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The Effects Of
The 'Mind Mapping' Technique
On Learning

Doris Carolyn Bennett

A Thesis

In

The Department

Of

Education

Presented in Partial Fulfillment of the Requirements
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ABSTRACT

The Effects of the 'Mind Mapping' Technique on Learning

Doris Carolyn Bennett

In this thesis, a technique to induce deep level processing of information was assessed. This technique evolved from the research on various study skills, strategies, learning resources and the theories of learning behaviour. It is hypothesized that the technique here called 'Mind Mapping', which is constructed from elements of several techniques and linked to recent findings on learner processing would promote more effective learning than would result in a similar situation where this technique is not used.

The sample consisted of 44 CEGEP students divided into one control and one experimental group. Both groups were required to write a post-test. The results of this study indicated two important factors: (1) the approaches to learning varied both within and between the groups, and (2) the students using the 'Mind Mapping' technique achieved a higher level of understanding than the control students. These results were statistically significant ($p<0.05$), helping to confirm the main hypothesis: when carefully integrated into classroom learning, 'Mind Mapping' can function as an effective learning technique.

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1.0 INTRODUCTION

1.1 Context of the Problem

A survey on "New Methods of Assessment and Stronger Methods of Curriculum Design" (Lewis & Hawkridge, 1978) condemned the practice of 'indoctrinal education' which produces students superficially familiar with knowledge structure but incapable of sophisticated thinking. In this thesis, this problem will be addressed and, in order to view it in the context of current research, the term 'sophisticated thinking' will be equated with and referred to as deep level processing.

The term 'deep level processing' is used by Ference Marton to describe the procedure a student takes to grasp what is signified when learning from prose or lectures.

> Those who succeed best seem to have an approach that aims beyond the written or spoken discourse towards the message the discourse is intended to communicate. These students feel themselves to be agents of learning, they utilize their capacity for logical thinking in order to construct Knowledge. To grasp what is signified is simply to discover or create meaning. In our opinion this is precisely what it takes to learn. (Marton, 1975a, p.52)

In this statement Marton not only refers to the type of procedure a learner takes but to the characteristics of a deep level learner as opposed to the surface level learner who becomes only superficially familiar with knowledge structure.

The research concerned with deep level learning has been continuous since the early 1970's. The general suggestion from the research on this topic is that there are fundamental differences in how people set about learning. The specific distinotion is whether people have the discourse or what the discourse is about as their focal object. Svensson (1976) characterized the differences in learning processes in terms of atomistic and holistic, Goldman (1972) made the distinction between 'logical' and 'concrete' mnemonics, and Biggs (1976), between 'reproductive' and 'transformational' strategies, when they considered individual differences in the process of learning. Pask & Scott (1972) speak of 'Holist' and 'Serialist' and Marton (1975-76) found learners to be 'deep' or 'surface' in their approaches to learning. It appears that they are all referring to different aspects of the same phenomenon.

There is a growing recognition from the research above that students cannot be expected to acquire learning skills incidentally. (Entwhistle, 1980) The goal of this thesis was to evaluate a way in which students' approaches to learning may be modified through the use of a skill. Since Pask argues that a knowledge of one's own style of learning is important in

'learning to learn', the secondary goal is to help students determine their own style and approach to learning.

The researcher has developed instructional and self-instructional materials intended to help students become aware of their approach to learning and to use a technique that, when used, would induce a deep level processing. The ideas on learning were drawn from the research on learning spanning the last 10 years and the actual technique is a modification of an instructional package called "Use Your Head".

This package, produced by Buzan (1974), is comprised of a 10-part television series and is supported by a short book published by the BBC in 1974. The adaptation consists of a slide/tape presentation and a self-instructional book of exercises compiled of the same ideas but re-structured for classroom and self-instructional use.

1.2 Statement of the Problem

The objective of this thesis was to investigate the effects of 'Mind Mapping' on the promotion of deep level learning.

1.3 Review of Related Research

1.3.1 Student Learning

Research on student learning was for many years the almost exclusive province of the experimental psychologist. The experiments undertaken dealt with such aspects of learning as verbatim recall and evidence of memory decay over time. Further advanced research on this issue dealt with the controlling of variables from the instructional point of view: the behavioural objective, the use of pictures, the inserted questions, the advance organizer, etc. It is only recently that the question "How do we learn?" is becoming the focus of attention for researchers in the area of student learning. It may very well be the same core question of the student's perspective and in a more holistic way.

There has undoubtedly been a significant shift in both research methodology and theoretical assumption about the nature of student learning. In the research referred to here, the substantive interest is in the learning of the students themselves, within their natural learning environments. The view implied is that the conception of something may depend on the conception of something else which is more fundamental. In other words, learning can be considered as a process in which a large variation of our environment is interpreted on different levels by the learner in terms of a limited number of basic concepts and

structures.

If this is an accurate assessment of the learning process it seems reasonable that, in order to improve learning, instructional technologists should concentrate their efforts on putting across basic concepts or structures to all involved in the learning process.

1.3.2 Approaches to Learning

The researchers working within the new paradigm (how students learn) of student learning have been focusing on such issues as: what students learn, how they approach study, the relationships between approach to study and learning outcome, what students understand learning to consist of, and whether it is possible to manipulate students' approaches to studying in order to influence the learning outcome.

"What does it take to learn?", questions Marton (1975a) as he sets the goal of his research to arrive at a description of differences in the outcome of learning in students. A variation in depth in the process of learning (level of processing) was found as well as a correspondence to the variation in depth in the outcome of learning (level of outcome). The two levels identified in this study (deep and surface) are, of course, not to be considered as two distinct and separate categories. Rather, they imply a dimension along which individuals vary.

The students who took the deep level approach concentrated on what the discourse was about rather than the discourse itself. However, the key idea that Marton suggests is not just the variation in learning style, but also cognitive skills to penetrate different content at a deep level. His view of the purpose of cognitive skills is precisely stated in the following:

> ... If the training in skills is aimed at skills in the sense of technique only (e.g., to use reference books, to underline, to find one's way around a library), then one has missed what we consider to be the real purpose of the cognitive skills. On the other hand, to concentrate on knowledge at a superficial level, i.e., more or less in the form of learning by rote, is unlikely to result in knowledge of any value or interest. One should seek to promote as deep a level of understanding of different content as possible, independent of whether one insists upon skills or knowledge. If one has a certain content of a course or a curriculum as a starting point, then wholehearted concentration on deeper understanding means that the content must be reduced drastically from a quantitative point of view compared

> with what is usual today. If, on the other hand, one starts with different concrete problems rooted in the student's own experience and spheres of interest, then one must endeavour to take the analysis to a sufficiently deep level. Irrespective of the content one begins with, one must arrive at a set of limited number of scientific concepts and principles in terms of which a number of varying phenomena can be interpreted. If this is not done and if one, as a learner, does not penetrate further one's analysis of the initial problem than that which is specific for just that problem, then one is hardly better equipped to meet the new problem. (Marton, 1979, p.612)

Attempts to induce deep level processing through the manipulation of questions was not successful (Marton & Saljo, 1976).

> ... questions intended to induce deep-level processing becomes the focal attention instead of a thorough comprehension of the entire discourse which the questions (or rather the answers to them) were meant to be signs of. (p.7)

Although the attempt was unsuccessful the study did further demonstrate the relationship between the approach a student takes to a learning task and the learning outcome.

Individual differences in the student's approaches to learning and the learning outcome was also investigated by Gordon Pask (1976a) on the use of a 'teach back' technique, which was employed in these studies where students gave a spontaneous account of the topic they were studying. Pask distinguished between serialist and holist learners. Thus, Pask derived this dichotomy of learning style.

> Holism and serialism appear to be extreme manifestations of more fundamental processes, which are induced by systematic enforcement of the requirement for understanding. If the strict understanding condition is relaxed, as it is in class tutoring or self-study, some students act like 'holist' (comprehension learners) and others like 'serialist' (operation learners). (Pask, 1976b, p.133)

Pask concludes that both styles are needed for full understanding but nonetheless, comparison between students shows that there are marked differences in bias towards one style or the other.

By giving students feedback about their own style of learning, and discussing the characteristic pathologies of such strategies, it is thought to be possible to help develop a more versatile approach to learning. (Entwhistle, p.215)

In summary, the levels of understanding are strongly affected by the approach to learning. Although they are qualitatively different, there may also be a distinct hierarchy which runs from more complete to less complete understanding. A holistic approach to reading, for example, involves relating facts to conclusions in an active way which should bring the reader/student closer to the author/teacher's intended message.

1.3.3 Students' Adaptability to Strategy

Individual differences in the study process were also investigated by Biggs (1979). As predicted, students responded to study during the experiment in the manner they perceived they should, and adapted their strategy to the perceived demands of the task.

Ramsden (1979) investigated the effects of different contexts of learning. The results of this study showed that students adapt their learning strategy to the perceived demands of lectures and departments.

Svensson (1977) found that students took the same approach to experimental studies as they did in normal studies, whereas Laurillard (1979) has shown that students will take a surface or

deep approach to a task depending on the nature of a task. Thus, it is concluded that it is possible for students to change strategies and adopt an approach that appears more conducive to the task at hand. This lends support to the practical application of this research in that, if a student's approach to learning is flexible, it is a worthwhile endeavour to give students of a surface nature a technique that leads to a deep level of processing.

1.4 Generalized Learning Skills

The suggestion that 'common problem solving' skills underline all learning activity is examined by Pask (1978). Pask argues convincingly for the need at this particular time in history for skills in general problem-solving which he describes as 'learning to learn'.

> The balance between what subject matter should be structured (say, as an entailment mesh with its conversational domain) and what subject matter should be structured only by the student, depends upon the 'conscious being' being able to assume responsibility and 'learn to learn' or generally solve problems. Any person should have this skill, to some extent. Some people may learn anything on their own, by browsing and rumination. Other people may

> be able to exercise the skill in concert with others, or given the support afforded by a structured environment, and their ability to exercise the skill unaided, will be context specific. Finally, efficient education, the realization of several orders of magnitude increase in the rate of understanding topics, depends upon the appreciation and creation of valid analogies in which the skill of 'learning to learn' or of 'general problem solving' is an important (if not the only) ingredient. On these grounds, at least (and there are others that might be cited), it does not seem difficult to justify general problem solving as a prerequisite of education. (Pask, 1978, p.412)

Pask's recent work on the generality of problem-solving examines the literature on problem-solving in order to establish the credibility of a construct by showing that there is a skill called problem-solving that has certain common ingredients and that there are common features that can be described about its use in a wide variety of settings. Problem-solving may well be a generalized learning skill that would facilitate a deep level of processing, and 'mind mapping' could be a variation of that learning skill.

1.5 Mind Mapping: A Technique for Inducing Deep Level Processing

In exploring the many approaches that have been taken to the idea of improving 'learning', 'study skills" and 'learning to learn', and looking at the many resources that have been developed, one resource seemed to address all sides of the problem presented in this research. This resource, as previously mentioned, is "Use Your Head", produced by the BBC (1974) and based on the work of Tony Buzan.

Tony Buzan's work grew from his experience as a speed reading specialist and his work on memory and mnemonics. His ideas are most often presented by two- or three-day workshops given by teachers trained in Buzan's 'method'. Buzan claims that his method draws on both left and right hemispheric functions and helps the learner to understand his or her own processes and how to develop them, use them more efficiently and integrate them consciously. The empirical evidence for the work, however, is negligible.

The Use Your Head resource uses creativity exercises and problem-solving. It challenges the student to apply the new information in new situations. It promotes introspection and with it, internalized conversation. It also promotes perspective switching, analogy-searching and synergistic associational exercises of Gordon Pask's work. The circle retutns to Pask and the idea of learning to learn. Could the 'Mind Mapping'

technique be a facilitator in learning to learn? Could it actually affect learning style by expanding a natural human potential or deepen the natural process?

It would seem that 'creativity' with respect to learning is a key idea in Pask's theoretical model on the generality of problem-solving (Pask, 1978) and Marton's deep level processing.

The notation of learning that comes from these researchers is the flexibility to open up one's intellectual structure to accept a new idea that may profoundly change the structure by expanding or deepening it.

Deep level processing implies such a structural change, especially when knowledge structures probe the complexity of subjects and the inter-relationships between key concepts. Problem-solving also seems dependent on the intellectual hypothesis of such a change.

The 'Mind Mapping' technique was viewed as a possible way to induce these kinds of changes in the learner's processing of information. In this regard, this present study took an additional step in the direction started by Marton, Pask and others. Its goal was to study the effects of 'Mind Mapping' used as a technique on the learning of prose and from lectures that would represent the types of learning one is involved in, in the natural learning environment.

In achieving this goal, the theories previously discussed were relied upon as a base to examine the technique's value.

The 'Mind Mapping' technique or strategy involves a compilation of ideas. Like many innovations, it is not really new, but is a novel or different combination of existing ideas. The actual 'Mind Mapping' itself is based on a feature of Buzan's Use Your Head; it is also known as Key word note-taking, brain sprays and brain patterns notes.

In the actual process of 'Mind Mapping', one starts with a key word, symbol or drawing that represents the concept of what one is going to learn. As the student reads or hears more information on the topic, he or she chooses key words relevant to the initial key idea. The key words derive increasing meaning as they are self-generated and integrated into a progressively more complex conceptual framework or map. The key ideas are linked together through the use of connecting lines, arrows or colours in a creative way that will be meaningful to the learner as he continues to build his mind map. It is basically a technique of analysis done while learning, where one can show on paper a conceptual structure, which is a cluster of key words representing concepts and the way in which these concepts are related. (See Figure 1) 'Mind Mapping' is a very flexible tool that can help students (1) identify the main concepts in a block of learning, and (2) determine how key concepts are inter-related to provide deep level understanding. The 'Mind Mapping' booklet describes the technique in detail as well as providing justification for its use. (See Appendix B)

Mind Map

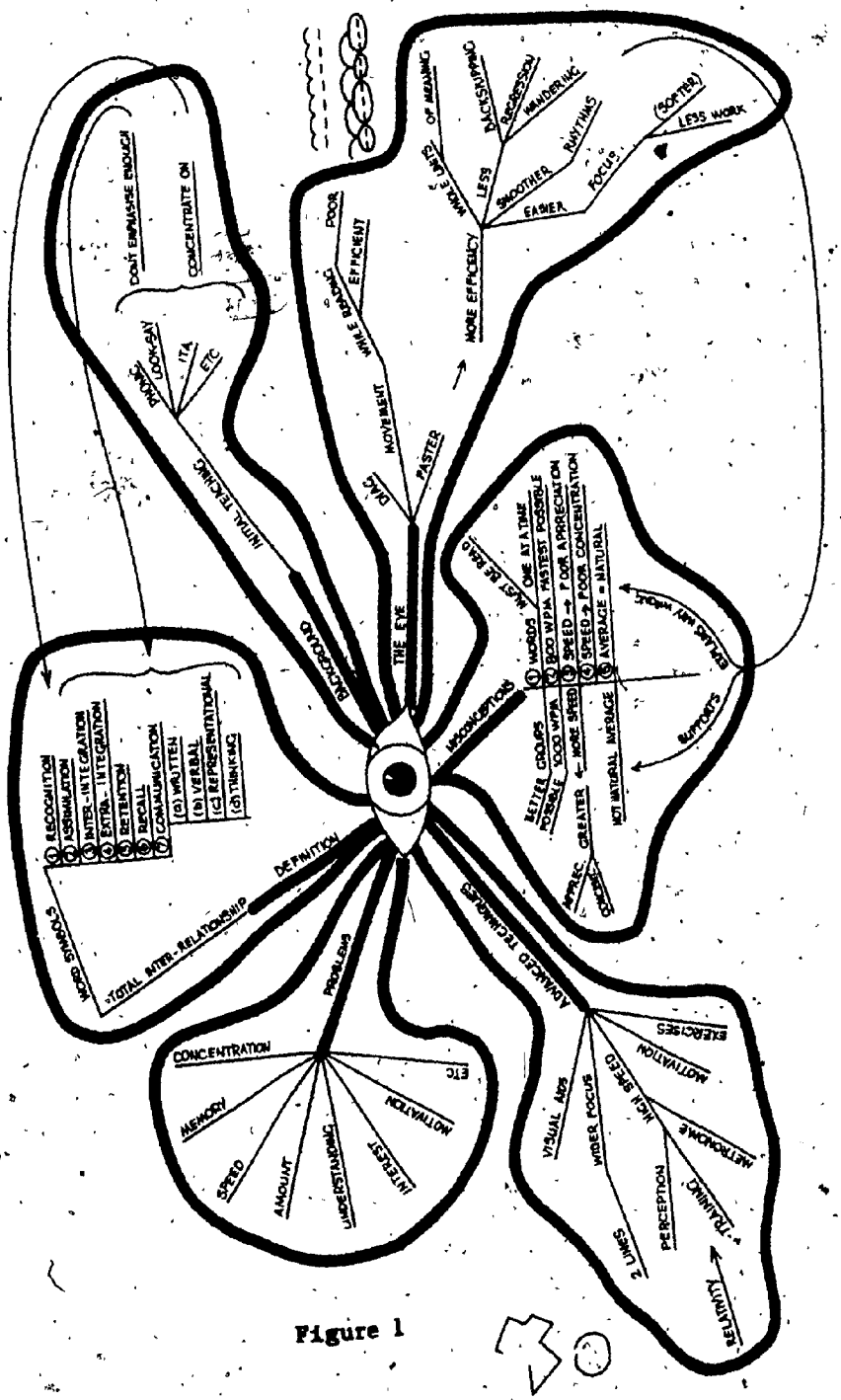

Figure 1

Buzan claims that the efficiency of the mind map for both memory and learning as well as for creativity is because it integrates both hemispheres of the brain. Whether or not this is the case was not the focus of this study; the investigation of the value of the technique in bringing about a deeper level of learning was the main concern.

1.6 Statement of the Theoretical Hypothesis

The general hypothesis was that the 'Mind Mapping' technique would facilitate a high level of understanding more than would be expected in a similar environment lacking the exposure to the technique.

1.6.1 Theoretical Definition

1. 'Mind Mapping' is a technique of note taking that incorporates the use of memory techniques, spatial visual organization, word association and concept linking.
2. Deep-level processing is operationally defined on page 34 in the context of scoring procedures.

1.6.2 Rationale for the General Hypothesis

Although there are many study skills resources available, almost all these suffer from the fact that they are extraneous to the learning process, i.e., they are not integrated with the content or structure of the knowledge to be learned. Having a skill that is intrinsic to the content leads to a deeper level processing. It demonstrates an approach to problem solving that is consistent with Pask's analysis, it is adaptable to individual styles, and is student-centered. It is containable within a learning system and exhibits features of system design. Students who are already at a deep level approach have already developed skills to achieve a high level of understanding, whereas students who do not process at a deep level will do so after being exposed to techniques that promote this type of approach to learning

1.6.3 Specific Question

1. Does training on the use of 'Mind Mapping' facilitate a higher level of understanding when reading prose? Does knowledge and practice of 'Mind Mapping' encourage a deeper approach to learning?

1.7 Operational Hypothesis

Students who go through the slide/tape presentation and follow-up book of activities (developed to teach the Mind Mapping technique) would give 'more comprehensive' answers (answers that demonstrate independent thinking) to the deep level processing questions than the surface level students who do not get this treatment.

1.7.1 Independent Variables

1. The slide/tape presentation introduces a technique of note-taking called 'Mind Mapping'. It includes the explanation of several skills used by a learner when processing information and demonstrates how these skills can lead to a deep level processing of information.
2. The 'Mind Mapping' booklet is a 60-page self-instructional booklet that reviews the Mind-Mapping technique and involves the student in actively trying this technique. (See Appendix B)
3. The response to the deep and surface level questions in the learning experiment allowed the evaluator to assess the level of understanding achieved by subjects as well as categorize the approach the student had taken in the process of learning. (See Appendix A)

1.8 Summary

In trying to focus upon the learner rather than the materials to be learned, this study subscribed to my understanding of educational technology, which emphasizes the diagnosis of educational needs, the design of effective learning systems, and the assessment of achievement through educational measurement and evaluation. In implementing the 'Mind Mapping' techniques, the study has attempted to satisfy the need to help students 'learn how to learn'. This study also fulfilled the task of designing an entire instructional package, where instructional objectives were identified, where instructional materials and activities were set up and implemented. Finally, through the application of the post-test and the attitude questionnaire, the study has also been able to monitor the progress of the students, to form some judgements about the characteristics and achievements of the students and especially assess the efficacy of the instructional materials.

2.0 METHOD

2.1 Sample

The sample for the study comprised 44 first-year English students at Dawson College. Due to the amount of time required to carry out this study, and the necessity of keeping the class atmosphere as natural as possible, the classes were treated as intact groups. Although intact groups may pose a threat to generalizability (since they are usually not random), in this case the administration personnel at the college assured the researcher that student assignment to these classes had indeed been random. Therefore the study's overall effect on the intact experimental group approximated the effect on a randomly selected group of subjects.

The experimental group consisted of 24 subjects: 11 females and 13 males. The mean age of the group was 18 years. The control group consisted of 20 subjects: 9 females and 11 males. The mean age of this group was also 18 years. The mother tongue of all subjects was English.

It is important to note that both groups were doing the exact same course of study, covering the same material over the same period of time. The time spent by the experimental group learning how to generate mind maps was not additional, but included in the fixed sequence of sessions.

2.2 Experimental Design

The hypothesis was tested using factorial design. The hypothesis called for a 2x2 design, with two independent factors (instructional method and level of processing) and a measure (post-test) with scores that correspond to two levels of processing.

2.3 Materials

* **Prose Passage** - A learning experiment, taken from Entwhistle's Styles of Learning and Teaching. This article was used in previous experiments (Marton, 1975-76) (Entwhistle, 1979a) to establish the approach students took to learning. It is an imaginative reconstruction of concepts which deliberately leads the learner into taking a very surface approach in search of facts or in the opposite extreme, to finding the general message the author is trying to deliver. The article is written for the 'intelligent layman', makes no specific demand on previous knowledge, and contains a clear argument supported by evidence. In summary, the questions, responses and scoring procedures in this learning experiment were designed to allow researchers to find patterns of relationship between approach and outcome. (See Appendix A)

* **Slide/Tape** - A presentation developed by the researcher on 'Mind Mapping' and how this technique can be applied to new learning situations. The presentation is composed of theory on a deep approach to learning, how we learn, the elements involved in the process of learning: linking ideas, looking for significance of a message, generalizing, memorizing, associating, etc. The actual 'Mind Mapping' technique draws on all of these elements and in the Slide/Tape these elements are looked at through actual construction of Mind Maps.

The Slide/Tape presentation was developed using the systems approach proposed by Romiszowski (1981). The initial version was reviewed and evaluated by a group of six Educational Technologists and two media consultants at CN Rail for content validity and quality of production. Based on the assessment of this group, the production was revised by increasing the pace of the presentation, rewording some of the statements and changing the graphics. The materials were later presented in a pilot project in an Educational Technology class at Concordia. No further revision was deemed necessary.

* **Practice Booklet** - A booklet developed by the researcher, making use of Buzan's material as a base to work from. It reviews the concept of 'Mind Mapping' as a useful technique for learning and also provides exercises on constructing mind maps from new information. The booklet was designed using

the same approach as mentioned for the slide/tape and was assessed by the same group. It too was pilot tested at Concordia; since this section required more input from the pilot test subjects only nine students reviewed the materials and offered opinions for revisions. These opinions mainly suggested rewording of statements and abbreviation of some of the content. Accordingly, this pilot group provided helpful information for production of the final version of the booklet. (See Appendix B)

Attitude Questionnaire - This questionnaire was designed to gather information from students regarding their attitudes towards the 'Mind Mapping' technique and to help assess the quality of the instructional materials. (See Appendix C)

2.4 Procedure

This experiment began the first week of the summer semester. A presentation on the materials and procedure had been given to the participating teachers. In the initial phase, both groups of students were introduced to the researcher and asked to participate in the experiment. Students were advised that they had the right not to participate. No one declined participation. During this time the students of both control and experimental groups were told what the study was about and what would be expected of them. The control group was advised that the researcher would return in five weeks to administer the learning

experiment. To begin the study, the experimental students did the Entwhistle inventory for approach to learning and, guided by the teacher, they rated themselves as to whether they were deep, surface or versatile learners. This was done only to stimulate interest in the study. This was followed by a discussion of 'learning to learn', reports from research on learning, learning skills and ability to change styles. The session took 1.5 hours and was part of the experimental treatment.

The following day, the experimental group (n=24) were shown the slide/tape presentation on the 'Mind Mapping' technique. After viewing the presentation, the researcher discussed the technique with the students and presented them with the practice booklet on 'Mind Mapping'. After perusing the booklet, the students participated in two simple exercises in 'Mind Mapping'. The researcher and teachers reviewed the maps with students, offering encouragement and direction on use of the technique. This session took 2 hours, after which the students were then asked to take the booklet home, read it and do the exercises involved. They were given five weeks to do this, during which time the teachers encouraged them to use the technique in class and while doing homework assignments.

The period of five weeks was chosen for several reasons, as follows: to allow students time to work through the booklet, master the technique and to apply the technique to their ongoing course of study.

At the end of the five weeks, both groups were given the learning experiment. Both groups were advised that they would be required to study an article, taking as much time as they needed, and that they would be tested afterwards. The Experimental group (n=24) was encouraged to use the 'Mind Mapping' technique, while the control group (n=20) was just told to approach the assignment as if it were any other class assignment. All subjects took approximately 2 hours to complete the learning experiment. In addition, the experimental group was asked to complete the attitude questionnaire. After testing, the students were given a written assessment of their approach to study by the researcher and level of understanding as measured by the Learning Experiment. (See Figure 2)

Procedure	Experimental Group	Control Group
Phase 1	Mind-Mapping Practice Booklet	
Phase 2	Prose Passage Post-test	Prose Passage Post-test
	n=24	n=20

Figure 2

3.0 RESULTS

3.0 Results

The purpose of this study was to examine the effect of the 'Mind Mapping' technique on the promotion of deep level learning.

The Chi-square test was applied to category frequencies obtained for levels of understanding. The Chi-square value 3.1 was obtained ($p<0.05$).

A t-test was calculated for the scores of Question 2 (specific detail learned) which compared the students' scores on specific detailed questions. The results of this test demonstrate that with a t value of $t=1.4$ ($p>0.05$), there was no significant difference between groups in this section of the test.

A Chi-square test was applied to the results of Question 3 of the post-test. This question assessed the approach students took to learning. The Chi-square value for Question 3 was 2.7 ($p>0.05$).

3.1 Data Analysis

Since judgement was involved in the scoring, the post-test was scored independently by two Educational Technologists. No differences were found between the two assessors' scores. In fact, the ratings were exactly identical for both. Each question was analysed separately and these will be discussed in consecutive order.

Question 1 was scored by adhering to the categories of Responses from Entwhistle's Learning Experiment. The Question and categories of Responses are as follows:

1. Write down what you have learned from this article. Imagine you were going to describe what the article is about to someone who had not read it. What would you say?

Levels of Understanding

The problem with categorizing the outcome of learning is that it necessarily depends on the particular article read. But as long as the article is appropriately difficult and presents a clear argument supported by evidence, it is possible to use a general classificatory scheme for describing differences in the levels of understanding reached by students in these experiments. It is usually possible to identify four types of response (Fransson, 1977; Saljo, 1975).

A. **Conclusion-oriented, detailed**

The student summarizes the author's main arguments, shows how evidence is used to support the argument, and explains the thoughts and reflections used to reach personal understanding of that argument.

B. **Conclusion-oriented, mentioning**

Again there is an adequate summary of the main argument, but the use of evidence or personal experience to support that argument is not made clear.

C. **Description, detailed**

The student gives an adequate list of the main points presented in the article, but fails to show how these are developed into an argument.

D. **Description, mentioning**

A few isolated points are made, some relevant, others irrelevant. At the bottom end of this category an impression of confusion and misunderstanding is given by the student's comments.

Note: The main difference between the two extracts which showed an emphasis on detail is that A brought together two main points to emphasize the author's message, while C listed the main points without integrating them effectively. B understands the author's message but does not relate it to any evidence, while D lists a series of topics. Note that C and D follow the order in which the article presents its main points, indicating more reliance on sequential memorization than on personal understanding.

By following the scoring scheme, the students were grouped by level of understanding A, B, C, D. If an A or B score was obtained, subjects were considered to have achieved a high level of understanding; if scoring C or D, they were considered to have achieved a low level of understanding.

The Chi-square test was then applied to the category scores of Question 1 in order to analyse the results.

Question 2 consisted of a set of eight specific detailed questions. The scores were found and then a t-test was calculated on the means of the two groups to determine the statistical significance of the results.

A t-test was calculated for the scores of Question 2 (specific detail learned) which compared the students' scores on specific detailed questions. The results of this test demonstrate that with a t value of $t=1.4$ ($p>0.05$), there was no significant difference between groups in this section of the test. Question 2 was not used to test any of the hypotheses, yet supplied additional information on the approach to learning. (See Appendix A for specific questions.)

Question 3 was designed to determine the approach students took to learning:

3. Students tackle the task of reading articles or books in many different ways, and with different expectations of what is required of them and of what they should be getting out of their reading. How did you tackle this article? Was this approach typical of, or different from, what you would do in your normal studying?

In Question 3 the approach to learning was again assessed by overall impression category scores of three aspects of the deep approach and the surface approach.

Deep Approach (3 aspects): * looking for meaning
* using previous knowledge
* relating facts to conclusion

Surface Approach (3 aspects): * looking for facts
* unease about the situation and outcome
* efforts to memorize

A Chi-square test was applied to determine significance of results.

3.1.1 Appraisal of Materials and Technique

Table 1 summarizes the students' responses on their opinions of the materials and the 'mind mapping' technique. Theirs reactions are extracted from the course unit evaluation form (Appendix C). The measurement used for the question is a 5-point Likert scale, ranging from a 5, denoting 'very effective', to 1, denoting 'not very effective'. The table shows the distribution of the mean scores of their responses.

Judging from the positive responses to all questions, students felt that the materials and technique were practical, interesting and effective.

Table 1

Appraisal of Materials and Technique

Question Areas	Mean Scores (Scale 1 to 5)
Usefulness of Materials	3.6
Value of Technique	3.7
Meaningfulness	3.7
Practical Application	3.8
Effectiveness	4.1

3.2 Discussion

In this study, the experimental group who received the 'Mind Mapping' technique exhibited greater level of understanding in learning. Concerning the results of the specific question section of the post-test, the differences between groups was only marginal. Finally, the deep approach to learning in the experimental group appeared to be proportionally higher than in the control group although the results were not statistically significant. In the following discussion, possible reasons for the results of this experiment will be explored. Recommendations for further research will also be drawn from this discussion.

The hypothesis of this study stated that subjects receiving the 'Mind Mapping' technique would display a greater understanding of the concepts dealt with in the learning experiment. As shown in the contingency table (Table 2), 71% of the experimental group had a high level of understanding on the post-test versus 29% scoring a low level of understanding. In comparison, the control group had only 40% scoring a high level of understanding, and 60% achieving a low level of understanding. The proportions show that the experimental group did much better than the control group in achieving high levels of understanding, with the Chi-square value of 3.1 showing this significance. (See Figure 3)

Table 2

Contingency Table for Question 1

(Level of Understanding)

	High	Low
Experimental	0.71	0.29
Control	0.40	0.60

N=44

$X^2 = 3.1$ $(p<0.05)$

Results of Question 1

(Level of Understanding)

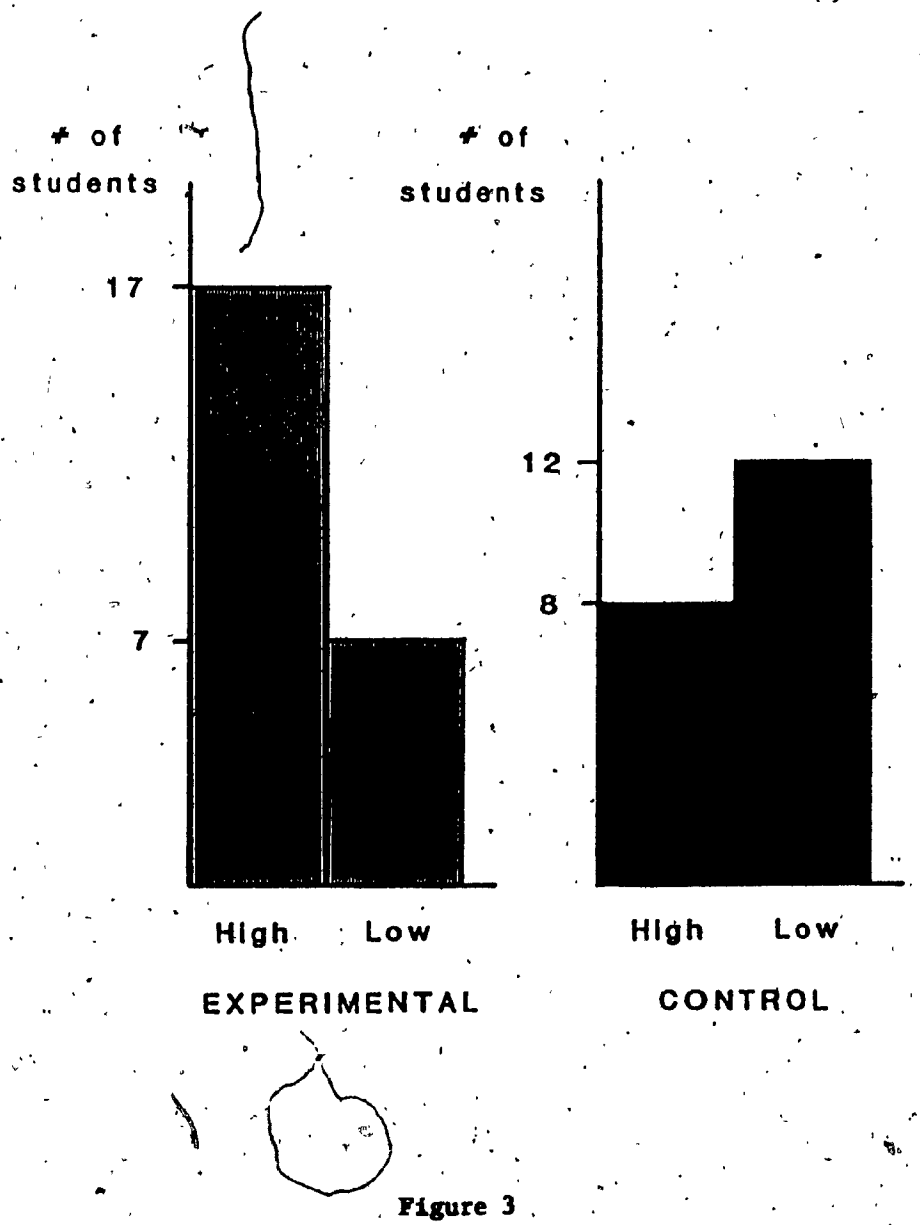

Figure 3

There are many possible reasons for this outcome. The teacher of the experimental group who was involved in this study was very interested in the technique and anxious to learn it herself. This enthusiasm, coupled with motivation to help her students do well in all studies, may have been a big factor in their adoption of the technique. The fact that the students had ample time to practise the technique, applied it to their ongoing learning in their courses and received encouragement from their teacher, probably accounted for the significance achieved. Also, the time spent discussing the approaches to learning may have affected the students as well.

The present work seems to lend support to the assertions of Entwhistle and Pask. Entwhistle (1981) proposes that by giving students feedback about their own style of learning and discussing the characteristic pathologies of such strategies, it is thought possible to help develop a more versatile approach to learning. Pask (1976b) states that the versatile learner, with command of both approaches, will achieve the most in learning.

One other area that must be considered is that of the instructional materials. Through the attitude questionnaire, the students expressed the opinion that the materials were well organized, interesting, effective and useful. In general, the ideas and concepts they learned during the study were novel to them and obviously seen as useful.

Question 2 was designed as a caricature of the extreme factual questions found in some examination papers and which may influence a student's subsequent approach to learning. Entwhistle states that it is very unlikely that a student would be able to remember the article in sufficient detail to give full answers to Question 2 because of the type of questions being asked. It would, however, be possible to answer most, if not all, of the questions correctly without really understanding the main message the author was trying to present.

As mentioned before, the differences between the scores is not significant. The experimental group scores were only marginally higher than the control group scores. Yet the fact that they appear slightly higher might indicate that, in striving to achieve a higher level of understanding while studying, the student might absorb more specific detail.

Question 3 attempted to determine the approach students took during study. The results were not statistically significant yet the proportions (see Table 3) show that 69% of the experimental group took a deep approach versus 31% taking a surface approach. In the control group, only 40% took a deep approach, whereas 60% took a surface approach. Also in this question, one subject in the experimental group did not answer this section of the post-test. Since the significance level is only marginally unacceptable, the larger sample would probably give a clearer indication as to whether the 'Mind Mapping' technique could

actually induce a deep level approach in students while learning. (See Figure 4)

Also, since Marton established that having a high understanding depends on being able to relate evidence and conclusions, a student's approach must necessarily have included this activity if a high level of understanding has been achieved. He also established that it is impossible for a student adopting a surface approach to reach a deep understanding of the article (Marton & Saljo, 1976a). Once again, with a larger sample, stronger conclusions may have been possible.

Table 3

Contingency Table for Question 3

(Approach to Learning)

	Deep	Surface
Experimental	0.69	0.31
Control	0.40	0.60

N=43

$X^2 = 2.7$ $(p>0.05)$

Results of Question 3

(Approach to Learning)

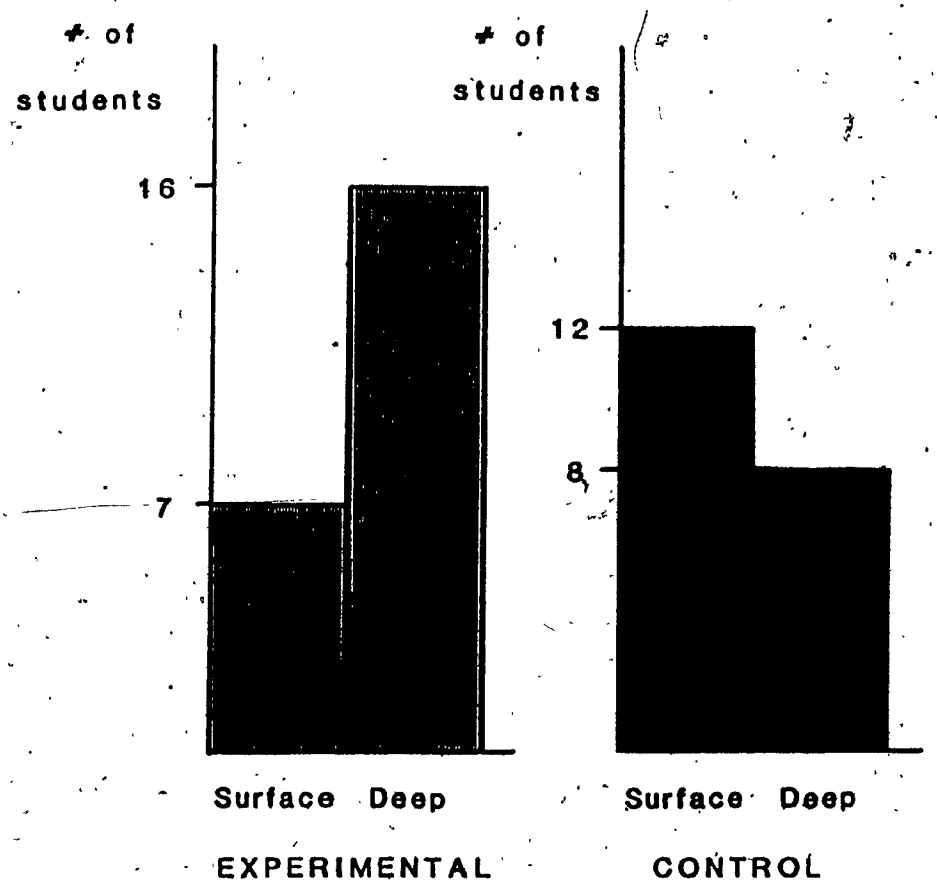

Figure 4

3.3 Summary

Based on the learning outcome of the students in the experimental group and their observed attitudes, it is concluded that 'Mind Mapping' as a technique to improve learning can yield a considerable level of success in comprehending academic material. It would be worthwhile to arrange for a broader trial with random assignment of subjects to groups to confirm the apparent effectiveness shown with this small sample. It might also be advisable to test this technique on learners at junior high and high school levels to determine optimal developmental levels for the application of this technique.

The question of whether or not the 'Mind Mapping' technique induces 'deep level' processing is not answered here, and therefore opens another area for further research. Once again, with larger samples and random assignment it might be possible to draw some conclusions about the technique in this regard. While psychological and instructional research is slowly building theories of instruction and learning, there remains a great need for the development of practical methods and techniques to help students learn how to learn. Perhaps educational technology research could further its practical objectives by continuing such studies of effective learning techniques.

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5.0 APPENDICES

5.1 APPENDIX A

The Learning Experiment

QUESTIONNAIRE ON THE WERTHEIMER ARTICLE

DO NOT LOOK AT THIS QUESTIONNAIRE UNTIL YOU HAVE FINISHED READING THE WERTHEIMER EXTRACT

Answer the first question before turning over to look at subsequent questions.

1. Write down what you have learned from the article. Imagine you were going to describe what the article is about to someone who had not read it. What would you say?

2. Specific questions

(a) What is traditional logic mainly concerned with?

(b) To what did Wertheimer compare the rules of formal logic?

(c) What was John Stuart Mill's contribution to logic said to be?

(d) How does associationism treat thinking?

(e) On what grounds did Wertheimer's consider each of these approaches to thinking to be inadequate?

(i) logic

(ii) associationism

(f) What method did the teacher in Wertheimer's example use to teach children how to find the area of a parallelogram?

(g) Why did Wertheimer consider this method to be inadequate?

(h) Wertheimer uses the analogy of a physicist's interest in the growth of crystals to illustrate the research approach he recommends for studying thinking. What is that approach and how does the analogy illustrate it?

3. Students tackle the task of reading articles or books in many different ways, and with different expectations of what is required of them and of what they should be getting out of their reading. How did you tackle this article? Was this approach typical of, or different from, what you would do in your normal studying?

Max Wertheimer*: Thinking as imaginative reconstruction

What occurs when, now and then, thinking really works productively? What happens when, now and then, thinking forges ahead? What is really going on in such a process?

If we look for answers in books, we often find apparently easy ones. But confronted by actual processes of this kind — when one has just had a creative idea, however modest the issue, when one has begun really to grasp an issue, when one has enjoyed a clean, productive process of thought — those answers often seem to cover up the real problems rather than to face them squarely. The flesh and blood of what has happened seem to be lacking in those answers.

Surely in the course of your life you have been curious about a lot of things, sometimes seriously. Have you been equally serious about what this thing called thinking may be? There are, in this world of ours, eating, thunderstorms, blossoms, crystals. Various sciences deal with them; they attempt by great effort to get real understanding, to grasp what these things really are. Are we equally serious when we ask what productive thinking is?

There are fine cases. You can find them often, even in daily life. If you have had your eyes open, you have probably encountered somewhere in your life — if nowhere else, then in children — this surprising event, the birth of a genuine idea, of a productive development, the transition from a blind attitude to understanding in a productive processs. If you have not been fortunate enough to experience it yourself, you may have encountered it in others; or you may — fascinated — have glimpsed it when reading good books.

Many are of the opinion that men do not like to think; that they will do much to avoid it; that they prefer to repeat instead. But in spite of many factors that are inimical to real thinking, that suffocate it, here and there it emerges and flourishes. And often one gets the strong impression that men, even children, long for it.

What really takes place in such processes? What happens if one really thinks, and thinks productively? What may be the decisive features and the steps? How do they come about? Whence the flash, the spark? What are the conditions, the attitudes, favorable or unfavorable to such remarkable events? What is the real difference between good and bad thinking? And in connection with all these questions: how improve thinking? your thinking? thinking itself? Suppose we were to make an inventory of basic operations in thinking — how would it look? What, basically, is at hand? Could the basic operations themselves be enlarged and improved, and thus be made more productive?

For more than two thousand years some of the best brains in philosophy, in logic, in psychology, in education, have worked hard to find real answers to these questions. The history of these efforts, the brilliant ideas brought forward, the hard work done in research and in theoretical discussion, present on the whole a rich, dramatic picture. Much has been achieved. In a large number of special questions solid contributions to understanding have been made. At the same time there is something tragic in the history of these efforts. Again and again when great thinkers compared the ready answers with actual, fine thinking, they were troubled and deeply dissatisfied — they felt that what had been done had merits, but that in fact it had perhaps not touched the core of the problem at all.

The situation is still somewhat of this kind. To be sure, many books deal with these questions as if, fundamentally, everything were settled — in one way or another. For there are basically different ideas about what thinking is, each with

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*Extracts taken from *Productive Thinking* published by Harper, New York in 1945 (pages 1-3, 5-11, 14-17, 45, 46, 48-50, 56-58).

serious consequences for behavior, for education. When observing a teacher we may often realize how serious the consequences of such ideas about thinking can be.

Although there are good teachers, with a natural feeling for what genuine thinking means, the situation in schools is often not good. How teachers act, how a subject matter is taught, how textbooks are written, all this is widely determined by two traditional views about the nature of thinking: the view of traditional logic and the view of association theory. These two views have their merits. To a degree they seem adequate to certain types of thought processes, to certain jobs in thinking; but it is at least an open question whether the way in which they interpret thinking does not cause serious hindrance, an actual impairment of genuine abilities. . . .

As a kind of background for the following discussions, I present first a very short characterization of the two traditional approaches. They surpass all others in the rigor and completeness with which they consider operations and establish basic concepts, standards, criteria, laws and rules. Other approaches — even if they seem at first in strong opposition to these two — often still contain as their very meat, in one way or another, precisely the operations, the rules of these two. Modern research in thinking is largely determined by one or the other, or both at the same time. I shall indicate their main lines, but shall omit some points which appear as additions of another nature and which, besides, are not clear in themselves.

Traditional logic attacked the problems in an ingenious fashion: how are we to find the main issues in the vast variety of the topics of thinking? As follows: thinking is concerned with truth. Being true or false is a quality of assertions, propositions, and only of these. The elementary form of proposition asserts or denies some predicate of a subject, in the form 'all S are P,' or 'no S is P,' or 'some are,' or 'some are not.' Propositions involve general concepts — class concepts. These are basic to all thinking. For the correctness of a proposition it is decisive that its 'intension' or 'extension' be dealt with correctly. On the basis of assertions inferences are drawn. Logic studies formal conditions under which inferences are or are not correct. Certain combinations of propositions make it possible to derive 'new', correct propositions. Such syllogisms, with their premises and their conclusions, are the crown, the very heart of traditional logic. Logic establishes the various forms of syllogism which guarantee correctness of the conclusion.

Although most of the textbook syllogisms seem barren, a kind of circle, like the classical example —

All men are mortal
Socrates is a man
therefore, Socrates is mortal —

there are examples of real discoveries which can in a first approach be regarded as syllogisms, as for example the discovery of the planet Neptune. But formally, basically, there seems to be no real difference between the two kinds of syllogism. The decisive characteristics and the rules are identical for both — the somewhat silly and the really sensible ones.

Traditional logic is concerned with the criteria that guarantee exactness, validity, consistency of general concepts, propositions, inferences and syllogisms. The main chapters of classical logic refer to these topics. To be sure, sometimes the rules of traditional logic remind one of an efficient police manual for regulating traffic.

If we disregard differences of terminology, controversies of a subtle nature, we may list as characteristic the following operations of traditional logic:

definition
comparison and discrimination
analysis
abstraction
generalization
forming class concepts
subsumption, etc.
forming propositions
forming inferences
forming syllogisms, etc.

These operations as conceived, defined, and utilized by the logician have been and are being taken by psychologists as subjects for investigation. As a result, we have many experimental investigations on abstraction, generalization, definition, drawing conclusions, etc.

Some psychologists would hold that a person is able to think, is intelligent, when he can carry out the operations of traditional logic correctly and easily. The inability to form general concepts, to abstract, to draw conclusions in syllogisms of certain formal types is viewed as a mental deficiency, which is determined and measured in experiments.

However, one may view classical logic, it had and has great merits:

in the decisiveness of its will to truth;
in the concentration on the basic difference between a mere assertion, a belief, and an exact judgment;
in its emphasis on the difference between hazy concepts, hazy generalizations, and exact formulations;
in the development of a host of formal criteria which are suited to testing for, and discovering mistakes, haziness in thinking such as unjustified generalization, jumping at conclusions;
in its emphasis on proof;
in the seriousness of the rules of discussion;
in the insistence on stringency and rigor in each individual step in thinking.

The system of traditional logic, as envisaged in its main lines in the *Organon* of Aristotle, was recognized as final through the centuries; elaborations were added here and there, but these did not change its main character. A new branch started at the time of the Renaissance, a development that was essential to the growth of modern science. The central point was the introduction, as fundamental, of a procedure which until then had been regarded as of minor value because of lack of complete conclusiveness. This is the procedure of induction, with its emphasis on experience and experimentation, a methodological concept which reached its greatest perfection in John Stuart Mill's famous canon of rules of induction.

The emphasis here is not on rational deduction from general propositions but on gathering facts, on studying the empirically constant connections of facts, of changes, and on observing the consequences of changes introduced into factual situations, procedures which culminate in general assumptions. Syllogisms are viewed as tools by which one can draw consequences from such hypothetical assumptions in order to test them.

It is widely believed that inductive logic adds to the classical rules and operations the emphasis on:

empirical observations
careful gathering of facts
studying problems empirically
introducing experimental methods
correlating facts
developing crucial tests

The second great theory of thinking is centered in the classical theory of associationism. Thinking is a chain of ideas (or, in more modern terms, a chain of stimuli and responses, or a chain of behavior elements). The way to understand thinking is clear: we have to study the laws governing the succession of ideas (or, in modern terms, of behavioral items). An 'idea' in classical association theory is some remnant of perception, a copy, in more modern terms, a trace of stimulations. What is the fundamental law of the succession, of the connection of these items? Answer — very elegant in its theoretical simplicity: if two items, *a* and *b*, have often occurred together, a subsequent occurrence of *a* will call forth *b* in the subject. Basically the items are connected in the way in which my friend's telephone number is connected with his name, in which nonsense syllables become reproducible when learned in a series of such syllables, or in which a dog is conditioned to respond with salivation to a certain musical sound.

Habit, past experience, in the sense of items repeated in contiguity — inertia rather than reason, are the essential factors, just as David Hume had maintained. As compared with classical associationism, this theory is now being developed in a most intricate way; but the old idea of repetition, in contiguity, is still the central feature. A leading exponent of this approach stated explicitly not long ago that the modern theory of the conditioned reflex is essentially *of the same nature* as classical associationism.

The list of operations here looks about as follows:

association, acquiring connections — bonds on the basis of repetitions
role of frequency, of recency
recall from past experience
trial and error, with chance success
learning on the basis of repeated success
acting in line with conditioned responses, and with habit

These operations and processes are now being widely studied with highly developed methods.

Many psychologists would say: ability to think is the working of associative bonds; it can be measured by the number of associations a subject has acquired, by the ease and correctness with which he learns and recalls them.

No doubt there are merits in this approach also, with regard to the subtle features at work in this kind of learning and behaving.

Both approaches had difficulties with regard to sensible, productive processes of thinking.

Consider first traditional logic. In the course of the centuries there arose again and again a deep-felt dissatisfaction with the manner in which traditional logic handles such processes. In comparison with actual, sensible, and productive processes, the topics as well as the customary examples of traditional logic often look dull, insipid, lifeless. To be sure, the treatment is rigorous enough, yet often it seems barren, boring, empty, unproductive. If one tries to describe processes of genuine thinking in terms of formal traditional logic, the result is often unsatisfactory: one has, then, a series of correct operations, but the sense of the process and what was vital, forceful, creative in it seems somehow to have

evaporated in the formulations. On the other hand it is possible to have a chain of logical operations, each perfectly correct in itself, which does not form a sensible train of thought. Indeed there are people with logical training who in certain situations produce series of correct operations which, viewed as a whole, nevertheless form something akin to a flight of ideas. Training in traditional logic is not to be disparaged: it leads to stringency and rigor in each step, it contributes to critical-mindedness; but it does not, in itself, seem to give rise to productive thinking. In short, there is the danger of being empty and senseless, though exact; and there is always the difficulty with regard to real productiveness.

Realization of the latter point — among others — led in fact to the emphatic declaration by some logicians that logic, interested in correctness and validity, has nothing at all to do with factual thinking or with questions of productivity. A reason was also given for this: logic, it was said, has timeless implications and is, therefore, in principle, divorced from questions of actual thought processes which are merely factual and, of necessity, processes in time. This separation was certainly meritorious for certain problems; from a broader view, however, such assertions often look somehow like the declaration of the fox that the grapes were sour.

Similar difficulties arose in association theory: the fact that we have to distinguish between sensible thought and senseless combinations, and the difficulty in dealing with the *productive* side of thinking.

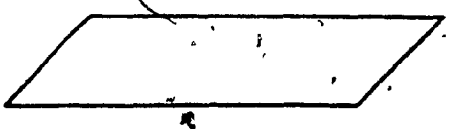
If a problem is solved by recall, by mechanical repetition of what has been drilled, by sheer chance discovery in a succession of blind trials, one would hesitate to call such a process sensible thinking; and it seems doubtful whether the piling up of such factors only, even in large numbers, can lead to an adequate picture of sensible processes.

(The distinction between productive thinking and the approaches more commonly encouraged in school work can best be illustrated by concrete examples. One such example is a problem children are often given – finding the area of a parallelogram.)

I am visiting a classroom. The teacher: 'During the last lesson we learned how to find the area of a rectangle. Do you all know it?'

The class: 'Yes.' One pupil calls out: 'The area of a rectangle is equal to the product of the two sides.' The teacher approves, then gives a number of problems with rectangles of varying sizes, which all solve readily.

'Now,' says the teacher, 'we shall go on.' He draws a parallelogram on the blackboard: 'This is called a parallelogram. A parallelogram is a plane quadrilateral the opposite sides of which are equal and parallel.'

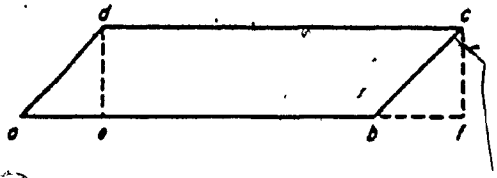


Here a pupil raises his hand: 'Please, teacher, how long are the sides?' 'Oh, the sides may be of very different lengths,' says the teacher. 'In our case one line measures 11 inches, the other 5 inches.' 'Then the area is 5 × 11 square inches.' 'No,' answers the teacher, 'That's wrong; you will now learn how to find the area of a parallelogram.' He labels the corners *a, b, c, d.*

'I drop one perpendicular from the upper left corner and another perpendicular from the upper right corner.

'I extend the base line to the right.

'I label the two new points *e* and *f*.'



With the help of this figure he then proceeds to the usual proof of the theorem that the area of a parallelogram is equal to the product of the base by the altitude, establishing the equality of certain lines and angles and the congruence of the pair of triangles. In each case he states the previously learned theorem, postulate, or axiom upon which the equality or congruence is based. Finally he concludes that it has been proved that the area of a parallelogram is equal to the base times the altitude.

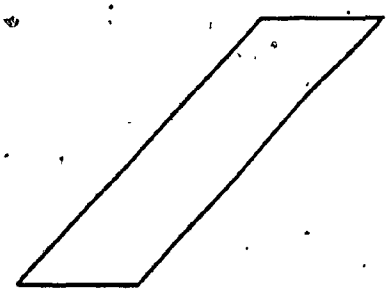
'You will find what I have shown you in your textbook on page 62. Do the lesson at home; repeat it carefully so that you will know it well.'

The teacher now gives a number of problems all of which require finding the areas of parallelograms of different sizes, sides and angles. This being a 'good' class, the problems are all correctly solved. Before the end of the hour the teacher assigns ten more problems of this kind for homework.

At the next meeting of the class, one day later, I am there again.

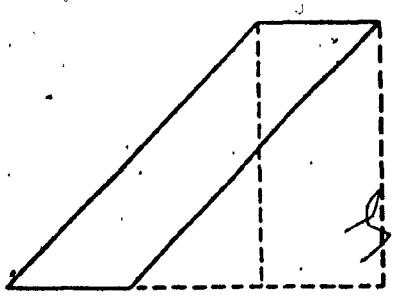
The lesson begins with the teacher calling on a pupil to demonstrate how the area of a parallelogram is found. The pupil does it exactly. One sees that he has learned the problem. The teacher whispers to me: 'And he is not the best of my pupils. Without doubt the others know it as well.' A written quiz brings good results.

Most people would say, 'This is an excellent class; the teaching goal has been reached.' But observing the class I feel uneasy, I am troubled. 'What have they learned?' I ask myself. 'Have they done any thinking at all? Have they grasped the issue? Maybe all that they have done is little more than blind repetition. To be sure, they have solved promptly the various tasks the teacher has assigned, and so they have learned something of a general character, involving some abstraction. Not only were they able to repeat word for word what the teacher said, there was easy transfer as well. But — have they grasped the issue at all? How can I clarify it? What can I *do*?'



I ask the teacher whether he will allow me to put a question to the class. 'With pleasure,' he answers, clearly proud of his class.

I go to the board and draw this figure.

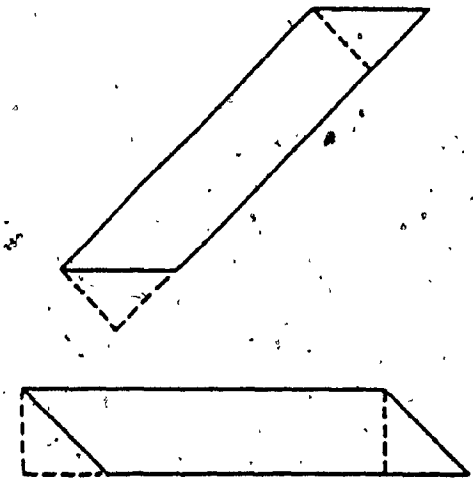


Some are obviously taken aback.

One pupil raises his hand: 'Teacher, we haven't had that yet.'

Others are busy. They have copied the figure on paper, they draw the auxiliary lines as they were taught, dropping perpendiculars from the two upper corners and extending the base line. Then they look bewildered, perplexed.

Some do not look at all unhappy; they write firmly below their drawing: 'The area is equal to the base times the altitude' — a correct subsumption, but perhaps an entirely blind one. When asked whether they can show it to be true in this case, they too become perplexed.



With still others it is entirely different. Their faces brighten, they smile and draw the following lines in the figure, or they turn their papers through 45°, and do it.

The teacher, observing that only a minority of the pupils has mastered the problem, says to me with some indignation: 'You certainly gave them a queer figure. Naturally they are unable to deal with it.'

Now just between us, haven't you too been thinking: 'No wonder so many failed when he gave them a figure so unfamiliar!' But is it less familiar than the variations of the original figure which the teacher previously gave and which they solved? The teacher did give problems in which the figures varied greatly with regard to length of sides, size of angles, and size of areas. These were decided variations, and they did not appear at all difficult for the pupils. Did you notice, perchance, that my parallelogram is simply the teacher's original figure turned around? With regard to all the part-qualities it was not more but less different from the original figure than the teacher's variations. . . .

Now I shall tell what happened when I put the problem of the area of the *parallelogram* to subjects, especially children, after having briefly shown how the area of the rectangle is found, saying nothing further, giving no help, simply waiting for what they would say or do. There were grown ups of all types, students who showed by their reactions that they had entirely forgotten this theorem, and children who had never heard of geometry, even children as young as five.

There are different types of reactions.

First type. No reaction at all.

Or someone says, "Whew! mathematics!" and dismisses the problem with, "I don't like mathematics."

Some subjects simply wait politely for what is to come or ask, 'What else?'

Others say, 'I don't know; that is something I have not learned.' Or, 'I learned that in school but I have completely forgotten it,' and that is all. Some show indignation: 'How do you expect me to be able to do that?' To which I reply, 'Why not try it?'

Second type. Others search their memory intensively, some even frantically, to see if they can recall anything that might be of help. They search blindly for some scraps of knowledge that might apply.

Some ask, 'Could I ask my older brother? He surely knows.' Or: 'Could I look for it in a geometry book?' Which is certainly one way of solving problems.

Third type. Some start making speeches. They talk around the problem, telling of analogous situations. Or they classify it in some way, applying general terms, perform some subsumptions, or engage in aimless trials.

Fourth type. But in a number of cases one can observe real thinking at work — in drawings, in remarks, in thinking out loud.

'Here is this figure — how can I get at the size of the area? I see no possibility. The area just in this form?'

'Something has to be done. I have to change something, change it in a way that would lead me to see the area clearly. Something is wrong.' At this stage some children produce Figure 1. In such cases I add: 'It would be nice to be able to compare the size of the area of the parallelogram with the area of the rectangle.' The child is helpless, then starts anew.

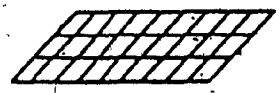
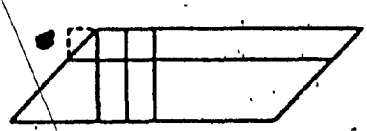


Figure 1

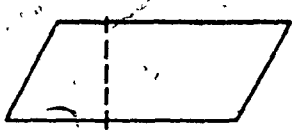
There were other cases in which the child said: 'I have to get rid of the trouble. This figure cannot be divided into little squares.'...



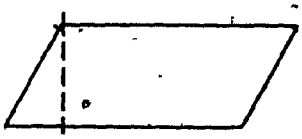
But there were cases in which the thinking went straight ahead. Some children reached the solution with little or no help in a genuine, sensible, direct way. Sometimes, after strained concentration, a face brightened at the critical moment. It is wonderful to observe the beautiful transformation from blindness to seeing the point!

First I shall report what happened with a 5½-year-old child to whom I gave no help at all for the parallelogram. Given the parallelogram problem, after she had been shown briefly how to get at the area of the rectangle, she said, 'I certainly don't know how to do *that*.' Then after a moment of silence: 'This is *no good here*,' pointing to the region at the left end; 'and *no good here*,' pointing to the region at the right.

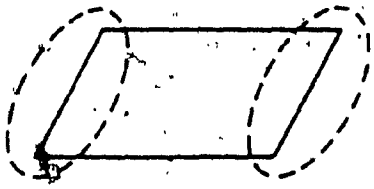
'It's troublesome, here and there.' Hesitatingly she said: 'I could make it right here... but...' Suddenly she cried out, 'May I have a scissors?' What is bad there is just what is needed here. It fits.' She took the scissors, cut vertically, and



placed the left end at the right. Another child proceeded in a similar way to cut off the triangle.



In several cases the procedure ran this way:



1.	'Disturbance'	'Disturbance also'
2.	'Too much here'	'Too much here'
3.	_____	'No! This needs over here at the right just what is too much at the left.'

and she put the left end 'in order.' Then, looking at the other end, she tried to do the same thing there, but changed suddenly from seeing it as 'too much' to seeing it as 'gap.'

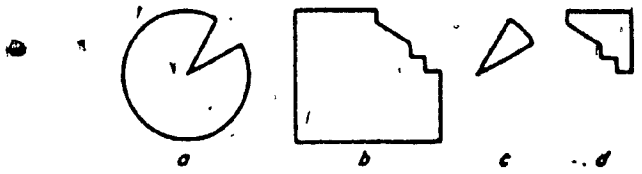
There were other ways. A child to whom I had given the parallelogram, a long one cut out of paper, remarked in the beginning, 'The whole middle part is all right, but the ends —' She continued to look at the form, clearly interested in the ends, suddenly took the paper figure, and, with a smile, made it into a ring, bringing the two ends together. Asked what this meant, she answered, holding the two ends together with her little fingers: 'Why, I can cut it now, this way' and indicated a vertical somewhere in the middle, 'Then it is all right.'...

What are the operations, the steps in the procedure?

We saw that in such genuine, positive processes as those just described, there are operations (such as) regrouping with regard to the whole, reorganization,

fitting; factors of inner-relatedness and of inner requirements are discovered, realized, and followed up. The steps were taken, the operations were clearly done in view of the whole figure and of the whole situation. They arose by virtue of their part-function, not by blind recall or blind trial; their content, their direction, their application grew out of the requirements of the problem. Such a process is not just a sum of several steps, not an aggregate of several operations, but the growth of one line of thinking out of the gaps in the situation, out of the structural troubles and the desire to remedy them, to straighten out what is bad, to get at the good inner relatedness. It is not a process that moves from pieces to an aggregate, from below to above, but from above to below, from the nature of the structural trouble to the concrete steps.

It is also interesting to observe the behavior of children (even of very young children) in the following situations. Four solid figures of this kind are given:



Children often show a strong trend to bring them together properly, to fit *c* into *a*, *d* into *b*. If the grownup tries to do it the other way, insists on placing *d* with *a*, and *c* with *b*, or puts *c* with *a*, and *d* with *b* but improperly, children are often not only puzzled, or amused, but interfere passionately, fitting the figures into their proper positions.

In all these cases we have structural changes, tendencies toward the better structure, toward fitting, with the disappearance of disturbances.

Such changes are often dramatic in productive processes, much more so than in this modest example of the parallelogram. Indeed, the whole process is often a kind of drama with powerful dramatic forces — with tension and dramatic structural changes in the transition from an incomplete or inadequate structure to a view of the complete, consistent structure, in the transition from not having understood structurally, from being troubled, to really grasping and realizing the requirements.

The most urgent need in the experimental investigation of the problems seems to be not so much to get the quantitative answer, 'How many children achieve a solution, how many fail, at what age?' etc., but to get at an understanding of what happens in good and in bad processes.

A physicist studying crystallization may try to find out in how many cases he finds pure crystals and in how many he does not — there are crippled crystals some corners of which are jagged, there are impure crystals, there are Siamese twin crystals improperly grown together, there are even crystals shaped by artificial polishing into perfect forms entirely incongruous with their nature. All such cases are of primary interest to the physicist, not as problems of statistics but for what they reveal of the inner nature of genuine crystallization.

It is also important to find out what are the conditions under which pure crystallization may take place, what conditions favor it, what factors endanger it.

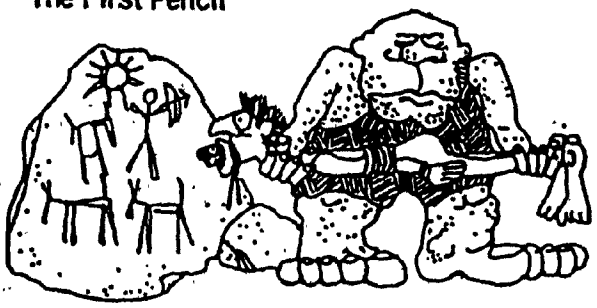
And so in psychology.

5

5.2 APPENDIX B

Practice Book: Mind Mapping

The First Pencil



Don't be afraid to try new things.

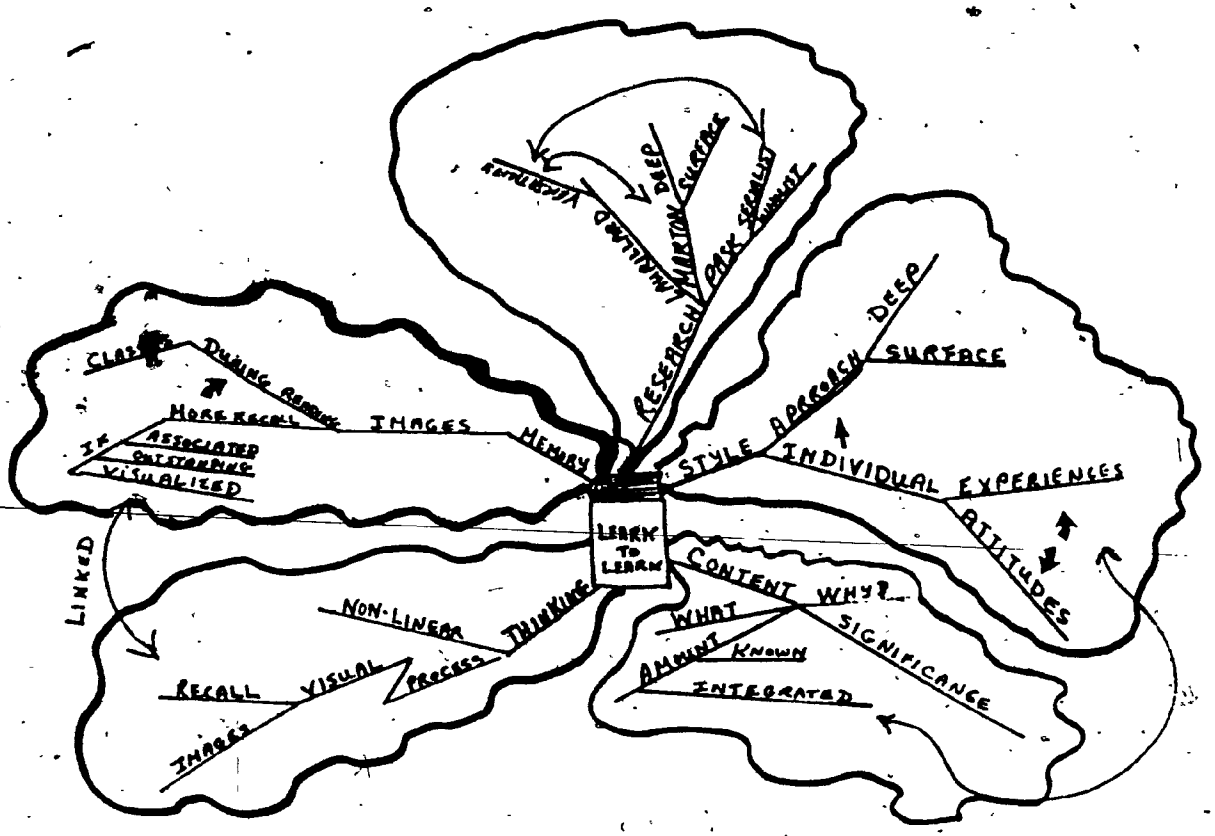
The Mind-Maps on the following pages represent a new technique for noting.

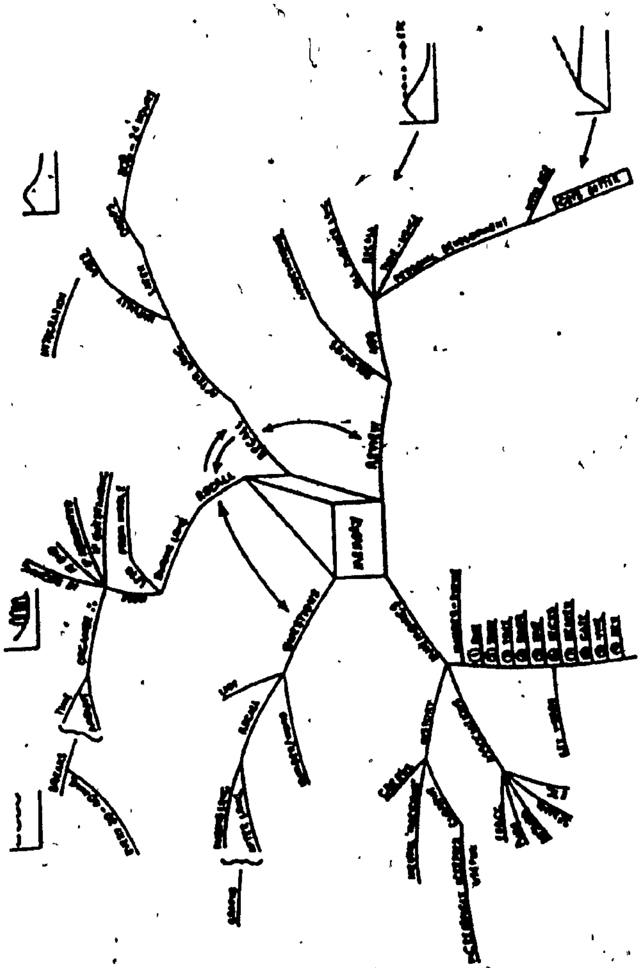
These maps summarize the sections of this booklet.

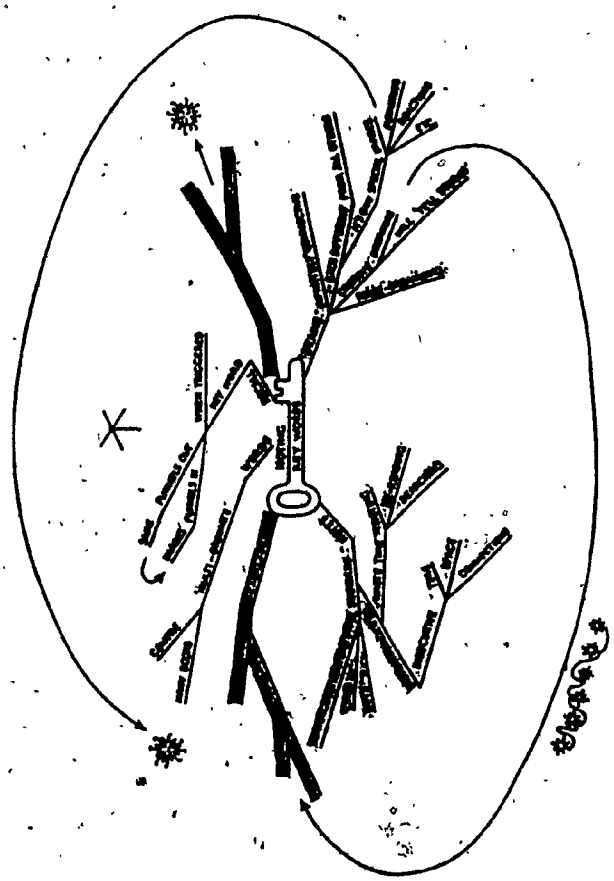
In these 'Mind-Maps' key words are linked to each other around a Main Center (in these cases, the overall theme of a section), and a mental picture is built up of an entire thought structure.

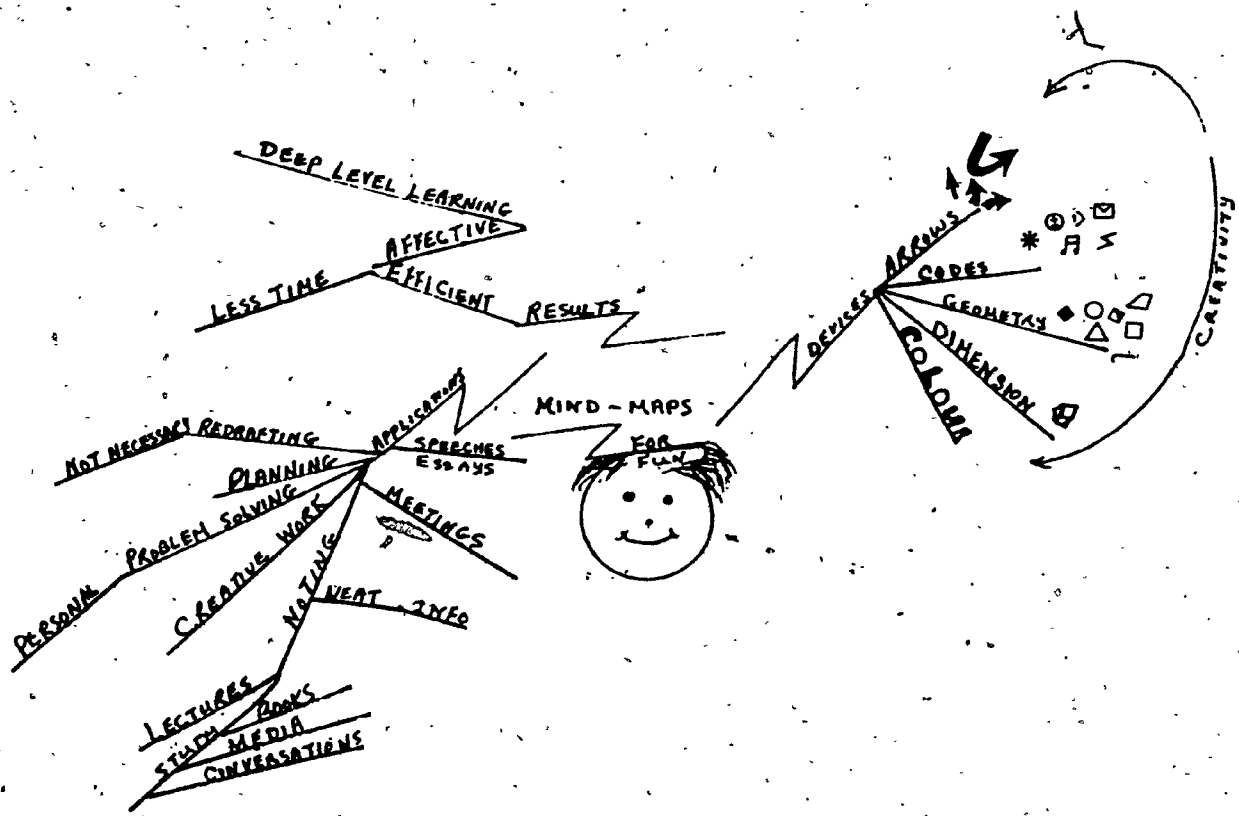
- Use the Mind-Maps as a preview of what is to come, they will make the reading easier.

- After finishing the booklet, look at the Mind-Maps again. This will serve as a good review, and will help you to remember what you have read.


LEARN TO LEARN
RESEARCH
DEEP
SURFACE
STYLE APPROACH
INDIVIDUAL EXPERIENCES
ATTITUDES
CONTENT WHY?
WHAT
SIGNIFICANCE
AMOUNT KNOWN
INTEGRATED
NON-LINEAR THINKING
RECALL VISUAL PROCESS
IMAGES
LINKED
IMAGES
MEMORY
HOW RECALL
ASSOCIATED
VISUALIZED






DEEP LEVEL LEARNING
AFFECTIVE
LESS TIME
EFFICIENT RESULTS
MIND - MAPS
FOR FUN
DEVICES
ARROWS
CODES
GEOMETRY
DIMENSION
COLOURS
CREATIVITY
APPLICATIONS
NOT NECESSARY REDRAFTING
PLANNING
PROBLEM SOLVING
CREATIVE WORK
PERSONAL
SPEECHES
ESSAYS
MEETINGS
NOTING
VERY USEFUL
LECTURES
BOOKS
STUDY
MEDIA
CONVERSATIONS

MIND-MAPPING

Mind-Mapping is a course with a difference, rather than learning a set subject this course is about learning itself.

During the course you will be exploring your own learning, finding out how you can improve upon what you already know, how you can improve your ability to remember, to think and to create and to solve problems.

The information and the technique presented in this course is not a prescription for instant success. You probably already know a great deal about how you learn best. Maybe you feel like many other people, that you would like to be able to learn a lot more! Because of your individual life experience and your attitudes, your learning will always be unique to you. We expect you to be critical about this course. Think about and try what seems comfortable to you. Perhaps you will find that you are a much more efficient learner than you think you are!

At the end of this course you should:

1) Be able to remember more
2) Be able to use Mind-Maps for recall, study and creative purposes.
3) Be more aware of how you think and how you learn.

Now, before we begin this course take a few minutes to write down what you think learning is, what happens to you when you learn. Remember, there is no right or wrong answer because everyone's answer will be unique.

At the end of the course you will be asked to do this again. We hope that you will find some changes in your concept of what learning means to you.

LEARNING

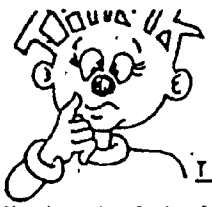
There is more to your learning than skills. There is your experience and your attitude. Whenever you try to learn something you bring to the situation all your previous experience of learning, all your previous knowledge and your attitudes. These will be different for each person and it is this uniqueness that makes teaching and learning difficult processes to understand.

By itself "learning to learn" is an almost useless activity. We cannot read without having something to read. Indeed, learning is part of knowledge as learning involves both what you are learning and how you are learning it. Therefore, you must apply this course to learning something. You must decide what you want to learn and how you will do it.

As the purpose of the course is to help you improve your learning, this process should continue long after you've finished the course. For this reason no time schedule is provided.

As you take this course, you will be expected to practice and apply what you learn by using your ongoing courses. You won't be checked on this because it is you who must want to improve your learning.

TIME_____



THINKING CHECKLIST

Check each of the following statements that best expresses the feeling you had while you were learning. The statements particularly apply to learning from reading. You may add your own reactions, if you like.

_____ 1. I really thought about the point of what I was learning.

_____ 2. I didn't remember what I read, because I was just thinking of hurrying on . . .

_____ 3. I got a clear impression of what it meant.

_____ 4. The whole time I was thinking "how I must remember this" and "now I must remember this".

_____ 5. I tried to make connection between various points.

_____ 6. I just read straight through without looking back at anything.

_____ 7. I thought over all the ideas and tried to build up an outline in my head.

_____ 8. I wasn't so much that I drew conclusions... and reacted to them... but that, well, that I read it sort of because I was supposed to read it... and not so as to react to it.

_____ 9. I tried to relate the ideas to what I already know.

_____ 10. I was thinking about the fact that I was going to have to repeat all this...I didn't think about what I was reading.

YOUR COMMENTS:

_____

_____

_____

_____

_____

_____

1. To get you started, here is a little test. Get a friend to time you as you do this.

   In two minutes, write down all the uses for a paper clip that you can think of. Any idea goes!

Count the number of separate uses of a paper clip. Divide by 2 and enter into the box. ☐

This is a standard Creativity Test. Most people score between 0 and 7. Anything over 8 is unusual, 12 is exceptionally rare and 15 incredible! Do not worry about your score at this time because this test only measures quantity and not the quality of the ideas generated, creativity involves both.

Think about what was going on in your brain as you were doing this. How were you thinking, in pictures, in words, in actions? Write down your reactions. How did you feel about this?

Approaches to Learning

The researchers working within the new paradigm of student learning have been focusing on issues such as: what students learn, how they approach study, the relationships between approach to study and learning outcome, what students understand learning to consist of, and whether it is possible to manipulate students approaches to studying in order to influence the learning outcome.

What does it take to learn?, questions (Marton, 1975A) as he sets the goal of his research to arrive at a description of differences in the outcome of learning in students. A variation in depth in the process of learning (level of processing) was found as well as a correspondence to the variation in depth in the outcome of learning (level of outcome). The two levels identified in this study (deep and surface) are, of course, not to be considered as two distinct and separate categories. Rather they imply a dimension along which individuals vary.

The students who took the deep level approach concentrated on what the discourse was about rather than the discourse itself. However, the key idea that Marton suggests is not just the variation in learning style, but also cognitive skills to penetrate different content at a deep level. His view of the purpose of cognitive skills is precisely stated in the following:

> ...If the training of skills is not only aimed at skills in the sense of technique (eg. to use reference books, to underline, to find ones' way around a library), then one has missed what we

consider to be the real purpose of the cognitive skills. On the other hand, concentrate on knowledge at a superficial level, ie., more or less in the form of learning by rote, is unlikely to result in knowledge of any value or interest. One should seek to promote as deep an understanding of different content as possible, independent of whether one insists upon skills or knowledge. If one has a certain content of a course or a curriculum as a starting point, then wholehearted concentration on deeper understanding means that the content must be reduced drastically from a quantitative point of view compared with what is usual today. If, on the other hand, one starts with different concrete problems rooted in the students' own experience and spheres of interest, then one must endeavor to take the analysis to a sufficiently deep level. Irrespective of the content one begins with, one must arrive at a set of limited number of scientific concepts and principles in terms of which an unlimited number of varying phenomena can be interpreted. If this is not done and if one - as the learner - does not penetrate further ones' analysis of the initial problem than that which is specific for just that problem, then one is hardly better equipped to meet the new problem. (Marton, 1979, p. 612)

Attempts to induce deep level processing through the manipulation of questions resulted in students using a technified approach. (Marton & Saljo 1976)

> the very questions intended to induce deep-level processing becomes the focal attention instead of a thorough comprehension of the entire discourse which the questions (or rather the answers to them) were meant to be signs of. (p. 7)

Although the attempt was unsuccessful the study did further demonstrate the relationship between the approach a student takes to a learning task and the learning outcome.

Individual differences in student's approach to learning and the learning outcome was also investigated by (Gordon Pask, 1976a) the use of a "teach back" technique, where students gave a spontaneous account of the topic they were studying which employed in these studies. Pask distinguished between serialist and holist learners. Thus, Pask derived this dicotomy of learning style.

> Holism and Serialism appear to be extreme manifestations of more fundamental processes, which are induced by systematic enforcement of the requirement for understanding. If the strict understanding condition is relaxed, as it is in class tutoring or self-study, some students act 'like holist' (comprehension learner) and others 'like serialist' (operation learners) (Pask, 1976b, p. 133)

Pask concludes that both styles are needed for full understanding but nontheless, comparison between students show that there are marked differences in bias towards one style or the other.

Students adaptability to STRATEGEY

Individual differences in the study process was also investigated by Biggs (1979), as predicted students responded to study during the experiment in the manner they perceived they should, adapting their strategey to the perceived demands of the task.

Ramsden (1979) investigated the effects of different contexts of learning, the results of this study showed that students adapt their learning strategey to the perceived demands of lectures and departments.

Swenson (1977) found that students took the same approach to experimental studies as they did in normal studies, whereas Laurillard (1979) has shown that students will take a surface or deep approach to a task depending on the nature of a task, thus it is concluded that it is possible for students to change strategies and adopt an approach that appears more condusive to the task at hand. This lends support to the practical application of this proposal in that, if a skill is adapted by the learner in this experimental study they may very well use it in normal studies.

PURPOSE

The purpose of this stage is to help you understand how your memory works and to explore ways of using it to remember what you learn.

DISCUSSION

In Stage 1, we learned that there are several styles and approaches to learning. Perhaps at this point you are wondering how this course can possibly be of value to you right now. You may be thinking how you are ever going to be able to do all this particulary when you have trouble even remembering telephone numbers. It is important to remember that even though this course presents information about learning which lead to a learning method, it is up to you to explore what works best for you.

Here are some things to remember and (hopefully) to encourage you.

1. Study Habits are partly a matter of personal choice.

2. No magic tricks exist which will automatically triple learning efficiency.

3. We all have quite a bit of ingenuity in choosing strategies which suit our needs.

4. Personal study styles change slowly, develop slowly and cannot easily be altered. This course asks you to think about yours.

5. Adotping new methods may result in getting worse to start with. While we have been encouraging you to think about your learning in order to conciously choose how to improve your self-conciousness may be distracting, at first. This will disappear as you get used to the new methods.

6. Techniques must have a purpose. Only if you know what you want to get out of learning can you choose what methods will work best for you. Always ask yourself why you are doing something. If you can't find an answer, perhaps that's why it seems so difficult!

MEMORY

Since the time of the Greeks certain individuals have impressed their fellow men with the most amazing feats of memory. They have been able to remember: hundreds of items backwards and forwards and in any order; dates and numbers; names and faces; and have been able to perform special memory tricks such as memorising whole areas of knowledge perfectly, or remembering decks of cards in the order anyone chose to present them.

In most cases these individuals were using special memorising techniques known as mnemonics. Traditionally these techniques have been scorned as mere tricks, but recently the attitude towards them has begun to change. It has been realised that methods which initially enable minds to remember something more easily and quickly, and then to remember it for much longer afterwards, must be more than simple tricks.

Current knowledge about the ways in which our minds work shows that these techniques are indeed closely connected to the basic ways in which the mind functions. The use of mnemonic techniques has consequently gained respectability and popularity, and they are currently being taught in universities and schools as additional aids in the general learning process. The improvement of memory performances that can be achieved is quite remarkable, and the range of techniques is wide.

This section is not intended to give a complete coverage, but I shall introduce here the basic theory behind the systems, and a simple system for remembering up to ten items.

Lets assume that the items to be remembered are:

1 table
2 feather
3 cat
4 lear
5 student
6 orange
7 car
8 pencil
9 shirt
10 poker

In order to remember these it is necessary to have some system which enables us to use the associative and linking of memory to connect them with their proper number.

The best system for this is the Number-Rhyme System, in which each number has a rhyming word connected to it.

The rhyming key words are:

1 bun
2 shoe
3 tree
4 door
5 hive
6 sticks
7 heaven
8 gate
9 vine
10 hen

In order to remember the first list of arbitrary words it is necessary to link them in some strong manner with the rhyming words connected to the numbers. If this is done successfully, the answer to a question such as 'what word was connected to number 5?' will be easy: the rhyming word for 5, 'hive', will be recalled automatically and with it will come the connected image of the word that has to be remembered. The numbers, rhyming words, and items to be remembered can be thought of respectively as the clothes rail, the hangers, and the clothes in a clothes rail, the hangers, and the clothes in a clothes cupboard. (See fig. 1)

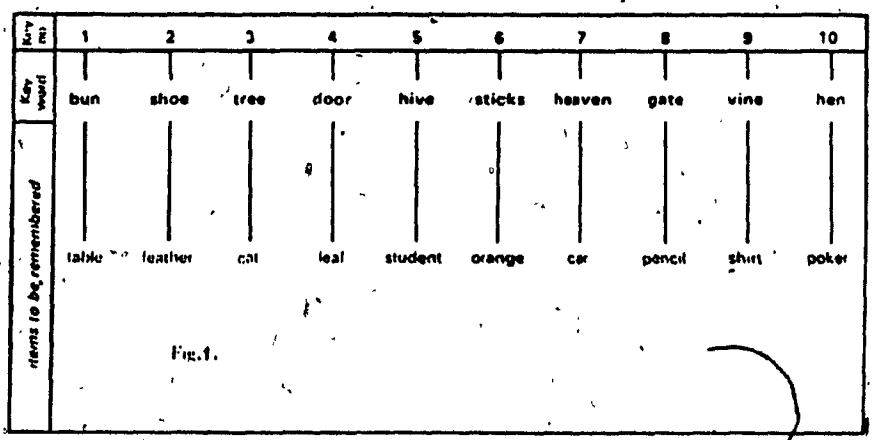


Fig.1.

The important thing in this and all other memory systems is to make sure that the rhyming word and the word to be remembered are totally and securely linked together. In order to do this, the connecting images must be one or many of the following:

EXAGGERATED

The image must be made exceptionally or grotesquely large, or loud, etc.

ABSURD

Where possible the linked images should form a new image which is humorous or ridiculous.

SEXUAL

If sex can be brought in in anyway, bring it in.

VULGAR

Things which are obscene are recalled exceptionally well also!

SENSUAL

As with sex, any of the basic bodily senses will help to form a memorable image.

MOVING

A moving image usually lasts longer than a static one.

COLOURED

Coloured as brightly and gaudily as possible.

IMAGINATIVE

Imaginative in any other way not yet mentioned.

PURE

The two items must be linked together with as few other items as possible. Linkages which are too witty, abstract or confused will not help.

MEMORY

It is important, when forming the images, to have a very clear mental picture in front of your inner eye. To achieve this it is often best to close your eyes and to project the image on to the inside of your eyelid.

To make all this clearer, let us try the ten items given.

1 bun table

Imagine a giant bun on top of a fragile table which is in the process of crumbling from the weight.

2 shoe feather

Imagine your favourite shoe with an enormous feather growing out of the inside, preventing you from putting your shoe on.

3 tree cat

Imagine a large tree with either your own cat or a cat you know stuck in the very top branches frantically scrambling about and mewing loudly.

4 door leaf

Imagine your bedroom door as one giant leaf.

5 hive student

Imagine a student as his desk, instead of a book in front of him, imagine an enormous bee hive with bees circling it and occasionaly attacking him.

6 sticks

Imagine large sticks puncturing the juicy surface of an orange that is as big as a beach ball.

7 heaven car

Imagine all the angels sitting on cars rather then clouds.

8 gate

Imagine a gate made completely out of giant pencils rather than normal wood.

9 vine shirt

Imagine a vine as large as Jack in the Bean Stalk's bean stalk, instead of leaves on the vine hang it all over with brightly coloured shirts blowing in the wind.

10 hen poker

Be vulgar!

Now turn immediately to page 26 and fill in as many of the words as you can.

With a little practice it would be possible to remember ten out of ten each time, even though using the same system. The words to be remembered can, like the clothes they were compared to, be taken off the hook and other clothes substituted. The words which must remain constant and which in any case are almost impossible to forget are the rhyming key words.

As mentioned earlier there are many other systems which are equally as easy to remember as this simple one. Ones which are particularly useful include the Major System, which enables recall of more than a thousand items in the matter of the Number-Rhyme System, as well as giving a key for memorising numbers and dates,, and the Face-Name System which helps prevent the embarrassing and widespread habit of not being able to recall either the names or faces of people you have met.

Key words and concepts in remembering

As you will have gathered throughout the development of this chapter, memory is primarily an associative and linking process which depends in large part on key words and key concepts properly imagined.

Although the chapter entitled Memory is coming to an end the next three chapters on Key words and Creative pattern linkages are themselves very closely connected with remembering and recalling. The information in this chapter should be reconsidered after the following chapters have been completed.

In the spaces below write the rhyming key word for the Number-Rhyme System, and next to it the words used earlier in the chapter to illustrate the system.

	Rhyming key words	Word connected
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____
10	_____	_____

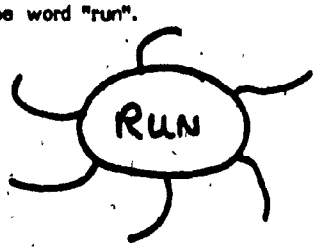
KEY WORDS

MIND MAP

The purpose of this stage is to introduce you to a method of note-taking that can be used for learning, planning, recall and creativity.

WORD ASSOCIATION GAME

Along the following hooked lines, write the first words that come into your mind that you associate with the word "run".



Ask a friend or family member to do the same. Do you think they will have the same set of words as you?

If you are lucky then perhaps they may have one or two words the same. This may not be what you expected. If you wish to test this, try this exercise on five other people and compare results.

Does it surprise you that we all have different associations for words.
How do we communicate? How do we make sure that people will understand which association is intended when we use words?

We understand by the way we use the words in association with each other. For instance if we say "cat run" we will probably have a mental image of a cat running. We can change the image by saying "black cat run".

The idea that words have many associations is important. The following pages build upon this important idea and will give you ideas about how you can use this information to improve your learning, your recall, and your creative thinking.

Exercise and discussion

Imagine that your hobby is reading short stories, that you read at least five a day, and that you keep notes so that you will not forget any of them. Imagine also that in order to ensure a proper recall of each story you use a card filing system. For each story you have one card for the title and author, and a card for every paragraph. On each of these paragraph cards you enter a main and a secondary key word or phrase. The key words/phrases you take either directly from the story or make up yourself because they summarize particularly well.

Imagine further that your ten thousandth story is Kuse-Hibari by Lafcadio Hearne, and that you have prepared the title-and-author card.

Now read the story on the next page and for the purpose of this exercise enter a key recall word or phrase for both the main and secondary idea for the first five paragraphs only, in the space provided in the table on page 33.

Kusa-Hibari

His cage is exactly two Japanese inches high and one inch and a half wide: its tiny wooden door, turning upon a pivot, will scarcely admit the tip of my little finger. But he has plenty of room in that cage-room to walk, and jump, and fly, for he is so small that you must look very carefully through the brown-gauze sides of it in order to catch a glimpse of him. I have always to turn the cage round and round, several times, in a good light, before I can discover his whereabouts, and then I usually find him resting in one of the upper corners clinging, upside down, to his ceiling of gauze.

Imagine a cricket about the size of an ordinary mosquito - with a pair of antennae much longer than his own body, and so fine that you can distinguish them only against the light. Kusa-Hibari, or 'Grass-Lark' is the Japanese name of him; and he is worth in the market exactly twelve cents: that is to say, very much more than his weight in gold. Twelve cents for such a gnat-like thing! . . . By day he sleeps or meditates, except while occupied with the slice of fresh egg-plant or cucumber which must be poked into his cage every morning: . . to keep him clean and well fed is somewhat troublesome: could you see him, you would think it absurd to take any pains for the sake of a creature so ridiculously small.

But always at sunset the infinitesimal soul of him awakens: then the room begins to fill with a delicate and ghostly music of indescribable sweetness – a thin, silvery rippling and trilling as of tiniest electric bells. As the darkness deepens, the sound becomes sweeter – sometimes swelling till the whole house seems to vibrate with the elfish resonance – sometimes thinning down into the faintest imaginable thread of a voice. But loud or low, it keeps a penetrating quality that is weird . . . . All night the atomy thus sings: he ceases only when the temple bell proclaims the hour of dawn.

Now this tiny song is a song of love – vague love of the unseen

and unknown. It is quite impossible that he should ever have seen or known, in this present existence of his. Not even his ancestors, for many generations back, could have known anything of the night-life of the fields, or the amorous value of song.

They were born of eggs hatched in a jar of clay, in the shop of some insect-merchant: and they dwelt thereafter only in cages. But he sings the song of his race as it was sung a myriad years ago, and as faultlessly as if he understood the exact significant of every note. Of course he did not learn the song. It is a song of organic memory – deep, dim memory of other quintillions of lives, when the ghost of him shrilled at night from the dewy grasses of the hills. Then that song brought him love – and death. He has forgotten all about death; but he remembers the love. And therefore he sings now for the bride that will never come.

So that his longing is unconsciously retrospective: he cries to the dust of the past – he calls to the silence and the gods for the return of time . . . . Human lovers do very much the same thing without knowing it. They call their illusion an Ideal: and their Ideal is, after all, a mere shadowing of race-experience, a phantom of organic memory. The living present has very little to do with it . . . . Perhaps this atom also has an ideal, or at least the rudiment of an ideal; but, in any event, the tiny desire must utter its plaint in vain.

The fault is not altogether mine. I had been warned that if the creature were mated, he would cease to sing and would speedily die. But, night after night, the plaintive, sweet, unanswered trilling touched me like a reproach - became at last an obsession, an affliction, a torment of conscience; and I tried to buy a female. It was too late in the season; there were no more kusa-hibari for sale, either males or females. The insect-merchant laughed and said, 'He ought to have died about the twentieth day of the ninth month.' (It was already the second day of the tenth month.) But the insect-merchant did not know that I have a good stove in my study, and keep the temperature at above 75° F. Wherefore my grass-lark still

sings at the close of the eleventh month, and I hope to keep him alive until the Period of Greatest Cold. However, the rest of his generation are probably dead: neither for love nor money could I now find him a-mate. And were I to set him free in order that he might make the search for himself, he could not possibly live through a single night, even if fortunate enough to escape by day the multitude of his natural enemies in the garden - ants, centipedes, and ghastly earth-spiders.

Last evening, the twenty-ninth of the eleventh month – an odd feeling came to me as I sat at my desk: a sense of emptiness in the room. Then I became aware that my grass-lark was silent, contrary to his wont. I went to the silent cage, and found him lying dead beside a dried-up lump of egg-plant as gray and hard as a stone. Evidently he had not been fed for three or four days; but only the night before his death he had been singing wonderfully - so that I foolishly imagined him to be more than usually contented. My student, Aki, who loves insects, used to feed him; but Aki had gone into the country for a week's holiday, and the duty of caring for the grass-lark had devolved upon Hana, the housemaid. She is not sympathetic, Hana the housemaid. She says that she did not forget the mite – but there was no more egg-plant. And she had never thought of substituting a slice of onion or of cucumber! . . . I spoke words of reproof to Hana the housemaid, and she dutifully expressed contrition. But the fairy-music had stopped; and the stillness reproaches; and the room is cold, in spite of the stove.

Absurd! . . . I have made a good girl unhappy because of an insect half the size of a barley-grain! The quenching of that infinitesimal life troubled me more than I could have believed possible . . . . Of course, the mere habit of thinking about a creature's wants – even the wants of a cricket - may create, by insensible degrees, an imaginative interest, an attachment of which one becomes conscious only when the relation is broken. Besides, I had felt so much, in the hush of the night, the charm of the delicate voice telling of one minute existence dependent upon my will and selfish pleasure, as upon the favour of a god -

telling me also that the atom of ghost in the tiny cage, and the atom of ghost within myself, were forever but one and the same in the deeps of the Vast of being . . . . And then to think of the little creature hungering and thirsting, night after night and day after day, while the thoughts of his guardian deity were turned to the weaving of dreams! . . . How bravely, nevertheless, he sang on to the very end – an atrocious end, for he had eaten his own legs! . . . May the gods forgive us all – especially Hana the housemaid!

Yet, after all, to devour one's own legs for hunger is not the worst that can happen to a being cursed with the gift of song. There are human crickets who must eat their own hearts in order to sing.

Key words or phrases for main and secondary ideas from Kusa-Hibari

	main	*secondary*
paragraph 1		
paragraph 2		
paragraph 3		
paragraph 4		
paragraph 5		

In table 3 you will find sample key words and phrases from the notes of students who have previously done this exercise. Briefly compare and contrast these with your own ideas.

TABLE 3 Students' suggested key words and phrases

	main	*secondary*
paragraph 1	his cage	two Japanese inches
	wooden door	wooden floor
	ceiling of gauze	plenty of room
	small insect	discover whereabouts
paragraph 2	cricket	Grass-Lark
	weight in gold	twelve cents
	antennae	market
	Kusa-Hibari	gnatlike
paragraph 3	sleep	fresh cucumber
	clean and well fed	pains
	occupied	meditation
	absurd	small
paragraph 4	penetrating	silvery rippling
	music	house vibrating
	electric bells	penetrating
	wail	hour of dawn
paragraph 5	Love	night life
	amorous	insect merchant
	the hills	significance
	Death	love and death

In the class situation instructors then circled one word from each section:

TABLE	*main*	*secondary*
paragraph 1	wooden door	discover whereabouts
2	weight in gold	market
3	occupied	pains
4	penetrating	hour of dawn
5	love	night-life

Students were then asked to explain why, in the context of the exercise, these words and phrases and not others had been selected. Answers usually included the following: 'good image words', 'imaginative', 'descriptive', 'appropriate', 'good for remembering', and 'evocative', etc.

Only one student in fifty realised why the instructors had chosen these words: in the context of the exercise the series chosen was disastrous.

To understand why, it is necessary to imagine a time some years after the story has been read when you are going to look at the notes again for recall purposes. Imagine that some friends have played a prank, taking out the title cards of some of your stories and challenging you to remember the titles and authors. You would have no idea to start with to which story your cards referred, and would have to rely solely on them to give you back the correct images.

With the key words from table 4 you would probably be forced to link them in the following way: 'wooden door', a general phrase, would gain a mystery-story air when you read 'discover whereabouts'. The next two keys 'weight in gold' and 'market' would confirm this, adding a further touch of intrigue suggesting a criminal activity. The next three key words, 'occupied' 'pains' and 'penetrating' might lead you to

assume that one of the characters, perhaps the hero, was personally in difficulty, adding further tension to the ongoing plot as the 'hour of dawn', obviously an important and suspense-filled moment in the story, approached. The final two keys, 'love' and 'night-life' would add a romantic or risqué touch to the whole affair, encouraging you to thumb quickly through the remaining key words in search of further adventures and climaxes! You would have created an interesting new story, but would not remember the original one.

Words which seemed quite good at the time have not, for some reason, proved adequate for recall. To explain why, it is necessary to discuss the difference between key recall words and key creative words, and the way in which they interact after a period of time has passed.

A key recall word or phrase is one which funnels into itself a wide range of special images, and which, when it is triggered, funnels back the same images. It will tend to be a strong noun, or verb, on occasion being surrounded by additional key adjectives or adverbs. (See fig. 23).

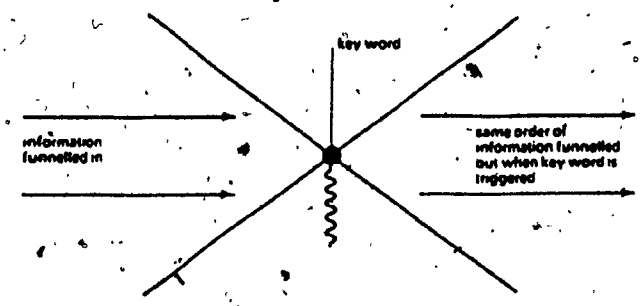


Fig. 23 Diagram representing key recall word. See text this page.

A key creative word is one which is particularly evocative and image-forming, but which is far more general than the more directed key word. Words like 'ooze' and 'bizarre' are especially evocative but do not bring back a specific image. (See fig. 24)

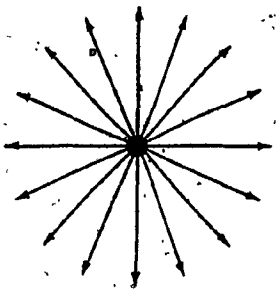


Fig. 24 A key creative word sprays out associations in all directions. See text this page.

Apart from understanding the difference between creative and recall words, it is also necessary to understand the nature of words themselves as well as the nature of the brain which uses them.

Every word is 'multi-ordinate', which simply means that each word is like a little centre on which there are many, many little hooks. Each hook can attach to other words to give both words in the new pair slightly different meanings. For example the word 'run' can be hooked quite differently in 'run like hell' and 'her stocking has a run in it'. (See fig. 25)

In addition to the multi-ordinate nature of words, each brain is also different from each other brain. As shown in the first chapter, the number of connections a brain can make within itself is almost limitless. Each individual also experiences a very different life from each other individual (even if two people are enjoying the 'same experience' together they are in

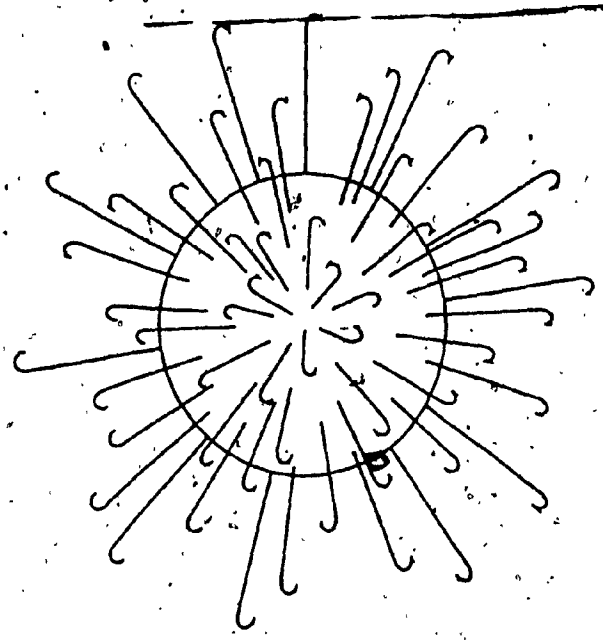


Fig. 25 Each word is multi-ordinate, meaning that it has a large number of 'hooks'. Each hook, when it attaches to another word, changes the meaning of the word. Think, for example, of how the word 'run' changes in different phrase contexts.

very different worlds: A is enjoying the experience with B as a major part of it, and B is enjoying the experience with A as a major part of it). Similarly the associations that each person will have for any word will be different from everybody else's. Even a simple word like 'leaf' will produce a different series of images for each person who reads or hears it. A person whose favourite colour is green might imagine the general greenness of leaves; someone whose favourite colour is brown, the beauty of autumn; a person who had been injured falling out of a tree, the feeling of fear; a gardener, the different emotions

connected with the pleasure of seeing leaves grow and the thought of having to rake them all up when they had fallen, etc. One could go on for ever and still not satisfy the range of associations that you who are reading this book might have when *you* think of leaves.

As well as the unique way in which the mind sees its personal images, each brain is also, by nature, both creative and sense-organising. It will tend to 'tell itself interesting and entertaining stories' as it does for example when we day- or night-dream.

The reason for the failure of the recall and creative words selected from *Kusa-Hibari* can now clearly be seen. When each of the multi-ordinate words or phrases was approached, the mind automatically picked the connecting hooks which were most obvious, most image-producing, or the most sense-making. The mind was consequently led down a path that was more creative than recall based, and a story was constructed that was interesting, but hardly useful for remembering. (See fig. 26).

Fig. 26 Showing how mind can follow the 'wrong connections' in a series of key words. See text this page.

Proper recall words would have forced the mind to make the proper links in the right direction, enabling it to recreate the story even if for all other intentional purposes it had been forgotten. (See fig. 27).

Fig. 27 Direction of correct associations when proper recall key words have been used. See text this page.

How can you use the information about key words to increase your recall during learning?

One way would be to link them - to make ASSOCIATIONS.

Another way might be to make them outstand - to EMPHASIZE them.

In this unit we looked at the nature of words. We saw that words are multi-ordinate, many hooked.

We saw that to communicate words are <u>associated</u> in specific <u>patterns</u> of meaning. We saw that certain words are essential to understanding the pattern.

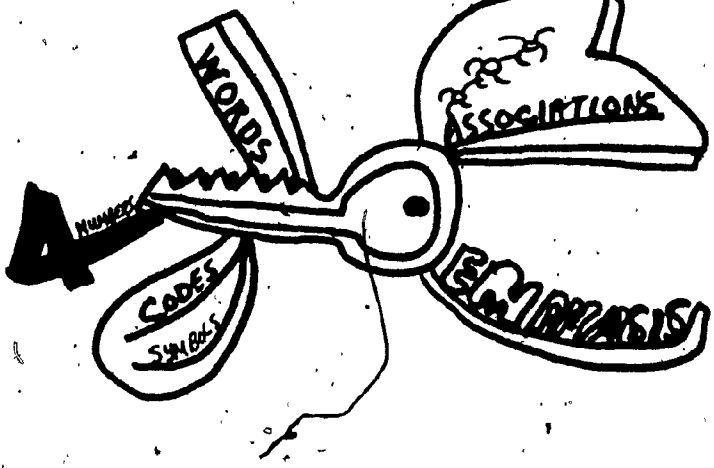
These words are called <u>key words.</u> Key words can also be used <u>creatively</u> to create new patterns of meaning.

We looked at how our recall works during learning and how we might use key-words to improve our recall by <u>associating</u> them and by <u>emphasizing</u> them. The next unit in this stage will give you more information on how you might <u>associate</u> and <u>emphasize</u> key words to build patterns of notes that reflect your understanding.

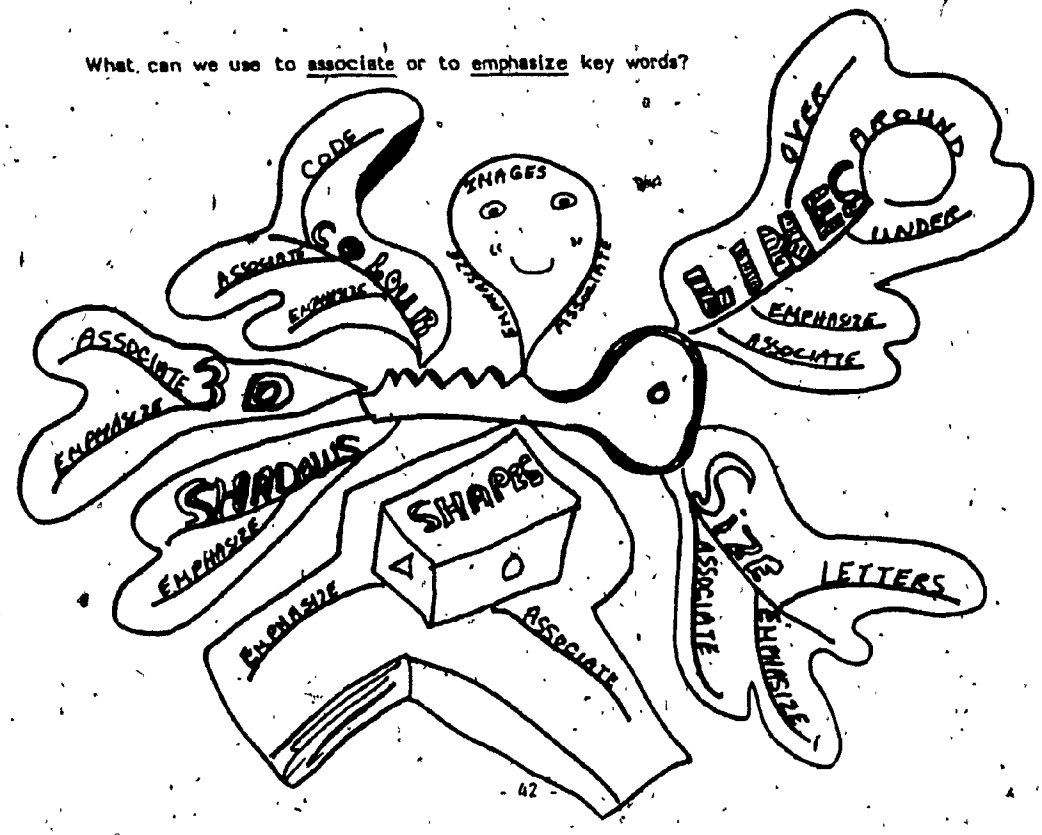
When you learned the Number-Rhyme system, what technique did you use to remember?

You used visual imagination to <u>associate</u> or <u>link</u> new images to a standard structure (the number rhyme) by emphasizing the image.

Keys for using our memory are <u>association</u> and <u>emphasis</u>. We can use all information as keys whether it be words, numbers, codes or symbols.



What can we use to <u>associate</u> or to <u>emphasize</u> key words?



Key Words

Key creative words can be used to generate ideas and to exercise the ability of the brain to make new connections, that is, to be creative.

When generating ideas you should remember that words are multi-ordinate, "Hooked" and that ideas can spray in many directions.

You will find a non-linear form of noting is more effective for the generation of ideas.

EXAMPLE: Generate as many uses of a screwdriver as you can.

Discussion:

Two important concepts about memory images are their vividness and their controlability. Memory images may be very vague or very clear but no matter how vivid they are rarely mistaken for an actual experience happening. In general, memory images are controllable, that is, you can summon them at will and you can usually stop them by thinking about something else.

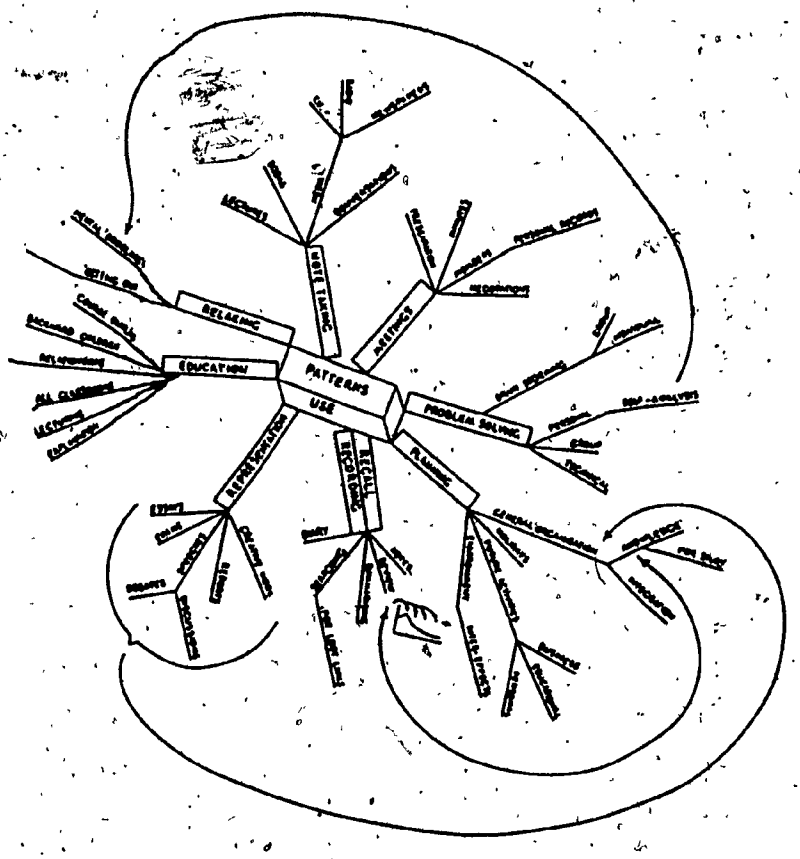
We often talk about being able to "see with the mind's eye". This is really the act of visualizing, being able to imagine pictures or images in our minds. We all use this ability in our remembering. The Number-Rhyme system which you learned in Stage 2 depends on your ability to rapidly associate visual images that were emphasized in the same way.

Mind-Mapping

Application

Purpose

The purpose of this section is to bring to your attention some of the valuable uses of Mind-Maps.


PATTERNS
USE
EDUCATION
RELAXING
NOTE TAKING
MEETINGS
PROBLEM SOLVING
REMEMBERING
RECALL
RECORDING
PLANNING

Key Words - Noting

Key versus standard notes

The main body of a person's recalling is of this key concept nature. It is not, as often assumed, a word-for-word verbatim process. When people describe books they have read or places they have been, they do not start to 're-read' from memory. They give key concept overviews outlining the main characters, settings and events, adding descriptive detail. Similarly the single key word or phrase will bring back whole ranges of experience and sensation. Think for example of the range of images that enter your mind when you read the word 'child'.

How does acceptance of the facts about key recall affect our attitude toward the structure of note taking?

Because we have become so used to speaking and writing words, we have mistakenly assumed that normal sentence structure is the best way to remember verbal images and ideas. Thus the majority of students and even graduates have taken notes in a normal literary fashion similar to the example of a university student whose notes were rated 'good' by his professor. (See next page)

Our new knowledge of key concepts and recall has shown that in this type of notes 90% of the words are not necessary for recall purposes. This frighteningly high figure becomes even more frightening when a closer look is taken at what happens with standard sentence notes:

1. Time is wasted recording words which have non bearing on memory (estimated waste - 90%).

2. Time is wasted re-reading the same unnecessary words (estimated waste - 90%).

3. Time is wasted searching for the words which are key, for they are usually not distinguished by any marks and thus blend in with other non-recall words.

4. The connections between key words are interrupted by words that separate them. We know that memory works by association and any interference by non recall words will make the connections less strong.

5. The key words are separated in time by intervening words: after one key word or phrase has been read it will take at least a few seconds to get to the next. The longer the time between connections, the less chance there will be of a proper connection being made.

6. The key words are separated in space by their distance from each other on the page. As with the point made about time, the greater the distance between he words, the less chance of there being a proper connection.

You are advised to practise key word and phrase selection from any previous notes made during periods of study. It will also be helpful at this point for you to summarize this chapter in key note form.

In addition, reconsider key and creative words in the light of the information in the chapter on Memory, especially the section dealing with mnemonic techniques. Similarly the memory chapter itself can be reconsidered in the light of this chapter, with a similar emphasis on the relationship and similarities between mnemonic systems, key and creative concepts.

The review graph is another important consideration. Review is made much easier when notes are in key form, because less time is expended, and because the recall itself will be superior and more complete. Any weak linkages will also be cemented more firmly in the early stages.

Finally, linkages between key words and concepts should always be emphasized and where possible simple lists and lines of key words should be avoided. In the following chapter advanced methods of key word linking and patterning will be explained in full.

Fig. 28 An example of traditionally 'good' university student's notes. See text on next page.

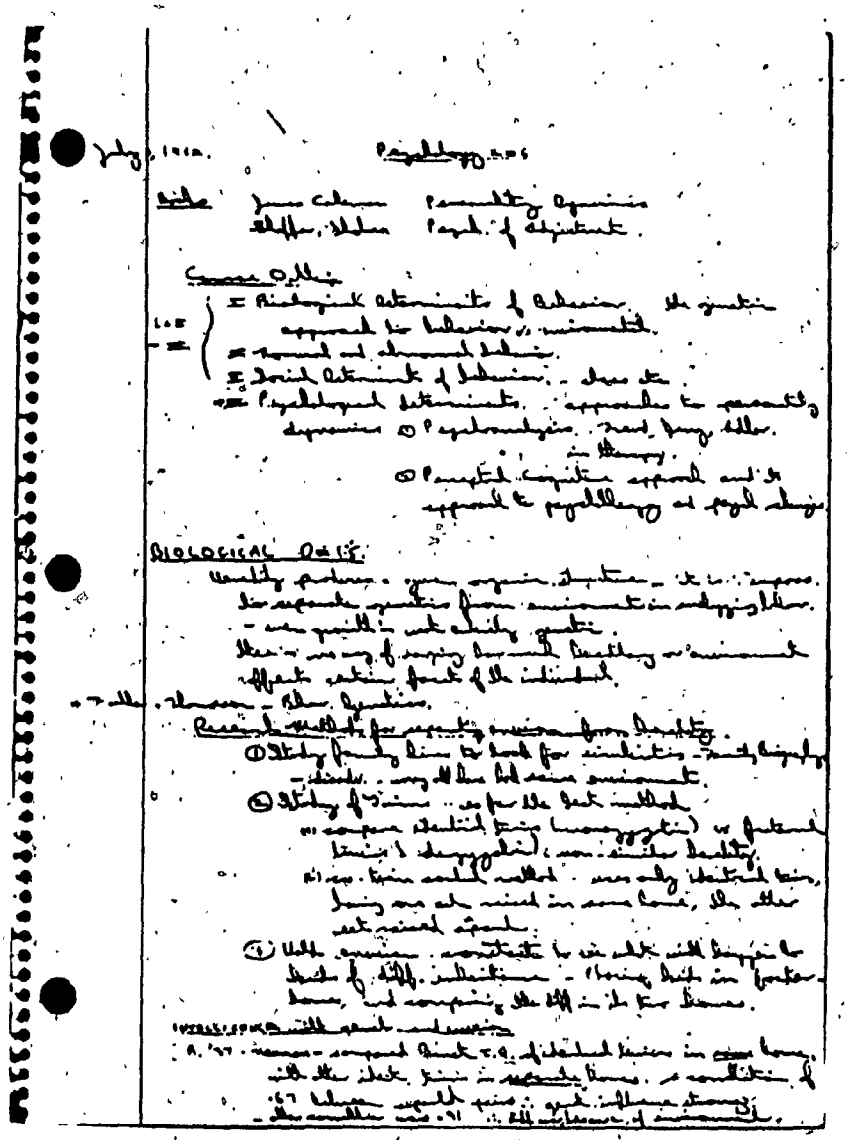


Fig. 28 An example of traditionally 'good' university student's notes.

- How can we use this information to help us with our learning?

- I hope you are beginning to see the connections between memory, recall, key-words and Mind-Maps! More important is that you stop now and think about how this information helps us with our learning.

- Try your hand (and mind!) at making a mind-map of all the information you have learned so far from this course. Try using colour, shapes, shadowing for emphasis, try to use visual images or drawings instead of words. Have fun and let you whole brain go!

Try Your Hand 

Observing that the brain handles information better if the information is designed to 'slot in', and observing also the information from this chapter about the dimensional nature of the mind, it follows that notes which are themselves more creative will be far more readily understood, appreciated and recalled.

There are many devices we can use to make such notes:

ARROWS

These can be used to show how concepts which appear on different parts of a pattern are connected. The arrow can be single or multi-headed and can show backward and forward directions.

CODES

Asterisks, exclamation marks, crosses and question marks as well as many other indicators can be used next to words to show connections or other 'dimensions'.

GEOMETRICAL SHAPES

Squares, oblongs, circles and ellipses etc... can be used to mark areas or words which are similar in nature - for example triangles might be used to show areas of possible solution in a problem-solving pattern. Geometrical shapes can also be used to show order of importance. Some people, for example, prefer to use a square always for their main centre, oblongs for the ideas near the centre, triangles for ideas of next importance, and so on.

ARTISTIC THREE DIMENSION

Each of the geometrical shapes mentioned, and many others, can be given perspective. For example, making a square into a cube. The idea printed in these shapes will this 'stand off' the page.

CREATIVITY

Creativity can be combined with the use of dimension by making aspects of the pattern fit the topic. One man, for example, when doing a pattern on atomic physics, used the nucleus of an atom and the electrons that surrounded it, as the centre for his pattern.

COLOUR

Colour is particularly useful as a memory and creative aid. It can be used, like arrows, to show how concepts which appear on different parts of the pattern are connected. It can also be used to mark off the boundaries between major areas of a pattern.

Now that you have been introduced to Mind-Mapping try using this technique for everything you do from making shopping lists, to taking lecture notes, to planning a letter! It is important for clarity that you print along the line and use key words, not sentences.

The technique will enhance learning because:

1 The centre or main idea is more clearly defined.

2 The relative importance of each idea is clearly indicated. More important ideas will be nearer the centre and less important ideas will be near the edge.

3 The links between the key concepts will be immediately recognizable because of their proximity and connection.

4 As a result of the above, recall and review will be both more effective and more rapid.

5 The nature of the structure allows for the easy addition of new information without messy scratching out or squeezing in, etc.

6 Each pattern made will look and be different from each other pattern. This will aid recall.

7 In the more creative areas of note making such as essay preparations, etc., the open-ended nature of the pattern will enable the brain to make new connections far more readily.

Remember, these notes are for you. Enjoy them, let your imagination work for you!

In the space below, write down all the uses for "mind-maps" that you can think of.

Discussion

Mind-maps are certainly very useful tools for catching the patterns that develop in our brains. Here are some tips about using mind-maps:

1) Never worry if you repeat your ideas. Repetition is important for emphasis and association.

2) If you get stuck and no ideas come, start a new mind-map. Try a new centre word or image.

3) Should mind-maps get progressively better? On average, mind-maps should be dynamic and should fluctuate from rough, speed notes made to catch a memory to the detailed large scale mind-map of an essay or speech. Your ability to identify and associate key words should get better, but your mind-maps, like your handwriting, are up to you. For instance, shopping maps (not lists!) can be detailed or as sketchy as you need.

4) If you are searching for a word, never concentrate on what you cannot remember! Surround the missing memory with hooks. Concentrate on the situation surrounding the memory.

Nothing is connected to Nothing!

5) Do not worry about messy mind maps! You can do a new one if you need to.

6) Indicate your feelings and express your reactions - colour code them.

7) Connections should be of meaning not necessarily time.

8) Use mind-maps to preview. Before you start learning something new, mind-map what you already know about it and thus key your brain's associations to be ready for the new information.

Mind-Maps - Uses

The nature of patterns is intimately connected with the function of the mind, and they can be used in nearly every activity where thought, recall, planning or creativity are involved. Figure is a pattern of the use of Mind-Maps, showing this wide variety of uses. Detailed explanation of each of these aspects would of course take up a large book, but the remainder of this booklet shall explain the application of Mind-Maps to the speech writing, examination type of task; to meetings and communications, and to note taking.

Transforming a Mind-Map to a speech, article etc.

Many people, when first shown Mind-Maps, assume that they cannot be used for any linear purpose, such as giving a talk or writing an article. Nothing could be further from the truth.

Once the Mind-Map has been completed, the required information is readily available. All that is necessary is to decide the final order in which to present the information. A good Mind-Map will offer a number of possibilities. When the choice is being made, each area of the pattern can be encircled with a different colour, and numbered in the correct order. Putting this into written or vocal form is simply a matter of outlining the major areas to be covered, and then going through them point by point, following the logic of the branched connections. In this way the problem of redrafting and redrafting yet again is eliminated - all the gathering and organizing will have been completed at the Mind-Map stage. Using these techniques at Oxford University, students were able to complete essays in one third of the previous time while receiving higher marks.

Note taking

It is advisable, when taking notes, to have two blank pages ongoing at the same time. The left-hand page should be for mapped information and the right-hand page for more linear or graphic information such as formulas, special lists, and graphs etc.

When taking notes, especially from lectures, it is important to remember that key words and phrases are essentially all that is needed. It is also important to remember that the final structure will not become apparent till the end. Any notes made will therefore probably be semi-final rather than final copy. The first few words noted may be fairly disconnected until the theme of the lecture becomes apparent. It is necessary to understand clearly the value of so-called 'messy' as opposed to 'neat' notes, for many people feel apprehension at having scrawly, arrowed, non-linear page of notes developing in front of them. 'Neat' notes are traditionally those which are organized in an orderly and linear manner. 'Messy' notes are those which are 'untidy' and 'all over the page'. The word 'messy' used in this way refers to the look and not the content.

Mind-Maps in their final form are usually neat in any case and it seldom takes more than ten minutes to finalize an hour's notes on a fresh sheet of paper. This final Mind-Map reconstructing is by no means a waste of time, and if the learning period has been organized properly will fit in perfectly as the first review.

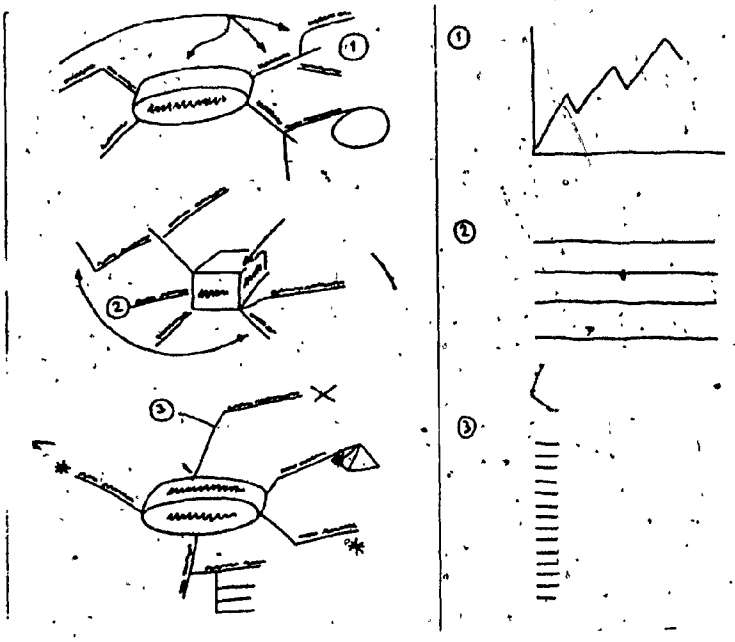


Fig. Showing recommended general form for note taking. Two pages should be used concurrenity, one for Mind-Maps, the other for graphic or more linear information.

Communications and meetings

Meetings, notably those for planning or problem solving, often degenerate into situations where each person listens to the others only in order to make his own point as soon as the previous speaker has finished. In such meetings many excellent points are passed over or forgotten, and much time is wasted. A further aggravation is that points which are finally accepted are not necessarily the best, but are those made by the most vociferous or most important speakers.

These problems can be eliminated if the person who organizes the meeting uses a creative Mind-Map. On a board at the front of the room the central theme of the discussion together with a couple of the sub themes should be presented in basic pattern form. The members of the meeting will have pre-knowledge of what it is about, and will obviously have come prepared. As each member finishes the point he is making, he can be asked to summarize it in key form, and to indicate where on the overall pattern he thinks his point should be entered.

The following are the advantages of this approach:

1. The contribution of each person is registered and recorded properly.
2. No information is lost.
3. The importance given to ideas will pertain more to what was said than to who said it.
4. Digressions and long waffllings will be eliminated because people will be talking more to point.
5. After the meeting each individual will have a patterned record and will therefore not have lost by the following morning most of what is said.

One further advantage of Mind-Maps, especially in note taking and communications, is that the individual is kept continually and actively involved in the complete structure of what is going on, rather than being concerned solely with 'getting down' the last point made. This more complete involvement will lead to a much greater critical and analytical facility, a much greater integration, a much greater ability to recall and a much greater overall understanding.

Why not start now with a Mind-Map of all the ideas and information you learned so far in an Ed. Tech. course.

How's that for a challenge??

THINKING CHECKLIST

Check each of the following statements that best expresses the feeling you had while you were learning. The statements particularly apply to learning from reading. You may add your own reactions, if you like.

____ 1. I really thought about the point of what I was learning.

____ 2. I didn't remember what I read, because I was just thinking of hurrying on . . .

____ 3. I got a clear impression of what it meant.

____ 4. The whole time I was thinking "how I must remember this" and "now I must remember this".

____ 5. I tried to make connection between various points.

____ 6. I just read straight through without looking back at anything.

____ 7. I thought over all the ideas and tried to build up an outline in my head.

____ 8. I wasn't so much that I drew conclusions... and reacted to them... but that, well, that I read it sort of because I was supposed to read it... and not so as to react to it.

____ 9. I tried to relate the ideas to what I already know.

____ 10. I was thinking about the fact that I was going to have to repeat all this...I didn't think about what I was reading.

YOUR COMMENTS:

5.3 APPENDIX C

Attitude Questionnaire

The Thinking Checklist

Look at the last Thinking Checklist you completed in your manual. Were the items you checked mainly odd numbers or even numbers? I expect they were odd numbers! The odd-numbered questions are indicators of "deep-level" thinking. The even numbers are indicators of "surface-level" thinking. Understanding and learning usually take "deep-level" thinking so these checklists are useful ways to see how your thinking may have changed or developed over this short course.

This course has taken an approach to learning that may be different from any you have previously encountered.

- We have tried to give you information about how you learn.
- We have tried to involve you in trying out the various new ideas to improve your learning.

The real test of the effectiveness of this course, however, is you and whether you feel it has helped you improve your learning in any way.

The Learning Project

You may have been applying the new information as you progessed through the courses you are now taking or you may have waited until you had the total picture before applying the ideas.

That's OK. The Project Checklist on the next page is your measure of whether you have achieved what you wanted to. You should ocmplete it when you feel you have given the ideas a fair chance. You will be asked to return this checklist to the researcher for evaluation purposes.

A. HOW USEFUL WAS:

	VERY USEFUL		USEFUL		NOT USEFUL
1. The Mind-Mapping book for explaining the use of technique?	5	4	3	2	1
2. The Slide/Tape presentation for illustrating the ideas of the technique?	5	4	3	2	1

B. WHAT WAS YOUR REACTION TO LEARNING IN THIS COURSE?

	ALWAYS VERY CLEAR		CLEAR		NEVER CLEAR
1. How clear are you about the purpose of what you were learning?	5	4	3	2	1
	VERY HARD		HARD		NOT HARD
2. How hard have you felt you have been working on your learning during this course?	5	4	3	2	1
	VERY PRACTICAL		PRACTICAL		NOT PRACTICAL
3. How practical has this course been to you?	5	4	3	2	1
	A LOT		SOME		NOT MUCH
4. How much do you feel you learned in this course?	5	4	3	2	1

C. WHAT WAS MOST MEANINGFUL TO YOU ABOUT THE COURSE?

D. HOW DID YOU APPLY THE COURSE TO:

1. Your Ed. Tech. courses

   ____ Right away?
   ____ Gradually, after you were part way through.
   ____ After you had finished & could see the whole thing?

	VERY EASY		EASY		NOT EASY
2. How easy was it to apply the technique to your learning project?	5	4	3	2	1
	VERY IMPROVED		**IMPROVED**		**NOT IMPROVED**
3. How would you rate your own approach to learning?	5	4	3	2	1

4. Would you recommend this course to others?

E. DESCRIBE HOW EFFECTIVE YOU THINK MIND-MAPPING HAS BEEN IN IMPROVING YOUR LEARNING.