance in the Reinstruction Condition in Experiment 2 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	19	20	21	21	21	21	21	21	21	21
2**	15	21	21	21	21	21	21	21	21	21
3*	14	19	20	20	21	21	21	21	21	21
4**	16	21	21	21	21	21	21	21	21	21
5**	12	18	19	19	20	20	21	21	21	21
6**	10	15	19	19	20	21	21	21	21	21
7**	18	21	21	21	21	21	21	21	21	21
8*	8	12	14	18	19	20	21	19	21	21
9**	7	18	20	21	21	21	21	21	21	21
10**	7	14	18	20	21	21	21	21	21	21
11*	11	18	20	20	21	21	21	21	21	21
12*	14	18	19	21	21	21	21	21	21	21
13**	14	16	17	20	21	21	21	21	21	21
14**	10	16	20	19	18	19	20	21	21	21
15*	15	20	21	21	21	21	21	21	21	21
16**	15	20	21	21	21	21	21	21	21	21
17**	8	12	11	13	19	18	19	20	20	21
18*	13	14	17	17	18	19	19	20	20	20
19*	2	12	11	13	12	18	14	19	17	18
20*	1	6	11	11	12	16	15	16	17	18

Maximum Score = 21

* Female

** Male

Probe Scores in the Reinstruction Condition

in Experiment 2 by Subject

Subject Number	Probe Number					
	1	2	3	4	5	6
1*	3	3	3	3	3	3
2**	3	3	3	3	3	2
3*	3	3	3	3	3	3
4**	3	3	3	0	3	3
5**	2	3	3	3	3	0
6**	3	3	3	3	3	3
7**	3	3	1	3	3	3
8*	3	3	1	0	1	1
9**	3	3	2	3	3	3
10**	3	3	3	3	3	0
11*	1	1	1	2	3	3
12*	3	3	3	1	3	0
13**	3	3	3	3	3	3
14**	3	1	3	3	3	3
15*	3	0	0	3	3	3
16**	3	1	3	3	3	3
17**	3	3	3	3	3	3
18*	2	3	3	3	3	3
19*	1	1	0	3	3	0
20*	2	3	0	2	3	3

Maximum Probe Score = 3

* Female

** Male

Recall Performance in the Control Condition in Experiment 3 on the City - Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	10	15
2**	13	19
3*	7	16
4**	6	12
5*	20	24
6*	3	4
7**	6	7
8*	16	18
9**	4	10
10**	11	15
11**	9	18
12*	3	6
13*	9	14
14*	7	10
15**	14	19
16**	4	8
17*	2	1
18**	17	20
19**	2	2
20**	7	10

Maximum Score = 25

* Female

** Male

Recall Performance in the Control Condition in Experiment 3 on the Latin - English Task by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	10	21	24	27	30	31	31	31	31	31
2**	18	30	31	31	31	31	31	31	31	31
3*	4	10	13	23	25	27	30	29	30	30
4**	15	19	26	29	31	31	31	31	31	31
5*	20	29	31	31	31	31	31	31	31	31
6*	5	7	11	16	17	19	19	22	21	23
7**	6	8	9	14	19	19	19	22	23	21
8*	18	27	29	31	31	31	31	31	31	31
9**	8	17	17	20	23	23	27	28	31	31
10**	11	20	25	26	27	29	30	31	31	31
11**	9	21	26	29	30	31	31	31	31	31
12*	3	5	7	7	10	13	15	17	18	18
13*	13	23	26	27	31	31	31	31	31	31
14*	4	13	17	25	26	29	31	28	30	30
15**	18	24	28	29	30	31	31	31	31	31
16**	4	8	14	17	21	25	24	25	28	30
17*	6	9	12	16	18	20	23	26	26	28
18**	18	27	28	31	31	31	31	31	31	31
19**	4	10	13	16	21	23	24	23	27	27
20**	7	14	19	22	24	27	29	28	29	31

Maximum Score = 31

* Female

** Male

Probe Scores in the Control Condition

in Experiment 3 by Subject

Subject Number	Probe Number 1	2	3	4	5	6	7	8	9
1*	0	0	1	1	0	0	1	2	3
2**	0	0	1	2	2	2	1	3	0
3*	1	0	0	0	0	0	0	0	0
4**	1	0	1	0	0	0	1	1	0
5*	0	2	3	1	3	0	0	0	1
6*	0	0	0	0	1	0	1	0	0
7**	0	0	1	0	0	1	0	0	0
8*	3	3	1	0	3	1	2	3	1
9**	0	3	3	1	1	1	0	3	1
10**	0	1	1	3	3	3	1	1	3
11**	0	1	3	3	3	3	0	2	3
12*	2	1	1	0	3	2	2	3	1
13*	0	2	3	3	3	0	0	0	1
14*	0	0	0	1	0	0	0	1	0
15**	0	0	1	0	0	0	1	0	0
16**	0	0	1	0	0	0	0	1	0
17*	0	1	2	0	2	0	1	3	0
18**	3	0	3	1	3	0	1	0	1
19**	0	1	1	2	1	1	3	0	[illegible]
20**	0	0	1	3	0	0	0	3	0

Maximum probe score = 3

* Female

** Male

Recall Performance in the Strategy Condition

in Experiment 3 on the City-Product Task

by Subject and Trial

Subject Number	Trial 1	Trial 2
1*	9	17
2*	16	23
3**	20	25
4*	15	22
5**	13	22
6*	10	20
7**	6	6
8**	16	22
9**	11	19
10**	18	22
11*	23	25
12*	11	20
13**	14	18
14**	12	22
15**	9	15
16**	4	10
17**	22	24
18**	9	17
19**	21	23
20**	18	24

Maximum score = 25

* Female

** Male

Recall Performance in the Strategy Condition
in Experiment 3 on the Latin-English Task
by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	12	17	25	27	30	31	31	31	31	31
2*	24	31	31	31	31	31	31	31	31	31
3**	25	31	31	31	31	31	31	31	31	31
4*	23	29	31	31	31	31	31	31	31	31
5**	24	30	31	31	31	31	31	31	31	31
6*	23	29	31	31	31	31	31	31	31	31
7**	2	5	11	17	19	21	25	25	27	30
8**	27	31	31	31	31	31	31	31	31	31
9**	19	27	30	31	31	31	31	31	31	31
10**	16	25	29	30	30	31	31	31	31	31
11*	26	31	31	31	31	31	31	31	31	31
12*	31	31	31	31	31	31	31	31	31	31
13**	19	30	31	31	31	31	31	31	31	31
14**	19	26	31	31	31	31	31	31	31	31
15**	5	17	22	26	25	25	25	26	28	28
16**	7	18	21	23	28	30	30	31	31	31
17**	27	31	31	31	31	31	31	31	31	31
18**	11	22	29	31	31	31	31	31	31	31
19**	29	31	31	31	31	31	31	31	31	31
20**	24	29	31	31	31	31	31	31	31	31

Maximum score = 31

* Female

** Male

Probe Scores in the Strategy Condition

in Experiment 3 by Subject

Subject Number	Probe Number								
	1	2	3	4	5	6	7	8	9
1*	2	0	0	0	0	3	0	3	3
2*	3	3	1	2	1	3	3	3	3
3**	3	3	3	3	3	3	3	3	3
4*	0	3	3	3	3	3	1	0	3
5**	1	2	3	2	0	0	1	1	3
6*	3	3	3	0	3	1	3	3	1
7**	2	0	2	3	0	1	3	0	1
8**	3	3	3	3	3	3	3	3	3
9**	3	3	1	1	3	3	1	1	0
10**	0	1	3	3	3	1	1	1	3
11*	3	3	3	0	3	3	3	3	3
12*	3	3	3	3	3	3	3	3	3
13**	3	3	3	0	2	3	3	1	1
14**	3	3	3	1	3	3	1	2	1
15**	1	0	3	1	1	0	0	0	1
16**	3	0	0	3	3	0	3	3	0
17**	2	3	3	3	3	3	3	3	3
18**	2	3	3	3	3	3	0	3	1
19**	3	3	3	3	3	3	3	3	3
20**	1	3	3	2	3	3	3	3	3

Maximum probe score = 3

* Female

** Male

Recall Performance in the Experience Condition

in Experiment 3 on the City-Product Task

by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	9	15
2*	10	20
3**	4	12
4*	14	17
5*	20	24
6**	12	13
7*	18	22
8**	15	22
9*	23	24
10**	17	21
11**	19	23
12**	17	22
13**	17	19
14*	11	21
15*	15	16
16**	16	20
17**	9	25
18*	15	24
19*	10	20
20*	5	15

Maximum score = 25

* Female

** Male

Recall Performance in the Experience Condition

in Experiment 3 on the Latin-English Task

by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	17	18	25	28	26	26	25	30	28	29
2*	19	29	31	31	31	31	31	31	31	31
3**	11	23	26	29	31	31	31	31	31	31
4*	15	27	30	31	31	31	31	31	31	31
5*	24	31	31	31	31	31	31	31	31	31
6**	12	19	25	28	28	31	31	31	31	31
7*	30	31	31	31	31	31	31	31	31	31
8**	25	30	31	31	31	31	31	31	31	31
9*	28	31	31	31	31	31	31	31	31	31
10**	19	28	30	31	31	31	31	31	31	31
11**	28	31	31	31	31	31	31	31	31	31
12**	25	31	31	31	31	31	31	31	31	31
13**	17	25	29	31	31	31	31	31	31	31
14*	18	28	30	30	31	31	31	31	31	31
15*	18	25	31	31	31	31	31	31	31	31
16**	17	29	29	31	31	31	31	31	31	31
17**	20	29	30	31	31	31	31	31	31	31
18*	19	28	31	31	31	31	31	31	31	31
19*	9	21	30	31	31	31	31	31	31	31
20*	15	21	27	30	30	30	31	31	31	31

Maximum score = 31

* Female

** Male

Probe Scores in the Experience Condition

in Experiment 3 by Subject

Subject Number	Probe Number								
	1	2	3	4	5	6	7	8	9
1*	2	1	1	2	0	1	1	3	2
2*	3	3	3	3	3	3	3	3	3
3**	1	2	2	3	3	3	0	2	3
4*	3	3	3	1	3	3	3	3	3
5*	3	3	3	3	1	3	3	3	3
6**	3	1	3	3	3	1	1	0	3
7*	3	3	3	3	3	3	3	3	3
8**	3	3	3	3	3	3	3	3	3
9*	3	3	3	3	3	2	1	3	3
10**	3	2	3	3	3	3	3	2	3
11**	3	2	3	3	3	3	3	3	3
12**	2	3	3	3	3	2	3	3	3
13**	3	3	3	3	3	3	3	3	3
14*	2	3	3	3	3	0	0	3	3
15*	2	3	3	3	3	3	3	3	3
16**	1	3	3	3	3	3	3	3	3
17**	3	3	3	1	3	3	3	3	3
18*	3	3	3	3	3	3	3	3	3
19*	3	3	3	3	3	3	3	2	3
20*	0	3	1	3	3	3	3	3	1

Maximum probe score = 3

* Female

** Male

Recall Performance in the Metamemory Condition

in Experiment 3 on the City-Product Task

by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	8	16
2**	11	17
3**	17	23
4*	16	21
5**	16	22
6*	16	22
7*	12	20
8*	23	22
9*	18	21
10**	7	15
11*	17	21
12*	18	24
13*	10	16
14*	23	25
15*	9	14
16**	5	15
17**	19	23
18**	15	23
19**	15	18
20**	10	21

Maximum score = 25

* Female

** Male

Recall Performance in the Metamemory Condition

in Experiment 3 on the Latin-English Task

by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1*	17	23	28	29	31	31	31	31	31	31
2**	9	15	19	19	22	25	23	23	24	25
3**	20	28	31	31	31	31	31	31	31	31
4*	25	29	31	31	31	31	31	31	31	31
5**	29	30	31	31	31	31	31	31	31	31
6*	27	31	31	31	31	31	31	31	31	31
7*	20	30	30	31	31	31	31	31	31	31
8*	25	31	31	31	31	31	31	31	31	31
9*	24	30	30	31	31	31	31	31	31	31
10**	23	29	31	31	31	31	31	31	31	31
11*	25	31	31	31	31	31	31	31	31	31
12*	27	29	30	31	31	31	31	31	31	31
13*	10	22	25	26	26	27	28	31	30	31
14*	31	31	31	31	31	31	31	31	31	31
15*	15	27	30	31	31	31	31	31	31	31
16**	12	23	27	28	30	28	28	30	30	30
17**	26	31	31	31	31	31	31	31	31	31
18**	18	28	30	30	31	31	31	31	31	31
19**	26	29	29	31	31	31	31	31	31	31
20**	17	23	25	28	29	29	30	30	31	31

Maximum score = 31

* Female

** Male

Probe Scores in the Metamemory Condition

in Experiment 3 by Subject

Subject Number	Probe Number								
	1	2	3	4	5	6	7	8	9
1*	3	3	3	3	1	3	3	1	1
2**	2	3	1	3	0	2	3	0	3
3**	1	3	3	2	3	3	3	3	3
4*	3	3	3	3	3	3	3	3	2
5**	3	3	3	3	3	3	3	3	3
6*	2	3	3	3	3	3	1	3	3
7*	3	0	3	3	2	2	1	3	3
8*	3	3	3	3	3	3	3	3	3
9*	3	3	3	3	3	3	3	3	3
10**	3	3	3	3	1	3	2	1	3
11*	3	3	3	3	3	3	0	3	3
12*	3	0	3	3	3	3	3	3	3
13*	3	3	3	0	3	3	3	0	3
14*	3	3	[illegible]	3	3	3	3	3	1
15*	2	3	3	2	3	3	1	3	3
16**	2	3	1	3	3	1	3	3	3
17**	3	3	3	2	1	3	3	3	3
18**	3	3	1	3	1	3	2	3	3
19**	3	3	3	2	3	3	3	3	3
20**	3	2	2	3	3	3	3	2	2

Maximum probe score = 3

* Female

** Male

Recall Performance in the Metamemory Plus Experience Condition in Experiment 3 on the City-Product Task by Subject and by Trial

Subject Number	Trial 1	Trial 2
1*	15	21
2*	14	23
3**	18	24
4*	19	24
5**	20	23
6**	20	24
7**	12	19
8*	13	22
9**	10	14
10**	11	13
11**	11	17
12*	11	18
13*	13	20
14**	17	20
15*	11	22
16*	7	20
17*	17	22
18**	18	23
19**	19	20
20*	5	14

Maximum score = 25

* Female

** Male

Recall Performance in the Metamemory Plus Experience Condition in Experiment 3 on the Latin-English Task by Subject and by Trial

Subject Number	Trial									
	1	2	3	4	5	6	7	8	9	10
1*	22	30	31	31	31	31	31	31	31	31
2*	17	26	29	29	31	31	31	31	31	31
3**	25	31	31	31	31	31	31	31	31	31
4*	19	28	30	31	31	31	31	31	31	31
5**	28	31	31	31	31	31	31	31	31	31
6**	24	30	31	31	31	31	31	31	31	31
7**	13	22	28	29	28	31	31	31	31	31
8*	23	28	31	31	31	31	31	31	31	31
9**	10	17	25	28	29	30	31	31	31	31
10**	21	28	29	30	31	31	31	31	31	31
11**	11	27	29	29	31	30	31	31	31	31
12*	27	30	31	31	31	31	31	31	31	31
13*	14	28	31	31	31	31	31	31	31	31
14**	20	26	29	31	31	31	31	31	31	31
15*	23	29	31	31	31	31	31	31	31	31
16*	17	30	31	31	31	31	31	31	31	31
17*	21	29	31	31	31	31	31	31	31	31
18**	26	31	31	31	31	31	31	31	31	31
19**	13	25	28	30	30	31	31	31	31	31
20*	9	20	23	27	31	28	29	30	31	31

Maximum score = 31

* Female

** Male

Probe Scores in the Metamemory Plus Experience

Condition in Experiment by Subject

Subject Number	Probe Number								
	1	2	3	4	5	6	7	8	9
1*	3	3	1	3	3	3	2	3	3
2*	3	3	3	3	3	3	3	3	3
3**	0	1	1	3	3	0	3	2	3
4*	3	3	3	3	3	3	3	1	3
5**	3	3	2	3	3	2	3	3	3
6**	3	2	3	2	3	1	3	3	3
7**	3	3	3	2	1	3	0	2	2
8*	3	2	3	3	3	3	3	3	3
9**	3	3	3	1	3	3	3	1	3
10**	3	3	3	3	3	3	2	3	3
11**	3	3	3	3	3	3	0	2	3
12*	3	2	3	3	3	3	3	3	3
13*	3	3	1	3	0	3	3	3	3
14**	3	3	3	3	1	3	3	3	3
15*	3	0	3	1	2	1	3	2	0
16*	3	3	3	2	3	3	3	3	3
17*	3	3	3	3	3	3	3	3	3
18**	3	3	3	2	3	3	3	3	3
19**	3	1	3	2	3	3	1	2	3
20*	2	3	2	3	3	3	3	1	3

Maximum probe score = 3

* Female

** Male

Recall Performance in the Reinstruction Condition

in Experiment 3 on the City-Product Task

by Subject and by Trial

Subject Number	Trial 1	Trial 2
1**	21	23
2*	15	19
3**	1	13
4*	11	18
5*	13	20
6**	12	14
7*	10	18
8*	13	22
9**	19	22
10*	9	16
11*	12	18
12*	15	22
13*	16	19
14**	21	23
15**	22	18
16**	14	19
17**	18	22
18**	14	21
19*	13	23
20**	7	15

Maximum score = 25

* Female

** Male

Recall Performance in the Reinstruction Condition
in Experiment 3 on the Latin-English Task
by Subject and by Trial

Subject Number	Trial 1	2	3	4	5	6	7	8	9	10
1**	22	30	31	31	31	31	31	31	31	31
2*	19	25	28	29	31	31	31	31	31	31
3**	7	14	18	22	24	24	22	26	27	28
4*	21	25	29	31	31	31	31	31	31	31
5*	22	31	31	31	31	31	31	31	31	31
6**	22	25	29	28	29	31	31	31	31	31
7*	11	23	26	29	26	27	27	28	29	30
8*	28	31	31	31	31	31	31	31	31	31
9**	27	31	31	31	31	31	31	31	31	31
10*	14	20	27	30	30	31	31	31	31	31
11*	15	27	30	31	31	31	31	31	31	31
12*	20	28	30	31	31	31	31	31	31	31
13*	19	25	28	29	29	31	31	31	31	31
14**	19	26	31	31	31	31	31	31	31	31
15**	27	30	31	31	31	31	31	31	31	31
16**	25	27	29	30	31	31	31	31	31	31
17**	23	30	31	31	31	31	31	31	31	31
18**	21	29	31	31	31	31	31	31	31	31
19*	22	29	31	31	31	31	31	31	31	31
20**	14	27	30	30	31	31	31	31	31	31

Maximum score = 31

* Female

** Male

Probe Scores in the Reinstruction Condition

in Experiment 3 by Subject

Subject Number	Probe Number								
	1	2	3	4	5	6	7	8	9
1**	3	3	3	3	1	3	3	3	3
2*	3	3	3	3	3	2	3	3	3
3**	2	0	0	3	0	3	2	3	1
4*	0	3	1	3	3	0	1	0	3
5*	3	3	3	3	3	3	3	2	1
6**	0	2	3	3	3	3	2	3	3
7*	3	3	3	1	1	3	1	1	3
8*	1	3	3	3	3	1	0	1	3
9**	2	3	3	3	2	3	0	2	1
10*	3	3	2	3	3	3	3	3	3
11*	3	3	3	3	0	3	3	3	3
12*	3	3	1	3	3	3	3	0	1
13*	3	3	3	3	0	2	0	3	1
14**	3	3	3	3	3	3	3	3	3
15**	3	3	3	3	2	3	1	2	3
16**	3	3	1	3	2	3	3	3	3
17**	3	3	3	3	3	3	3	3	3
18**	3	3	2	3	3	1	0	3	3
19*	3	3	3	3	3	0	3	3	3
20**	3	1	3	3	3	3	3	3	2

Maximum probe score = 3

* Female

** Male

APPENDIX D

Supplementary Analyses

Analysis of Covariance for Experiment 1

The data on recall performance on the Latin - English task in Experiment 1 indicated that the inclusion of a metamemory component in instruction promoted more successful generalisation than strategy or experience training. An analysis of covariance was conducted to determine if recall differences among these conditions would remain after adjusting for variation in recall performance on the city - product task. The data from the control condition was not included in this analysis as (1) the purpose in the analysis was to compare the effects on recall of training programmes that included a metamemory component to training programmes that did not include metamemory instruction, and (2) as recall performance on the city - product task in the control condition was significantly inferior (as a result of experimental manipulation) to performance in all other conditions, the inclusion of control data would have rendered the analysis less powerful and precise (Myers, 1979).

The value of the covariate for each subject was defined as the average number of items recalled across the two trials on the city - product task. The dependent measure was the average number of items recalled across 10 trials on the Latin - English task. A one way analysis of covariance for the effects of instruction on recall on the Latin - English task was then conducted. When recall performance was adjusted for the value of the covariate, method of instruction significantly affected recall performance on the Latin - English task $F(3,75) = 5.101$, $p < .003$. The mean recall performance adjusted for the covariate in each experimental condition together with the unadjusted means are displayed in Table A.

The analysis of covariance was followed by the Dunn-Bonferroni Test of the difference between appropriate means (Huitema, 1980). Thus, this analysis is consistent with the use of Dunn's comparisons to test differences between unadjusted mean recall performance. The results of this analysis are shown in Table B. Children in conditions that included a metamemory component in instruction recalled significantly more items than children in the strategy condition. Recall in the experience condition was intermediate between (and not significantly different from) recall in the two conditions that included metamemory instruction. Thus, when the effects of variation in recall performance on the city - product task were controlled for, training programmes that included metamemory instruction promoted more successful generalisation than other training routines. These data are entirely consistent with the results of the analyses comparing unadjusted mean recall performance.

Table A

Recall Across 10 Trials on the Latin - English Task Expressed as Unadjusted Mean Values and Mean Values, Adjusted for the Covariate, by Experimental Condition in Experiment 1

Experimental Condition	Unadjusted Mean Recall	Adjusted Mean Recall
Strategy	12.09	12.05
Experience	12.99	13.21
Metamemory	16.70	16.00
Metamemory Plus Experience	16.07	16.58

N = 20 in each condition

Maximum Score = 21

Table B

Absolute Values of the Dunn-Bonferroni Statistic Obtained by Comparing Adjusted Mean Recall Performance Experimental Conditions in Experiment 1

	Strategy	Experience	Metamemory	Metamemory Plus Experience
Strategy $\bar{x}_{adj}$ = 12.05	---	εDB = 0.845	εDB = 2.879†	εDB = 3.301*
Experience $\bar{x}_{adj}$ = 13.21		---	εDB = 2.033	εDB = 2.456
Metamemory $\bar{x}_{adj}$ = 16.00			---	εDB = 0.422
Metamemory Plus Experience $\bar{x}_{adj}$ = 16.58				---

*Critical value of $\varepsilon_{DB(6,73)} = 3.271$ at $p < .01$

†Critical value of $\varepsilon_{DB(6,73)} = 2.715$ at $p < .05$

Analysis of Covariance for Experiment 2

The data on recall performance on the Latin - English task in Experiment 2 indicated that children in the Metamemory and Reinstruction conditions demonstrated comparable recall performance and significantly outperformed children in the Strategy condition. An analysis of covariance was conducted to determine whether recall differences among these conditions would remain after variation in recall performance on the city - product task was controlled for. The value of the covariate for each subject was defined as the average number of items recalled across the two trials on the city - product task. The dependent measure was the average number of items recalled across 10 trials on the Latin - English task. A one way analysis of covariance for the effects of instruction on recall performance on the Latin - English task was then conducted. When recall performance was adjusted for the contribution of the covariate, method of instruction significantly affected recall performance on the Latin - English task $F(2,56) = 9.072$, $p < .001$. The mean recall performance adjusted for the covariate in each experimental condition, together with the unadjusted means are displayed in Table C.

The analysis of covariance was followed by the Dunn-Bonferroni Test of the difference between appropriate means. The results of these analyses are shown in Table D. Children in the Metamemory and Reinstruction conditions demonstrated comparable recall performance and significantly

Table C

Recall Across 10 Trials on the Latin - English Task Expressed as Unadjusted Mean Values and Mean Values Adjusted for the Covariate in Each Experimental Condition in Experiment 2

Experimental Condition	Unadjusted Mean Recall	Adjusted Mean Recall
Strategy	15.64	15.49
Reinstruction	18.56	18.57
Metamemory	18.60	18.75

N = 20 in each condition

Maximum Score = 21

Table D

Absolute Values of the Dunn-Bonferroni Statistic Obtained by Comparing Adjusted Mean Recall Performance in Each Experimental Condition in Experiment 2

	Strategy	Reinstruction	Metamemory
Strategy $\bar{x}_{adj}$ = 15.49	----	εDB = 3.585*	εDB = 3.795*
Reinstruction $\bar{x}_{adj}$ = 18.57		---	εDB = 0.209
Metamemory $\bar{x}_{adj}$ = 18.75			---

*Critical Value of $\varepsilon_{DB(3,56)}$ = 3.069 at $p < .01$

outperformed children in the Strategy condition. Thus, when the effects of variation in recall performance on the city - product task were controlled for, metamemory instruction was sufficient to promote maximal generalisation and was more successful than simple strategy training in promoting generalisation. These data are entirely consistent with the results of the analysis comparing unadjusted mean recall performance.

City - Product Recall in Experiment 3

In Experiment 3 the city - product list contained 25 pairs. Fifteen of these pairs had been used in Experiments 1 and 2 and 10 additional pairs were added for Experiment 3. In order to compare recall performance across all three experiments, an analysis of recall performance involving only those 15 pairs presented in all three experiments was conducted in Experiment 3.

The number of items (out of a total of 15) recalled on each of the two trials on the city - product task was calculated for each subject. The means and standard deviations of recall performance in each experimental condition on both trials are displayed in Table E. Recall performance in all six conditions was compared for Trial 1 and separately for Trial 2 using sets of Dunn's comparisons. For each trial, a set of 15 Dunn's comparisons was used to compare performance (α = 0.15 for each set; α = 0.01 per comparison).

The results of these analyses are shown in Table F (Trial 1) and Table G (Trial 2). On each trial the pattern of results was equivalent. Subjects in the Control Condition recalled significantly fewer items on each of the two trials than subjects in the other five conditions. All other differences between conditions were statistically insignificant. The results of these analyses involving 15 city - product pairs are comparable to the results of the analyses involving 25 pairs.

Table E

Recall of City - Product Pairs (Only Those Items Used in Experiments 1 and 2) as a Function of Experimental Condition and Trial in Experiment 3

Experimental Condition	Trial 1	Trial 2
Control	$\bar{x}$ = 5.20 S.D. = 3.15	$\bar{x}$ = 7.80 S.D. = 4.08
Reinstruction	$\bar{x}$ = 7.70 S.D. = 3.13	$\bar{x}$ = 11.05 S.D. = 1.95
Experience	$\bar{x}$ = 8.30 S.D. = 3.01	$\bar{x}$ = 12.20 S.D. = 2.16
Metamemory Plus Experience	$\bar{x}$ = 8.40 S.D. = 2.37	$\bar{x}$ = 12.05 S.D. = 2.16
Strategy	$\bar{x}$ = 8.60 S.D. = 2.87	$\bar{x}$ = 12.10 S.D. = 2.95
Metamemory	$\bar{x}$ = 8.95 S.D. = 3.13	$\bar{x}$ = 12.10 S.D. = 1.99

N = 20 in each condition

Maximum Score = 15

Table P

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the City - Product Task (Involving Only Those Items Used In Experiments 1 and 2) in Experiment 3

	Control	Reinstruction	Experience	Metamemory Plus Experience	Strategy	Metamemory
Control = 5.20	---	2.50*	3.10*	3.20*	3.40*	3.75*
Reinstruction = 7.70		---	0.60	0.70	0.90	1.25
Experience = 8.30			---	0.10	0.30	0.65
Metamemory Plus Experience = 8.40				---	0.20	0.55
Strategy = 8.60					---	0.35
Metamemory = 8.95						---

*Critical difference between means = 2.449 at $p < .01$

Table G

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the City - Product Task (Involving Only Those Items Used In Experiments 1 and 2) in Experiment 3

	Control	Reinstruction	Metamemory Plus Experience	Metamemory	Strategy	Experience
Control = 7.80	---	3.25*	4.25*	4.30*	4.30*	4.40*
Reinstruction = 11.05		---	1.00	1.05	1.05	1.15
Metamemory Plus Experience = 12.05			---	0.05	0.05	0.15
Metamemory = 12.10				---	0.00	0.1
Strategy = 12.10					---	0.1
Experience = 12.20						---

*Critical difference between means = 2.208 at $p < .01$

Latin - English Recall in Experiment 3

In Experiment 3 the Latin - English list contained 31 pairs. Twenty one of these pairs had been used in Experiments 1 and 2 and 10 additional pairs were added for Experiment 3. In order to compare recall performance across all three experiments, an analysis of recall performance, involving only those 21 pairs presented in all three experiments, was conducted in Experiment 3.

The number of items (out of a total of 21) recalled on each of 10 trials on the Latin - English task was calculated for each subject. Recall performance in each condition was compared separately for Trial 1, Trial 2 and across 10 trials (consistent with the analyses of recall performance involving all 31 Latin - English pairs). Sets of 15 Dunn's comparisons were used to compare performance on each of these three measures (α = 0.15 for each set; α = 0.01 per comparison).

The means and standard deviations of recall performance on Trial 1, Trial 2 and across 10 trials are displayed in Table H. When recall performance in each condition was compared for Trial 1 (see Table I), Trial 2 (see Table J), and across 10 trials (see Table K), the pattern of results was equivalent. Subjects in the Control condition recalled significantly fewer items on Trial 1, Trial 2, and across 10 trials than subjects in the remaining five conditions. There were no other significant differences in recall performance between conditions. The

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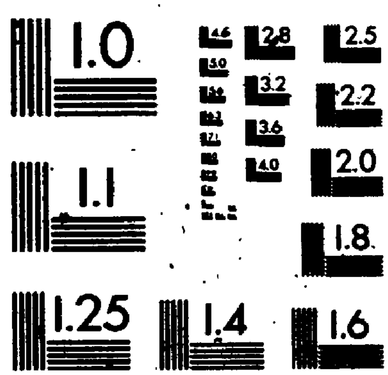

Table H

Recall of Latin - English Pairs (Only Those Items Used in Experiments 1 and 2) as a Function of Experimental Condition and Trial in Experiment 3

Experimental Condition	Trial 1	Trial 2	Across 10 Trials
Control	$\bar{x}$ = 6.55 S.D. = 4.47	$\bar{x}$ = 11.30 S.D. = 5.60	$\bar{x}$ = 16.03 S.D. = 3.45
Experience	$\bar{x}$ = 12.80 S.D. = 4.23	$\bar{x}$ = 17.70 S.D. = 3.37	$\bar{x}$ = 19.55 S.D. = 1.48
Metamemory Plus Experience	$\bar{x}$ = 12.85 S.D. = 4.41	$\bar{x}$ = 18.15 S.D. = 2.81	$\bar{x}$ = 19.65 S.D. = 1.07
Strategy	$\bar{x}$ = 13.40 S.D. = 5.56	$\bar{x}$ = 17.30 S.D. = 5.11	$\bar{x}$ = 19.26 S.D. = 2.43
Reinstruction	$\bar{x}$ = 13.55 S.D. = 3.92	$\bar{x}$ = 17.75 S.D. = 3.30	$\bar{x}$ = 19.48 S.D. = 1.67
Metamemory	$\bar{x}$ = 14.60 S.D. = 4.71	$\bar{x}$ = 18.35 S.D. = 3.40	$\bar{x}$ = 19.55 S.D. = 2.04

N = 20 in each condition

Maximum Score = 21

Table I

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 1 of the Latin - English Task (Involving Only Those Items Used In Experiments 1 and 2) in Experiment 3

	Control	Experience	Metamemory Plus Experience	Strategy	Reinstruction	Metamemory
Control = 6.55	---	6.25*	6.30*	6.85*	7.00*	8.05*
Experience = 12.80		---	0.05	0.60	0.75	1.80
Metamemory Plus Experience = 12.85			---	0.55	0.70	1.75
Strategy = 13.40				---	0.15	1.20
Reinstruction = 13.55					---	1.05
Metamemory = 14.60						---

*Critical difference between means = 3.799 at $p < .01$

Table J

Dunn's Comparisons of Recall Performance in Each Experimental Condition on Trial 2 of the Latin - English Task (Involving Only Those Items Used In Experiments 1 and 2) in Experiment 3

	Control	Strategy	Experience	Reinstruction	Metamemory Plus Experience	Metamemory
Control = 11.30	---	6.00*	6.40*	6.45*	6.85*	7.05*
Strategy = 17.30		---	0.40	0.45	0.85	1.05
Experience = 17.70			---	0.05	0.45	0.65
Reinstruction = 17.75				---	0.40	0.60
Metamemory Plus Experience = 18.15					---	0.20
Metamemory = 18.35						---

*Critical difference between means = 3.379 at $p < .01$

Table K

Dunn's Comparisons of Recall Performance in Each Experimental Condition Across 10 Trials on the Latin → English Task (Involving Only Those Items Used in Experiments 1 and 2) in Experiment 3

	Control	Strategy	Reinstruction	Experience	Metamemory	Metamemory Plus Experience
Control = 16.03	---	3.23*	3.45*	3.52*	3.52*	3.62*
Strategy = 19.26		---	0.22	0.29	0.29	0.39
Reinstrudtion = 19.48			---	0.07	0.07	0.17
Experience = 19.55				---	0.00	0.10
Metamemory = 19.55					---	0.10
Metamemory Plus Experience = 19.65						---

*Critical difference between means = 1.794 at $p < .01$

results of this analyses involving 21 Latin - English pairs are comparable to the results of the analyses involving 31 pairs.

Analysis of Covariance for Experiment 3

The data on recall performance on the Latin - English task in Experiment 3 indicated that subjects in all conditions that included training in keyword strategy use with city - product pairs achieved comparable recall performance on the generalisation task. An analysis of covariance was conducted to determine whether differences in recall among these conditions might result when variations in recall performance on the city - product task were adjusted for. As the purpose of the analysis was to compare recall performance in conditions that included strategy training with or without supplementary instruction, data from the Control condition was not included.

The value of the covariate for each subject was defined as the average number of items recalled across the two trials on the city - product task. The dependent measure was the average number of items recalled across 10 trials on the Latin – English task. A one way analysis of covariance for the effects of instruction on recall performance on the Latin - English task was then conducted.

When recall performance on the generalisation task was adjusted for the contribution of the covariate, method of instruction had no significant effect on performance, $F(4,94) = 0.342$, $p < .84$. The mean recall performance adjusted for the covariate in each experimental condition, together with the unadjusted means, are shown in Table L. Thus, these data are consistent with the results of the analysis comparing unadjusted mean recall performance and provide further evidence for the conclusion that recall performance was comparable in the Strategy, Experience, Metamemory, Metamemory Plus Experience, and Reinstruction conditions.

Table L

Recall Across 10 Trials on the Latin - English Task Expressed as Unadjusted Mean Values and Mean Values Adjusted for the Covariate by Experimental Condition in Experiment 3

Experimental Condition	Unadjusted Mean Recall	Adjusted Mean Recall
Strategy	28.58	28.59
Reinstruction	28.90	29.03
Metamemory	28.99	28.90
Experience	29.06	29.09
Metamemory Plus Experience	29.15	29.09

N = 20 in each condition

Maximum Score = 31

END

1 6 0 9 8 3

FIN