

CHAPTER 13

Types of learning

13.1 INTRODUCTION

As we have said, empirical educationists take cognisance of the fact that both learning and becoming are original problems which proceed inter-actively and interdependently. This implies that at each stage of the child's becoming he faces new demands and fresh emphases. New subject matter will often call for new learning methods. Learning occurs when the child is confronted with things outside his knowledge or ability that challenge him. If we see the developing child as someone who must grow to adulthood through learning, it is obvious that he needs to learn across the whole spectrum of his humanity. In the spheres of physical skills, emotions, attitudes, communication and especially cognition he must attain to a higher level of actualisation by means of learning. Clearly certain demands are made on the child who has to learn to write, control his anger, sit still in church, speak politely to adults, learn multiplication tables or solve problems. The diversity of the learning act makes it difficult to find a central theme around which it can be structured. We shall cite various classifications made in the literature. In empirical education we are concerned with the attribution of meaning, which is only possible through personal involvement. First we shall examine various attempts at structuring the types of learning and then we shall concentrate on meaning.

13.2 STRUCTURING TYPES OF LEARNING ACCORDING TO LEARNING ACTIONS

If a classification is based on learning actions one arrives at a loose cate-

gorisation with numerous parts, all apparently independent of the others.

- (a) Learning by reading
- (b) Learning by listening
- (c) Learning by doing
- (d) Learning by writing
- (e) Learning by repetition
- (f) Learning by meditation
- (g) Learning by reflection
- (h) Learning by imitation
- (i) Learning by practice
- (j) Learning by acquiring insight
- (k) Learning based entirely on teaching

13.3 CLASSIFICATION IN ACCORDANCE WITH THE OBJECTIVE OR PURPOSE OF LEARNING

Since the purposes for which people learn vary greatly, it would be possible to distinguish a great many learning processes. There are for instance forms of learning in which

- (a) the *skill or art* is the main objective, i.e. the automatising of motor (gymnastics, typing, pianoplaying, etc.) or mental skills (reading, writing, calculation, etc.)
- (b) the *solving of problems* is the main issue (thinking, understanding, gaining insight)
- (c) the main aim is *remembering* knowledge and *having it ready at hand*
- (d) *the main aim is the assimilation of working methods* (learning to learn, learning to work, learning to investigate, learning to look things up)
- (e) the main aim is *transference to other fields* (the studying of the *formal* subjects, such as Latin and Mathematics, for the sake of their *formative value*)
- (f) the main aim is the shaping of feelings, attitudes and dispositions
- (g) the main aim is the *inculcation of a deep interest in a particular subject* (specialisation)
- (h) a *change in behaviour* is the main objective
- (i) and so on. (You will by now have noticed though the list is long the end is not in sight.)

13.4 CLASSIFICATION IN ACCORDANCE WITH THE DEGREE OF AWARENESS WITH WHICH LEARNING TAKES PLACE

C.F. van Parreren has made the most important contribution with regard to learning awareness. He distinguishes between

- (a) *Intentional (conscious) learning*, i.e. a form of learning in which the subject is consciously, knowingly and willingly involved in the act or task of learning. In other words learning is an active and directed process with the learning task as its objective.
- (b) *Incidental or fortuitous (but nevertheless conscious) learning*, i.e. a type of learning in which there is no deliberate direction. Learning occurs by accident, in passing, and automatically. This kind of learning results, basically, from the appeal (valency) which the subject (or teacher) has for the child. Incidental learning via the appeal of the subject may give rise to deliberately directed learning. But according to Van Parreren the results of incidental learning (even if it does develop into intentional learning) never equal those of truly intentional learning.
- (c) *Unconscious learning* was experimentally proved by Thordike. It is learning that occurs without the learner being aware of the fact. There is no learning intention, so that one might rather speak of intuitive learning. Learning occurs through a challenge to the individual. For instance, the visual attractiveness of the subject matter may be enough to prompt the learner without requiring any cognitive activity. An example would be a television programme watched purely as recreation; at the same time the viewer *learns* the name of the river which flows through Paris but only realises this later on.

13.5 VAN PARREREN'S CATEGORISATION OF TYPES OF LEARNING

Van Parreren does not classify types of learning according to a preconceived principle, but simply identifies different types as manifested by pupils at school. Each variety is more or less independent. In each case he states the result of learning and then examines the action of type of learning that produces it. Each of these types of learning spurs the learner to some achievement that indicates that he knows what he has learnt or can do something he was unable to do before. The results listed by Van Parreren are insight, facts, accurate reproduction and automatism. He then examines the types of learning that produce these results.

13.5.1 Insight-promoting learning

At school and in everyday life we all find ourselves from time to time in situations in which we do not know which way to turn. Such situations are problematical, that is to say they raise questions for which one has no cut-and-dried answers. It is of course always possible in such a case to decide blindly on some course of action and simply "hope that it works". Fortunately however, human beings can avail themselves of more effective measures than that of simple trial-and-error in order to deal with such situations. *A human being is capable of reviewing all the components of the situation and then, by seeing how they are all connected (i.e., through insight) deciding on the most suitable way of tackling the problem.* But it is also true that all human beings are not equally good at seeing the connections between things. The Thought Psychologists ascribe these inequalities to differences in intelligence. Nevertheless one of them, Otto Selz, has demonstrated convincingly that children's intelligence levels can be raised (*Erziehbarkeit der Intelligenzleistungen*). He maintains that children can to a certain extent learn how to gain insight into problem situations by learning the "partial solution methods" used by someone else. This does not give the child a ready-made method of solving all problems but does provide him with a method of tackling them or of analysing any difficulties he may encounter.

If the teacher presents his material properly the pupils may benefit very greatly. Even if the child does not always arrive at the correct solution, he will always have a better chance of doing so than would the child who tries to solve problems by the trial-and-error process.

The quintessence of insight-promoting learning lies in the provision of (solution) methods which will enable the child to tackle a variety of new problems with a reasonable chance of solving them.

13.5.2 The acquisition of factual knowledge

This is another form of knowledge which is extremely important in the school context. The school does not exist solely for the purpose of training pupils to solve problems; part of its function is to turn out well-developed people. There are certain central facts which contribute to the development of the child and which every good citizen ought to know. Here we are thinking of the historical, geographical, scientific, linguistic, and other kinds of knowledge which are regarded as important in the cultural environment in which the child is growing up. These facts may help to promote insight of the kind discussed in the preceding paragraph, but that is not the primary reason for presenting them to the

child. They are regarded as worth knowing for their own sake. This type of learning is completely different *in character* from insight-promoting learning. One does not know of one's own accord or through reasoning that Jan van Riebeeck landed at Table Bay in 1652 and that this was the beginning of the White settlement of the Cape, or that General Louis Botha was the first premier of the Union of South Africa, or that General Andries Pretorius came from Graaff-Reinet. These are facts that must be communicated to one (verbally or in writing), and once they have been assimilated as incontrovertible facts one knows them and can remember them. There is no question here of mental relationships; one is dealing with concrete circumstances, people or events. We can of course arrange facts in such a way that their cohesion is explicable, for instance the facts that Van Riebeeck's statue is situated near the harbour in *Cape Town*. Similarly, we can explain why a statue of *General Louis Botha* has been placed outside the *Union Buildings* in Pretoria, or why the marble bust of General Andries Pretorius that stands outside Graaff-Reinet faces directly *North*, but at the same time looks towards "Letskraal", the farm that once belonged to Pretorius. Indeed genuine learning of this kind is characterised by the assimilation not only of facts but of the way in which the facts *cohere*. In this sense *insight* does form part of the learning; but the essential element in the acquisition of factual knowledge is the assimilation of unique and (in a certain sense) *fortuitous* data – fortuitous because, logically speaking, they could have been different.

13.5.3 Memorising

A third form of learning used in schools is memorising or "learning by heart". It might perhaps seem that this is no different from the remembering of facts that we have just been discussing. But there is actually an important difference between the acquisition of factual knowledge and *learning by heart*. When one has *memorised* something one is able to reproduce it (orally or in writing) word-for-word, in *precisely* the way in which it was originally *imprinted* on one's mind. Here the accent falls not on *knowing* about events, issues, people, etc., but on the *fixing* of particular expressions, sentences, maxims, formulae, or even single words, numbers or letters. The words or expressions may have some bearing on matters which the person has assimilated as factual knowledge, but this is not necessarily the case. It is important to remember that *the same material can form the content of various types of learning*. A pupil may memorise dates and at the same time assimilate them as facts connected in many significant ways with other facts.

13.5.4 The development of automatisms

When children learn to write, or to do gymnastics, they are engaging in yet another totally different form of learning: they are learning to execute various *physical movements*. One of the characteristics of this type of learning is that, once a person has gone through the process he no longer needs to think about the actions involved: the movements *come naturally*. In the Psychology of Learning movements of this kind are termed *automatisms*. Automatising is important because, once a person has mastered an automatism he can attend to something else while making the automatic movements. For example, once the movements required for writing have become automatic the child can pay attention to the content, style or correctness of what he is writing. Van Parreren emphasises automatisms with respect to motor action.

13.6 COETZEE'S CATEGORISATION OF TYPES OF LEARNING

Coetzee differentiates between two main types of learning. The first is a group of learning methods involving actions which result in particular physical skills. These actions increasingly demand the learner's attention.

The second category involves a mental act requiring a conscious image that is manipulated and internalised. Coetzee does not use a central theme to organise the various ways of learning but simply proceeds from conscious motor learning to conscious mental images or imaginative learning.

13.6.1 Motor, objective processes (mainly muscular reactions)

- (a) *Sensory-motor learning*, as in the acquisition of simple habits.
- (b) *Perceptual-motor learning*, as in the formation of social habits and the acquisition of complex skills.

In these types of learning, the objective is the acquisition of physical skills by developing control over the nervous and muscular systems.

13.6.2 Representational, subjective processes

These include:

- (a) *Perceptual learning*, as in observation and in activities which are partly skills.

- (b) *Associative learning*, as in the memorising of facts.
- (c) *Conceptual learning*, as in the assimilation of knowledge and the forming of concepts.
- (d) *Imaginative learning*, as in the production and development of original ideas.

What is unusual about Coetzee's classification is that it follows a line representing the increasing complexity of the various learning processes. Even animals can be conditioned, drilled and trained by means of motor learning processes to acquire certain patterns of behaviour; but they are incapable of using representational learning processes. These can be attained only by human beings. And among the various representational and subjective forms of learning, conceptual learning is a "higher" form than associative and perceptual learning. Imaginative learning is probably the highest form of all.

13.7 CATEGORISATION OF TYPES OF LEARNING ACCORDING TO MEANING

In this classification the *central theme is meaningfulness*. The types of learning are not new. In fact, the learning methods are merely rearranged each time. This classification is based on the fact that the *learner must be involved* in his learning task to understand it. The main categories of learning encountered in schools are motor and verbal learning. In both cases the success of the learning act depends on the meaningfulness of the learning task to the learner. This is equally true of the child who must learn a proper attitude or conduct, inasmuch as he has to understand the new attitude or behaviour.

13.7.1 Motor learning

Any study of learning, and particularly of the different ways or types of learning, must start from the basic fact that the learner is totally involved in any learning act. It is always a person who learns – never just an intellect or an emotional system or a physical organism. And the person learns that which he does not know or cannot do. For this reason it would be hard to justify any classification of types of learning according to the degree of difficulty involved. It is just as difficult for a baby of four months to learn to walk as it is for a gymnast to learn to walk on a tight rope. Learning is always difficult.

Learning, no matter what its type may be, means conquering, mastering, attributing significance.

Motor learning relates to physical actions which are executed by

means of well co-ordinated muscular movements. However this delimitation is somewhat problematical, for it seems that even *purely mental* activities are accompanied by some degree of muscular activity. Experiments have shown (Sawrey & Telford, 1968) that people move their tongue-muscles while solving mental problems. And we all know how tense our muscles become in moments of heightened emotion.

But although muscular movements are involved in all types of learning there is good reason for giving separate consideration to the learning or acquiring of physical skills such as walking, running, riding a bicycle, javelin-throwing, writing, typing, painting, playing the piano, and so on. These activities cover an extremely wide range, from those involving and requiring but little conscious effort to those which require a great deal of attention, conscious effort and concentration both before and during execution. Writing, typing and playing the piano are some of the activities that fall into the latter category. Successful learning manifests itself in habitual action or automatism.

Much repetition is required before one is able to write without thinking about the shapes of the letters or to play the piano without having to look for F or G on the keyboard. A wide range of factors is involved in these types of muscular co-ordination: awareness, psychological maturity, motivation, repetition, etc. Co-ordination of muscular movements cannot be achieved without a great deal of practice and constant repetition. However *Research quarterly* (Maltz, 1969, p. 32) mentions an interesting and well-controlled experiment in which the investigator, significantly improved the goal-shooting of a group of basket-ball players by getting them to think about the actions involved in goal-shooting during their daily practice period. Moreover there was no significant difference between the performance of this experimental group and that of a control group which had actually practised every day. It seems, therefore, that a high degree of *involvement* (which implies mental phenomena such as motivation, purposefulness, aspiration and perseverance) can accelerate the acquisition of motor skills by making them *meaningful*.

A great many textbooks offer detailed accounts of conditioning, which is ultimately a question of conditioned reflexes. J.C. Coetzee gives in addition a detailed account of motor learning under the headings "Sensori-motor" and "Perceptual-motor learning".

The brain processes and neurological factors involved in learning have hitherto been left out of account in studies of learning, particularly learning in the didactic situation. As Penfield (Kagan, 1969, p. 138) remarks, ". . . there is no thoroughfare of cause and effect between the brain and the mind of man, and there will be none until a new bridge is built."

As we have said, the ideal result of motor learning is the formation of

automatisms. But as in other forms of learning, meaningfulness, personal involvement and the gradual experiencing of success are the conditions for speedy achievement.

13.7.2 Meaningful verbal learning

13.7.2.1 *Insight and significance*

According to the field approach, learning may be described as, among other things, the attainment of insight. Insight is the sensation of or feeling for relationships or patterns in the person's life space. This perception of the pattern of cohesion or structure of the perceptual field means that relationships have been understood. "Insight into a matter is its meaning" (Bigge & Hunt, 1962, p. 341). Insight often begins as a vague inkling which later becomes more distinct. One is learning with insight when one perceives and solves a problem. The development of insight is regarded as a change in the cognitive structure of the life space.

In the learning situation the child apprehends relationships which he has not previously noticed. It would therefore be true to say that a new thought structure has come into being. "Het optreden van inzicht gaat meestal gepaard met een emotie: het kind krijgt een gevoel van macht, omdat het zich tot een aantal dingen in staat weet, waartoe het oorspronkelijk niet in staat was; het krijgt ook een gevoel van veiligheid, omdat het zich nu in staat weet voor een sekere tijd aan gestelde voorwaarden te voldoen – dat wij met een echt inzicht te maken hebben, herkennen we aan het adequaat handelen in nieuwe situaties, adequaat ten opzichte van de oplossing van het probleem, dat het kind zich blijkbaar gesteld heeft" (Van Hiele, pp. 102-3).

When the observable data relating to the problem have been structured (and thus perceived) the problem is solved through the attainment of insight. In this context therefore, insight refers to meaningful methods of problem-solving.

But the attainment of insight also refers to new abilities to the power of "adekwat handelen" (adequate action). "(The former interpretation) . . . refers to insight as a *process* of problem solving; however the term is also used frequently to describe the *product* of meaningful problem solving . . . characteristics which are both subjective and objective. In the first case we are dealing with a largely affective reaction, in the second case we are specifying what we can do with the insight once it is achieved." (Ausubel & Robinson, 1969, p. 510).

“Problem” should not be taken to refer to a high-grade algebraic or scientific problem which must specifically be solved by means of reflective thought or by research. In our present context a problem is any obstacle which a person knows to be preventing him from the attainment of an objective. Even very small children attain insight when they find out how to fit two blocks together or how to fasten buttons. Once they have done these things they know how to do them on subsequent occasions.

The dawning of insight thus imbues the situation with psychological significance. In the sections that follow we shall be discussing the various types of learning mainly as functions of learning-with-insight. By meaningful learning we mean those types of learning which result in understanding, i.e. learning-with-insight. If he has learnt successfully, the learner understands. He has thus gained insight, and the ability to do something which he has never done before, is within his reach. It follows then that the child who has a wealth of insights at his disposal is more capable of intelligent action than the child who has not. We may mention in passing that explanations, where necessary, may contribute to understanding. The ability to understand does not necessarily obviate the need for explanations.

13.7.2.2 Language and meaningful learning

A small boy can produce sounds but is not able to speak or to use language. Language is essentially a medium of communication. Human beings use linguistic symbols as a means of inter- as well as intra-communication.

The baby's babbling sounds and the way in which he plays on and with his speech organs provide the practice which is necessary for the production of those pure sounds without which articulation would be impossible. Linguistic development depends upon milieu as well as upon maturation. Language is learnt through imitation. The child can only learn the language that he hears, and the quality of his language similarly depends upon his linguistic environment. “Children from superior homes have superior language abilities when compared with children from laborers' homes.” (Munsinger, 1971, p. 328)

The study of the development of language is important because it shows us how the structure has developed from phonemes to morphemes and has in the course of time become an efficient grammatical and semantic medium of communication and expression. The purpose and function of language forms an equally important field of study. Re-

search (Carmichael, 1954, pp. 499-502) has shown that when small children first use language they communicate by means of emotional expressions, particularly expressions of comfort or discomfort. The sounds they use soon develop into linguistic expressions because their denotative meanings can be understood by other people. The child thus becomes actively involved in establishing and maintaining the emotional climate of the home in which he is cared for and petted by loving people.

The next level of communication is characterised by the use of meaningful words with the intention of expressing ideas. The child understands the words he uses and he attributes meanings to the things and situations he encounters. "The meanings of words are cues to action and heavily tinged with feelings . . . Language activity grows . . . with the cyclical pattern repeated: with acceptance, the child takes over the sounds of speech, then the understandings of the meanings of words, then the use of the words themselves." (Gordon, 1969, p. 82)

During the pre-school years the child learns to use language with a considerable degree of semantic and grammatical correctness. He relies most heavily upon nouns and verbs, but can also use adjectives, adverbs, conjunctions, prepositions, etc. to express his thoughts. In normal circumstances cognitive development takes place hand-in-hand with the development of a functional language. It is therefore impossible to describe the various types of learning without constant reference to language.

13.7.2.3 Representational learning

The model of learning we have adopted here is that of meaningful learning (Ausubel, 1968). This rests on two assumptions, namely: (1) That meaningfulness depends upon the quantity, clarity and organisation of the knowledge, facts, concepts, mutual representations, theories and perceptions that a person has at his disposal at a given moment. This organised existing knowledge is known as the cognitive structure, and it includes certain determinants (Gordon, 1966, p. 8) such as the self-concept, selfrespect, ideals, aspirations and cognitive style, which relate directly to the personality. (2) The second important assumption concerns the focus of the study material.

Every learning activity that follows a meaningful course rests on these two assumptions. (We must remember that this elucidation of learning is merely a paradigm or model or construct of the mind, which we build up to enable us to explain and investigate learning phenomena.)

At birth the child apparently possesses only potential abilities. These

are activated and implemented at an astonishing tempo so that by the time he is six years old the child has a phenomenal cognitive structure at his disposal. Some investigators maintain that the human capacity for learning is on the increase throughout the period between birth and adulthood. (Sawrey & Telford, 1968, p. 60)

By the time he goes to school the child knows the names of the things in his environment and has acquired a wealth of more comprehensive concepts as well. Types of learning cannot be placed in any hierarchical order, but it is possible to distinguish different ways of learning and of adding knowledge to the existing cognitive structure.

Representational learning may be briefly described as naming or nomination. Learning the significance of individual symbols is one of the child's most important intellectual tasks. At first these symbols are encountered in the form of words spoken by the parents with reference to specific objects to which the child's attention is being drawn. This is how the child learns the names *dadda*, *mamma*, *dog*, *cat*, *chair*, etc.: he hears the name whilst he is looking at the object.

Initially, the child apprehends the meanings of things in terms of what he can do with them or what they can do to him. In a great many cases these meanings are functional, to a limited extent, even before he knows the name of the object concerned. This is demonstrated by the way in which young children define objects, e.g. "a chair is for sitting on", "porridge is what I eat", and so on.

On the basis of this experience the child attains insight and comes to realise that any and every object can be represented by a symbol, in other words that everything can be named. The significance assigned to the symbol is functional and is represented by the image of or mental idea of the object concerned.

Once the child has arrived at this generalisation the naming of things is no longer an arbitrary process. The idea that "things have names" and that the name symbolises the object and summons up an image of it, functions within his exploration and ordering of his life space. The process of naming things is no longer wholly arbitrary because the name recalls the image of the object it represents. Recognising the cat as a cat as distinguished from the dog requires an act of memory as well as of differentiation and integration. Thus even in this limited context representational learning is meaningful.

Other parts of speech such as adjectives, prepositions and particularly verbs, are probably learnt in the same way. Direct observation of the cat sitting *on* the chair, coupled with imitation of the parent who describes the situation in words, places the preposition in a meaningful context which makes learning possible. Representational learning continues as type, from childhood through adulthood. The man who *learns* at the age

of forty that the "name" of the new aeroplane is "Concorde" does so, not as an arbitrary learning act, but in continuation of the already well-known principle of representational learning.

13.7.2.4 Conceptual learning

All concepts or ideas are the property of a brain. They originate there and are stored there. A concept is not an actual concrete entity found in nature. It is a construct created by a human brain in an attempt to give meaning to some portion of the person's life space. A concept cannot therefore be literally handed over by one person to another. A teacher can only transmit his own concepts by explaining them verbally. Even the most coherent explanation of some particular aspect of a subject is at best only potentially meaningful as far as the pupil is concerned. "Each person has to make his own concepts." (Woodruff, 1970, p. 239) There are absolutely no grounds for the belief that a pupil can internalise concepts meaningfully, but in a passive and mechanical way, once they have been effectively explained to him. If the learner wishes to understand a concept he must personally attribute significance to it. According to Woodruff (p. 238) the relationship between a concept and the verbal symbol used to handle it has three dimensions, namely that of significance or understanding, that of feeling, as value-preference and a language symbol with which it is manipulated. The component of significance or understanding relates to the denotative aspect of meaning, whereas the feeling component relates to the connotative meaning, which is personal in character. The connotative overtones associated with concepts such as a friend, flag, terrorist, apartheid, etc., will vary from one person to the next, and in some cases may actually overshadow denotative significance.

It is necessary to distinguish between the formation and the assimilation of concepts. Concepts are formed when one discovers inductively the distinguishing characteristics of the members of the group or category to which the concept refers. For example, in order to form the concept "dog" the child must have had the opportunity of seeing large dogs and small dogs, black, white and spotted dogs, Alsatians, Boerboels, Collies and Dachshunds. He must have heard each one growl and bark, etc. These sensory experiences enable him to make his concept of "dog" more comprehensive and more adequate. Differentiation, integration and memorising – all of them specifically cognitive acts – are essential to this inductive process. While this denotative meaning is being formed the child may happen to be bitten by a dog and he may be afraid of all dogs in consequence. Or he may regularly have a good time play-

ing with his own dog and consequently develop a fondness for all dogs. This is how connotative significance develops. The main point is that conceptual learning and concept formation originate in direct personal perception of something concrete. "When a person is having his first significant experience with any fact or truth, it should not be a second-hand experience such as a lecture, or any form of verbal teaching. It should be a direct 'seeing' of the actual referent itself. There is no possible substitute for the mental images we acquire through our senses" (Woodruff, 1970, p. 243).

After the early years of childhood concepts are acquired mainly through the process of assimilation. The distinguishing characteristics of the concept, or of the members of the group represented by the concept, are not arrived at inductively through the differentiation and integration of sensory data. The new concept is assimilated because its distinguishing characteristics have been *explained* and have been related to the distinguishing characteristics of relevant aspects of the existing cognitive structure.

Conceptual learning through assimilation may be briefly described as follows: The new concept is explained by the teacher. In the course of this explanation the distinguishing characteristics are effectively singled out and "purified" of fortuitous features. The relevant elements in the cognitive structure – elements with which the new concept can be linked – are called "anchoring ideas". The new concept is now related, via its distinguishing characteristics, with the anchoring ideas already present in the cognitive structure. When meaningful study material is assimilated, subsidiary ideas are subsumed under comprehensive ones. Details of new concepts may be forgotten, but their significance will nevertheless have permanently enlarged the significance of the main ideas within the cognitive structure.

Concepts increase their range, density and complexity, and the acquisition of these more complicated types would best be discussed under the heading of propositional learning.

13.7.2.5 *Propositional learning*

(a) **IMAGE FORMATION**

Image formation can be regarded as a distinct facet of propositional learning and may be listed as a separate category.

One of the ways in which children learn is to construct a visual image of the facts that have to be understood or remembered. An infant soon learns to recognise his mother's face. Long before he

learns to read he is able to recognise and reproduce the names of cars, fruit, breakfast cereals, etc. It is difficult to account for this phenomenon except as the formation of a visual image which constitutes (to the child) a faithful replica of the particular object. Bruner (1973, p. 327) believes that enactive representation precedes the representation of visual images. It may be that a baby recognises his mother from the way she handles him before he learns to recognise her face.

The representation of objects through visual images which are internalised so that they can be memorised, recalled and used to recall similar objects, is a process that commences in early childhood and continues as an autonomous type of learning: ". . . all of them (enactive, iconic and language representations) remaining more or less intact and throughout life" (Bruner 1973, p. 327).

Coetzee refers to this type of learning viz. the formation of images as a way of acquiring knowledge about people, things and events that are inaccessible to direct observation and association. Accordingly he maintains that this is the ultimate form of learning in that it presupposes all the other types. However, from what we have said above it is clear that the child is capable of forming images before his linguistic powers and his reading and writing of language become functional. Bruner's conclusions from his empirical research are convincing, viz. that enactive representation is followed by the formation of images, which in turn is followed by symbolic or linguistic representation, while each type of representation continues to exist independently.

When a school child forms a visual representation by means of a visual image of a historical event or geographical phenomenon, this is merely a continuation of this autonomous type of learning, viz. image formation, which is established as a type of learning in the preschool phase.

The importance of image formation is stressed inter alia by neurologists and neurosurgeons such as Pribram (1969, p. 200), who writes: 'My plea is, therefore, that we not lose sight of the picturesque (image-making) for the brain is built to work with pictures.' He therefore recommends: '. . . instructors must help decode and recode the flux of material as it is registered.'

Language does not replace images but rather enables the learner to form more complete and detailed visual images. In fact, readers constantly visualise verbal descriptions as images.

Visual images are essential for the attribution of meaning to:

- a mother's comforting voice to her crying baby;
- the landing of Jan van Riebeeck; or

– rainfall distribution or the formation of horseshoe lakes.

This mode of representation is indispensable to architects and painters no less than to creative scientists. Kekule's 'seeing' of the circular molecular structure or organic bonds is a cliché, as is Faraday's visual representation of magnetic fields. Einstein (Roberts 1975, p. 404) said: 'The words or the language as they are written or spoken, do not seem to play any role in my mechanism of thought. The physical entities which seem to serve as elements in thought are certain signs and more or less clear images. . .'

The didactic implications for the learning event are of cardinal importance. The teacher must help the pupil to form visual images by the presentation of subject matter in the form of maps, drawings, models, etc. wherever relevant. He must also assist pupils in decoding and coding verbal subject matter so as to form structures that pupils can visualise, even when the form is fairly abstract. This is what happens in the representation of meanings that are assimilated in the cognitive structure. Thus representational learning involves not only the formation of images, but also the representation of comprehensive concepts during conceptualisation and assimilation of concepts.

(b) VERBAL COMPOSITE IDEAS

In conceptual learning the emphasis falls upon concept formation; but there is a certain similarity between propositional learning and the forming of concepts after verbal explanation. In the preceding section we were discovering individual concepts. *In propositional learning, however, the objective is to understand the meaning of a composite idea of the kind we express in sentences.* Though the sentence is made up of meaningful words, the composite idea it expresses is more than the sum total of the words. Understanding depends upon the reconstruction of individual meanings.

Syntactical rules fulfil the mediatory function of relating verbally-expressed ideas to one another, thus facilitating understanding of the new ideas. Learning a complete syntactical code is an extremely complex process; yet the child has mastered such a code some two years before he goes to school. The concepts expressing relationships such as out, in, on, under, etc. are apparently learnt inductively.

When propositional learning is proceeding in a meaningful way

the sentence that is being learnt is related to the ideas already present in the cognitive structure. The relationships thus established may be classified as follows:

(i) *Subordinate relationships*

The new concept is included in or under a more comprehensive concept which is already present in the cognitive structure. If for example the child already knows that dicotyledonous plants have tap roots he can understand with little cognitive effort that Jacarandas have tap roots: this is merely particularising. However the new concept may extend or qualify the more comprehensive concept with which it is connected. For instance if one knows that the opposite sides of a parallelogram are both parallel and equal, this knowledge is extended by the information that the opposite sides of a rhombus are parallel and that all its sides are equal.

(ii) *Superordinate relationships*

The new content gives the established knowledge a more comprehensive or a more encompassing character. For instance if the child already knows that the sum of the interior angles of a rectangle, a square or a parallelogram is always 360° , the new proposition, "the sum of the interior angles of any quadrilateral is equal to 360° " will be more comprehensive. The quadrilateral may be studied as a special case, but the information may also be acquired inductively.

(iii) *Combinational relationships*

In this type of learning there can be no inclusion under preexisting comprehensive ideas. This applies to the teaching of new study material, particularly when the whole subject is new. The new knowledge is presented against a background of vague general relevance. Material of this kind is difficult to learn. We know from experience that it often takes a student a long time to orient himself towards a new subject so that he can begin to learn successfully. It takes time to form new concepts. But even if immediate assimilation is not possible, and even if the subject is totally new, concept formation does not take place in a vacuum. The ideas may be strange, but the sentence will be semantically comprehensible all the same. Concrete representation, where possible, will greatly facilitate the establishment of connective relationships. Good organisation (Bruner) is also very important. The formation of clear and meaningful images or mental representations will soon obviate the need for mechanical memorising.

13.7.2.6 *Learning by discovery*

This is the type of learning that is required when the study material or learning task is not presented in a final explanatory form. It therefore differs in this respect from explanatory teaching and receptive learning. Before the learner can assimilate he must re-arrange, reorganise or re-structure, and to do this analysis and synthesis may be required.

Learning by discovery obviously intersects all forms of learning. It is clearly present in the process of concept formation and in the inductive acquisition of comprehensive concepts in the course of assimilation. It is present as a distinct type of learning in problem-solving and creativity.

13.7.2.7 *Problem-solving*

There have been many definitions of problem-solving some differing so widely as to be mutually exclusive. At every stage in his development, even in the very early phases, the child is confronted with *problems*, i.e. he encounters difficulties or obstacles within his life space, and must find ways of overcoming them. But if we accept as our criterion that "It (a problem) involves going beyond the information given," (Ausubel, 1968, p. 535) then all difficulties do not qualify as problems.

In the school situation, problem-solving occurs when the child is confronted "with a problem that is genuine to him in terms of his needs and experiences A real problem is more than an idea to be manipulated" (Mouly, 1970, p. 383). If the pupil is not directly aware of the problem and is not personally involved in it, then it is not a problem for him. It simply remains the teacher's or other person's problem, and leaves the child *stone cold*. In order to solve a problem that occurs to him, in Dewey's words, "as a felt need", the person must assemble the required information, organise and re-arrange it until insight is achieved and the solution is seen as a "means end relationship" (Ausubel, 1968, p. 534).

13.7.2.8 *Creativity*

Creativity is directly related to problem-solving. In problem-solving, as discussed above, thinking is mainly convergent. In geometry for instance one might be asked to prove that two lines are equal in length, or to find the value of a certain symbol. Only one correct answer is possible. Where creativity is required, in contrast, there is usually no pre-determined correct answer. What is required is a combination of realistic

thought and imagination. It is a kind of problem-solving, but without any set answer. Self-expression often predominates. And it is important that the answer should be useful. People who do creative work – writers, painters, scientists, or those who are creative in particular fields – follow rules that are relevant in their own particular fields.

Schools should encourage children to express themselves in ways that are new to them and to try methods that deviate from the tried-and-trusted, so that their originality can find expression in unusual answers – which may be astonishingly useful. Creative thought is completely divergent.

The meaningful verbal learning which we have been emphasising throughout this book fits in with a functional cognitive structure. Creativity is not a game in which fantasy is allowed free rein. Even if ideas are organised in strange new ways or complicated conceptual schemes are devised, the starting point for creative thought, and the medium in which it occurs, is always a functional cognitive structure.

13.8 CONCLUSION

However variously it may be defined, learning is always a meaningful act and always involves significance attribution. Intentional learning, which occurs in the pedagogic situation – particularly the pedagogic-didactic situation – takes place with the guidance of teaching/instruction provided by a parent/teacher. Since significance attribution is a natural activity of children, intentional learning is of the first importance, whether it occurs in a formal didactic situation or in an unstructured friendly or conversational situation.

All the different types of learning are constantly involved when a person learns in response to explanatory and heuristic instruction given by a teacher-educator.

We emphasise meaningful verbal learning because most learning activities proceed with the aid of spoken or written language. Language is extremely important because we name concepts by means of linguistic symbols, and this promotes the attainment of insight, which must occur in all forms of meaningful learning.

In this chapter we have emphasised learning activities as such. However it is also important that children should be taught how to learn. The question “How do pupils approach learning problems?” is highly significant. Every child has his own way of creating relationships within his own life world. This way of knowing things or approach to knowledge is called cognitive style. Kagan, Moss and Sigel (Gordon, 1966, p. 51) of the Fels Research Centre have been responsible for most of the re-

search that has so far been carried out in connection with *cognitive style*. They distinguish between an analytical and a non-analytical cognitive style. Many learners display a learning style (which is of course related to cognitive style) which consists in structuring the content to be learned; others again tend to begin memorising immediately. It is also possible to distinguish a cognitive style consisting in learning-with-insight, as against one which relies upon trial and error. Successful learning cannot summarily be coupled with any particular cognitive style, but some approaches are certainly more economical than others as far as the time required for significant learning is concerned. The cognitive style or approach plays an important part in successful learning.

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CHAPTER 14

Successful learning

14.1 INTRODUCTION

Children have an inherent inclination to impose order on their world, which is initially chaotic. They do this by assigning significance to their sensory perceptions of things in the world around them: they name things, differentiate between them and integrate their findings. All learning begins with direct personal perception of the people and things in the external world. A child's first experience of new facts or truths should therefore take place at first hand. Such direct *seeing* makes it possible for the learner to form correct images. In addition to their inherent or denotative significance, things have a connotative significance which is assigned to them by the learner on the basis of his own experience and expectations. When the baby cried yesterday he was, as usual, picked up and petted by his mother. Now he is quiet when he hears her footsteps, because he expects to be picked up again. He has thus attributed significance to the footsteps he hears.

In schools one often finds that teachers concentrate on imparting facts instead of trying to ensure that the pupils understand the facts. The accumulation of unassimilated facts which have been mechanically memorised confuses the child, and certainly does not pre-emphasise isolated facts without placing them in the context from which they derive their meaning. The children learn strings of facts, often without even understanding them. The advantage of doing this is that correct verbal reproduction gains more marks in tests and examinations than would a badly-worded expression of the child's own concept.

Of course facts must be taught, for without them reasoning, the assimilation of additional concepts, and abstraction would be impossible. But empty verbalisms are no substitute for the understanding of facts and concepts. Meanings cannot simply be transferred from one person

to another. A concept is a mental construct which is formed to enable the person to understand a situation, and each person must form his own concepts. Even adults cannot grasp the full meaning of a concept immediately. At every stage of development, linguistic knowledge at the required level is the pre-condition for the understanding and handling of concepts, for language is the vehicle for both percepts and concepts.

The specific task of the learner is to understand the content of the subjects he is taught with a view to mastering it. His initial mastery becomes permanent when the content is assimilated into the cognitive structure: the pupil then knows the subject.

The learner himself must understand the facts and concepts that he learns. We shall now consider the conditions and circumstances required for the initial successful understanding of facts and concepts.

14.2 COGNITIVE FACTORS AND SUCCESSFUL LEARNING

14.2.1 Aptitude, learning speed, and success in learning

Individuals differ as regards their aptitude for learning different subjects. In the past, various aptitude tests seemed to predict achievement very reliably. Carroll opposes this belief when he asserts "that aptitude is the amount of time required by the learner to attain mastery of a learning task" (J.H. Block 1971, p. 50). This statement implies that all pupils can understand every learning task if they are allowed sufficient time. If Carroll is right, then every pupil could master every learning task if suitable methods of teaching and learning were applied, and if sufficient time were allowed. Research, such as that carried out by Glaser and Atkinson seems to support this contention: they found that most of the pupils in their test groups were able to meet the achievement criterion, but that some did so more rapidly than others.

The aptitude distribution may be such that approximately 5% of learners show very little aptitude for a particular subject. The remaining 95% can all understand and master the subject if they are given enough time and suitable assistance. To assist them to master the study material, learning strategies which will reduce the time required for understanding the learning tasks involved must be developed.

Bloom (1964) and Hunt (1961) both found that aptitude for a subject, as determined by the available methods, was not completely stable. Improvements resulted from improved environmental factors and successful learning experiences.

Further research on aptitude is needed, but the indications are that a lack of aptitude is not a significantly disturbing factor as far as most learners are concerned, provided that suitable methods of instruction and study are used, and that the learner is given sufficient time to master the subject.

14.2.2 Ability to understand instruction

Successful learning depends upon the degree to which the learner understands the nature, content, methods and procedures of the subject concerned. As far as ordinary teaching is concerned, we are assuming that the pupil is not subject to any physical disability which would hamper learning. In the didactic situation one of the conditions for understanding is that teacher and pupils should be able to communicate. The teacher must have a message to impart to his pupils. And the level of knowledge of the class as a group must be such that they are able to understand the new information. Secondly, the linguistic knowledge of the class must be such that the words used by the teacher do not raise problems. The pupils must have acquired the necessary automatisms, both on the general academic level and with regard to specialised technical language, to enable them to keep pace with what is going on in the class. There may be a tremendous number of individual differences with regard to defects in the cognitive structure and in linguistic ability. Some pupils, consequently, will not be able to understand the material being taught. Nevertheless the majority of the class will understand and will make satisfactory progress.

14.2.3 Attention and advertency

Attention or advertency cannot in itself be described as a cognitive phenomenon, because it involves the direction of the total person towards something. The giving of attention is a conscious voluntary act resulting from a voluntary decision. Perception, and indeed all cognitive acts, have their origin in attention. *Attention not only initiates cognitive acts but also keeps them going until they have run their course.* One does not pay attention to everything that happens to be within one's field of vision. Attention is therefore directed and relatively limited, but not in a constant manner for it can be directed to one object or divided among several. In this connection we may distinguish between

- (a) fixed or concentrated attention and
- (b) fluctuating or distributive attention.

The attention not only includes only a limited number of objects: it also excludes certain objects or characteristics or facts. For example, if I am looking for a certain name or fact on a certain page of a book, my attention excludes everything and I see only the word I am seeking.

The conditions for concentrating the attention may be divided into

- external or objective conditions;
- inward or subjective conditions.

14.2.3.1 External conditions

- (a) Unusual, striking, unexpected stimuli such as a bright light, a sharp blow, movement, etc., compels attention.
- (b) The valency the object has for the observer affects attention. The compelling power of the thing being observed is closely connected with the connotative significance of the object for the person concerned.

14.2.3.2 Inward conditions

Interest in the object, together with aptitude for the task and practice in concentration make it possible for a person to fix his attention on a particular matter. Some people can concentrate even in very noisy surroundings, others are easily distracted.

Poor health can affect concentration, particularly when it must be sustained for long periods. The mental state of the learner is also significant: absent-mindedness resulting from domestic tension or anxiety, fear of a teacher or of the criticism or teasing of contemporaries may hinder concentration. Spasmodic attempts at protecting his own self-image may also disturb a learner's concentration on the subject in hand. The most important point about attention is that the more intensely it is concentrated on an object the clearer the person's image of that object will be. Intentional learning is not possible at all without concentrated attention.

14.2.4 Perseverance

It takes time to master any learning task. Perseverance can therefore be measured in terms of the time that an individual pupil is prepared to spend on a specific task. If the learner is not prepared to spend the minimum amount of time required for the mastering of the task, he will not

fully understand it. Generally speaking, a pupil's perseverance indicates his attitude to learning, to particular subjects, and to school life as a whole. Perseverance, regarded as the time that a pupil voluntarily decides to devote to various subjects, differs from one subject to another. It seems to be closely connected with interest and with the amount of success experienced in the subject concerned. If a person's previous efforts with regard to a particular subject have been successful, it is highly probable that he will be prepared to spend more time on that subject. Conversely, a teacher who is over-enthusiastic in his use of the red pencil may discourage perseverance.

People's frustration thresholds differ, but if a learning task is too difficult or too time-consuming, efforts at learning will eventually decline, even if perseverance is normally one of the person's character traits. Some measure of perseverance is required for the understanding of all learning tasks.

14.2.5 Learning time and successful learning

As we have said, every learner requires a certain minimum amount of time in which to understand every learning task. Schools must adhere to timetables if they are to function at all. A certain amount of time must be allocated to each subject and to each lesson. Some children will find the allocated time too short for some subjects, while to others it will seem unnecessarily long. In the school situation therefore, it is typical and to be expected that some children will not understand everything they are taught about some subjects. Teachers will be more successful, other things being equal, if they make provision for each child to work at his own tempo until he has achieved understanding.

14.2.6 Cognitive style

The child is continually in contact with the unknown: things, people, ways of behaving, ideas or concepts. In order to construct his own life world he must imbue all these things with meaning. The unknown is always problematical. In order to form relationships one must understand, and this requires differentiation, integration, comparison, and so on. Retention, and hence deliberate memorising, plays an important part in every problem and in every explication of the unknown.

By cognitive style we mean the way in which a person approaches problems or sets about tackling new study material. Here we distinguish between (a) the person who approaches the task via understanding and

(b) the one who aims at correct reproduction after memorising material in a mechanical way. As far as understanding is concerned, we may distinguish between an analytical approach and a non-analytical or total approach. A rigid cognitive style or a stereotyped approach may make it difficult for the person to understand a learning task. A flexible and thus adaptable cognitive style promotes rapid understanding; but it seems that cognitive style is strongly influenced by personality.

14.2.7 Insight

Köhler, (1929, p. 373) with whom the concept of insight originated, defines it as "Our experience of definite determination in a context, an event or development of the total field" (Gestalt Psychology N.T. 1929, p. 373). Insight thus consists in becoming aware of the relationships between data, in such a way that a pattern emerges. Insight occurs in respect of a problem situation. The person sees the relationships between the data in a way that points to the solution to the problem. A teacher can never "pass on" his own insight into a problem situation or into the solution to a particular problem. The insight must be achieved by the learner himself. Insight is almost synonymous with understanding: it involves much more than the memorising of isolated facts, for it places the facts in a coherent order and in a clear pattern with regard both to the existing cognitive structure and to one another.

If he is to understand, the learner must spend enough time on the learning task to allow insight to dawn. Understanding thus depends upon the attainment of insight into those relationships that are relevant to one's purpose.

14.3 THE CONNECTION BETWEEN AFFECTIVE FACTORS AND SUCCESSFUL LEARNING OR MASTERY

Affective factors cannot be divorced from cognitive factors; nor can they be isolated from other personality characteristics. The distinctions we are about to draw are intended to determine the degree to which these phenomena influence the understanding of study material.

14.3.1 Interest

By interest we mean the learner's personal involvement in a particular subject or learning task. It presupposes that the person is already partly

familiar with the material and has therefore established some kind of relationship with it. The nature of the relationship depends upon the importance of the material to him. *The Shorter Oxford English Dictionary* (1965) defines interest as "The feeling of one who is concerned or who has a personal concern in anything". This implies that it is impossible to be interested in a totally unknown object, theme or concept.

If a pupil is generally interested in what he does at school, he will be prepared to take an interest in subjects or material about which he as yet knows nothing. However this willingness to be interested will not last indefinitely; it will dwindle if it is not realised to a reasonable degree within a fairly short time.

If a student's first essay receives a high mark and favourable comments, he will tackle his second one with more enthusiasm and confidence than would otherwise have been the case. If his efforts repeatedly meet with the opposite response it will be difficult for him to maintain his interest in the subject. With an increasing number of experiences with learning tasks which the learner sees as identical, his interest will gradually stabilise, and subsequent tasks of a similar kind will be tackled with great interest, no interest or a degree of interest somewhere between the two.

We must remember that the degree of success will differ from one learner to another, but that the experience of success will always be an important factor with regard to the arousing and consolidation of interest. Success does not necessarily mean maximum achievement; the individual pupil will decide for himself more-or-less what his position is in relation to the distribution of marks for each subject. Experienced high-school teachers have found that when pupils have to choose subjects they are often influenced by the degree of success they have attained in the past in the subject concerned. In the absence of such experience they tend to choose subjects in which they think they have a good chance of succeeding. They choose what seem to them to be the *easiest* subjects.

14.3.2 Attitudes

In the present context an attitude may be described as a general tendency or state of preparedness to behave in a particular way with regard to the school. The pupil's attitude, whether it be favourable or unfavourable,

rable, stems mainly from his generalisation of his own experiences with regard to the school. An attitude is thus a much more generalised thing than interest, which relates exclusively to experiences regarding a particular subject. Once again, individual differences are an important factor. The number of successes or failures required to create a positive or negative attitude to the school will differ tremendously from one pupil to the next, but the difference is really only one of degree. Every individual will, after a sufficient number of experiences of success or failure, develop a correspondingly positive or negative attitude towards the school. A great deal of research has been done concerning the relationship between the pupil's achievement and his attitude towards the school (Block 1971, p. 20). The findings indicate that a well-defined attitude towards the school has already been developed by the end of the primary-school period, or to put it another way, that if a pupil has a strong attitude towards the school it will have been formed, in the main, by the time he leaves primary school.

Repeated experiences of incapacity are painful, and will tend to create a negative attitude towards the school: the pupil's efforts are likely to be directed towards withdrawal or even rationalisation, for he must find some way of defending and maintaining himself. This negative attitude will affect all his subsequent efforts in connection with learning and school affairs generally. The pupil's ability to complete a learning task successfully therefore depends, among other things, upon his attitude towards the school

14.3.3 Self-concept

The role played by the self-concept in learning activities constitute an extremely important problem which we shall not be able to discuss fully here. We shall merely refer to the following definition of the self-concept (Purkey, 1970, p. 7). "The self-concept is a complex and dynamic system of beliefs which an individual holds true about himself, each belief with a corresponding value." According to this definition the concept of the self is both organised and dynamic. The individual is the centre of his own experiences and of his own personal world. Everything he observes, understands and interprets is seen from this personal anchorage or reference point, and human or personal motivation is a product of the individual's endeavour to maintain and develop himself. The concept of the self is based on the person's experiences in the inter-personal world. These experiences are extremely varied, and the self-concept consequently has many facets. The learner's concept or idea of himself as a learner is important. His previous learning experiences may be such that

he sees himself as a successful learner. Or he may see himself as a successful learner in history but hopelessly incompetent at mathematics. The individual is constantly engaged in judging himself on the basis of his experiences. A few, or even a good many successful or unsuccessful experiences will not in themselves have any significant effect upon the self-concept. What is important is the way the person feels about his successful or unsuccessful experiences. Their intensity and duration must necessarily cause him to feel not only that his efforts with regard to the particular subject have failed but that *he* is a failure in that subject. Conversely, the self-assurance that accompanies successful experiences would cause him to feel competent in the subject concerned, with the result that he would tackle even the difficult problems in that field with a good deal of confidence.

Empirical research has not provided many data relating to the self-concept, for this is a difficult construct and suitable experimental methods are hard to devise. Findings such as those produced by Torshen indicate that the correlation between the academic self-concept and school achievement is approximately +0.150 which is not significant. The available experimental data also suggest that the academic self-concept has been fairly clearly formed by the end of the primary school period. The self-concept thus formed therefore depends upon the quality of school experience in the primary-school years. The precise manner in which and the conditions under which the academic self-concept is formed are of little importance at the moment. The point is that the academic self-concept may be high or low, and that a low academic self-concept increases the likelihood that the person concerned will form a negative general self-concept.

Successful experiences at school do not guarantee the formation of a positive general self-concept, but they do increase the likelihood. Conversely, unsuccessful school experiences are almost certain to result in the formation of a negative academic self-concept, and this increases the likelihood that the person will form a negative general self-concept. The individual is constantly engaged in self-maintenance and self-enhancement: he therefore tries with all his might to achieve some degree of certainty with regard to his own value (self-value), and if this is denied him in one area he will seek it in another.

Since the school is such a dominant factor in the lives of young people, it is extremely difficult for a person who has been progressively developing a negative self-concept to find an honourable way of satisfying his need for self-assurance elsewhere. We must remember that where interest and attitude are concerned the source of experience is situated outside the self, whereas when the self-concept is being formed the source of experience is inward: it is the actual self. The effect of the

academic self-concept – a concept which is largely undifferentiated – is that a person with a negative self-concept with regard to a particular subject does not say to himself “I cannot do this task” but “I am bad at arithmetic, regardless of the difficulty or otherwise of the problems placed before me”. Thus whenever he tackles the subject he does so with the conviction that he is a failure as far as that subject is concerned. Once a negative self-concept has been formed, even successful efforts with regard to the subject concerned may possibly not be experienced as successes. Success is sometimes rationalised out of existence, e.g. the person says “that problem must have been very easy”, or “it was a sheer fluke that I got it right”. The quality of the person’s total academic self-concept is of decisive importance as regards his approach to individual subjects and is thus the pre-condition for the experience of success.

14.3.4 Mental health

By mental health we mean a person’s ability to endure tensionfilled situations. It is the opposite of personality problems, personality disintegration and mental illness. In the classroom the first signs of defective mental health may appear in the form of hostility, aggressiveness, anxiety, fear, vandalism, withdrawal, and a variety of other symptoms. Mental health is indicated by an ability to overcome tense situations without suffering serious personal disintegration. A pupil may be so afraid of a teacher that he works only spasmodically and experiences so much tension that his powers of understanding and his ability to solve problems and to study successfully are completely disrupted. Excessive anxiety and tension produce emotional disturbances which retard successful learning. A constant inability – real or imagined – to cope with everyday situations such as those encountered at school leads to anxiety and frustration and paves the way for mental illness. Conversely, a person’s ego-strength – his belief that he has the ability to do things – is the quality that safeguards him against mental illness.

School experiences can thus contribute to mental health or mental illness. On the other hand, the pupil’s mental health is a pre-condition for a successful approach to the problems encountered in a particular subject, while insecure relationships with teachers and fellow-pupils often result in frustrations and experiences of anxiety. The pupil who is perpetually fearful and anxious must develop defence mechanisms in order to preserve himself. The successful pupil, on the other hand, can relax and forget himself and can therefore devote all his powers to the tackling and solving of problems.

It seems, then, that mental health is very closely related to the pupil’s

self-concept. Thorough exploration of the study material, so that the pupil can understand it and can thus experience success, is still indispensable. Praise and encouragement are among the most important of the motivational factors because they promote the pupil's ego-development.

14.4 TEACHING FACTORS AND SUCCESSFUL LEARNING

14.4.1 The teacher-pupil relationship

In the didactic situation the teacher is constantly engaged in assisting and supporting the pupil, offering explanations, and so on, while the pupil receives the proffered assistance. This immediately suggests that an authoritative relationship is indispensable in the didactic situation. Here however, we are particularly interested in the inter-personal events that take place in the classroom, and in the effect these have upon the success with which the pupil is able to learn. Initially, the authoritative relationship is transferred from the home to the school. With small children one strives for harmony, for they are emotionally involved in their experiences and therefore have a deep need for security. In the course of time the relationship becomes more matter-of-fact.

If we distinguish carefully between an authoritarian and a democratic classroom relationship, it is clear that the latter results in higher achievements than does the former. We should also mention the possibility of a permissive attitude on the part of the teacher: this results in the pupil's doing more-or-less what they like when they like. Coopersmith's (1967) investigation is highly significant in this regard. He found that the self-concepts and achievements of pupils who were developing in a permissive atmosphere were significantly lower than those of children growing up under definite forms of control with clearly marked educational boundaries. The child is engaged in exploring and getting to know the world and in orienting himself within it, and he requires educational assistance if he is to do these things successfully.

The psychological atmosphere in the classroom ultimately determines the mental welfare of the pupils as well as their ability to achieve. This psychological atmosphere is difficult to define. It is revealed by the emotional intellectual temperature of the classroom – in whether or not the pupils are cheerful, lively and outspoken. It is also revealed by the ways in which tensions arise and are resolved. In a warm classroom atmosphere one senses inspiration, comprehension, the acknowledgement of

personal worth, encouragement, comprehensibility: learning proceeds in a relaxed manner and with contributions from the pupils. Confidence is another important factor to be considered when one is assessing psychological atmosphere. There must be mutual confidence. The teacher must trust the pupils and the pupils must trust the teacher. If the psychological atmosphere is relaxed and imbued with mutual trust there is room for a genuine meeting between teacher and pupil; the teacher will be able to communicate his message to the pupils and they will be able to receive and interpret it without strain.

14.4.2 Extrinsic motivation by the teacher

All successful intentional learning is founded upon the will to learn; this will must therefore be aroused if one is to teach successfully. Klausmeier and Goodwin (1966, p. 447) draw attention to the following ways in which teaching can be mobilised to intensify the pupil's motivation.

- (a) Focus attention on aims that are important to the learner.
- (b) Encourage the development of positive aims.
- (c) Set realistic objectives.
- (d) Create a warm but orderly atmosphere.
- (e) Provide incentives.
- (f) Avoid serious tensions and disorganization.
- (g) Link the unknown with the existing cognitive structure.

Methodical punishment, reward, competition, co-operation, etc. always promote the will to learn. Mursell (1954, p. 53) says: "It is to organize learning in such a way as to get a grip on the motives and impulses of the learner which implies also that it becomes richly meaningful to him." To learn successfully the pupil must want to learn. By awakening interest, formulating objectives which the pupils can actually reach, and explaining the study material in such a way that the pupil can understand it, the teacher can do much to activate the pupil. The will to learn is a condition for successful learning, and it can be intensified by extrinsic motivation emanating from the teacher – particularly with regard to the experiencing of success.

14.4.3 The quality of the teaching

In the didactic situation, successful learning depends upon high-quality teaching, for all teaching means "hulp by het leren". In the past, the quality of teaching was judged largely by the answers the class as a group was able to give. Without going into a detailed discussion of the

didactic implications of high-quality teaching, it must be mentioned that the teacher should present the study material in such a way that it is meaningful to the pupil.

Nowadays we look to the individual pupil when we want to know whether or not teaching has been successful, for it is the individual who must learn successfully and thus derive the optimum benefit from the teaching he is given. The quality of teaching can therefore be improved if we take account of the individual pupils with regard to successful learning.

14.4.4 Development and readiness for learning

Piaget and Bruner distinguish corresponding stages in the cognitive development of children. In keeping with these stages, study material can be presented at varying levels of advancement. Bruner says that: "any subject can be taught effectively in some intellectually honest form to any child at any stage of development." This statement requires qualification, but what it boils down to is that the study material must be structured in such a way that it accords with every level of cognitive functioning (enactive, iconic and symbolic). This insight has inaugurated a new era with regard to readiness, applying to both the learner's particular level of development and the ordering of the study material. Bruner says that the concept of readiness should be revised in such a way as to include both the child and the study material. The study material must in fact be so ordered as to accord with the different stages of cognitive development, namely the level of concrete action, the level of image formation or representational learning, and the symbolic or abstract level. So far there has been little experimental confirmation, but there are indications that, up to a point, both the pupil and the study material can be brought to a state of readiness. The actual course of the child's development seems to provide the best indication of what could be meaningful to the child. Though problems do exist, empirical research seems to indicate that both the learner and the study material can be made ready with regard to a particular learning task. Once again the emphasis falls on the individual pupil, for it is he and only he who may be ready for a learning task, and the assimilation of new study material can take place only within the cognitive structure of a unique and singular individual. Nevertheless, individuals have enough characteristics in common to make class instruction a practical possibility.

One of the teacher's tasks, therefore, is to adjust the study material to the pupil (or class of pupils) after having made him/them ready for a learning task.

14.5 CONCLUSION

Initial success is a condition for the ultimate successful handling of a learning task, including the knowing of the material that had to be learnt. This ultimate success can only be attained if the learning has involved the total person, as discussed earlier on. To sum up, successful learning may be described in terms of three conditional or determining factors, namely:

14.5.1 Significance attribution

Learning can never be wholly successful if the learner himself has not found significance in it.

14.5.2 Involvement

As we have said before, learning is not solely a cognitive or rational matter. If the learner is to create meaningful relationships he must *WANT* to be involved as a person – somatically – mentally, cognitively, affectively and conatively. The greater the scope for total involvement, the greater the likelihood of successful learning; and the more intense the involvement the stronger the influence of the learning activity upon the self-concept. Among other things, the pupil's interest in and attitude to learning and intrinsic motivation will indicate the degree of his involvement. These factors are therefore related to successful learning.

14.5.3 Experience

Another aspect of successful learning is the learner's experience of or feeling for the significance of what he is learning: his lively participation in what he is deliberately making his own makes him at one with the material.

New material must be assimilated into the cognitive structure. This assimilation is not an exclusively cognitive act but is accompanied by experience, active participation and thus involvement in the learning act and its meaning, with a view to success. Success brings the learner even closer to the objectives that were initially formulated: total success is made up of a progressive series of successes.

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CHAPTER 15

Consolidation

15.1 INTRODUCTION

Human experiences are stored in the brain. That is why one is subsequently able to recall what one has experienced. From the cradle to the grave, man is always learning; he is constantly engaged in attributing meaning to his experiences. By so doing he imposes order upon the world and makes it his own. When a child arrives at school for the first time he already possesses a wealth of consolidated knowledge, of which the most important segment is probably his ability to use language. At school the child is taught various things relating to the adult cultural system. The child himself must attribute his own meanings to what he is taught and thus make the material his own by anchoring and establishing it. The formal learning that he does at school is a continuation of the processes of significance attribution and retention, in which he has already made considerable progress during the six pre-school years. The various types of learning are employed to ensure that the material is meaningful to the child. The functional, and therefore consolidated, knowledge required for the simpler types of problems is concrete-perceptual in character. Formal problems require the manipulation of organised concepts until insight into the solution is attained. Success at this level is dependent upon the possession of sufficient knowledge which has previously been consolidated in various ways and is thus functional and available for use.

15.2 THEORETICAL APPROACH AND ASSIMILATION

Consolidation presupposes that what is to be consolidated is already in

existence. There must therefore be a learning achievement signifying successful learning. This first or initial successful assimilation must now be improved upon, intensified, made more comprehensive in scope and more functional. At the same time, a higher degree of permanence must be attained, so that the results of the learning will be functional for future as well as for immediate use. When one discusses establishment or consolidation one needs to say everything at once. The topic cannot be divided into a number of different facets, and even the drawing of distinctions is a delicate matter, for the meanings (sometimes multiple) of various concepts are so closely intertwined that speculation about one inevitably involves speculation about the others. Setting aside this mass of interconnected concepts, let us try to clarify the question of consolidation by answering the following questions:

- (a) What is it that is consolidated?
- (b) What method(s) ensure consolidation?

H.J. Butcher (1968, p. 75) has pointed out that empirical research in connection with problem-solving is influenced by the theoretical orientation of the investigator. A Behaviorist and a devotee of the Field approach will set themselves differing problems, for example. They will propose different kinds of hypotheses and use differing methods. Descriptions of the learning results which are eventually consolidated vary in much the same way. One investigator (Thorndike) describes them as well-trodden reflex-paths; for another they consist of an organised additive accumulation of simpler "elements": "a student is ready to learn something new when he has mastered the prerequisites" (Gagne, 1970, p. 27). Those who adopt the Field approach maintain that learning results far from being additive, are organised and differentiated experiences arranged in significant patterns. As far as this group of investigators is concerned, consolidation is the organisation and re-structuring of meaningful relationships which, via partial and eventually full insight, lead to cognitive clarity. The individual consciousness thus possesses a wealth of structural *gestalts*.

To avoid the complications caused by differing approaches and virtually irreconcilable problems, methods and results, the following account will be based on a Field approach also adopted by cognitive theorists (Ausubel, 1968, p. 471). The learner is the subject who acts within his own psychological field. Within this field he perceives whatever aspects of the external world have significance for him and accord with his needs, aims, insights, former experiences and abilities. The reality he observes is phenomenological rather than objective and physical.

Since significance attribution takes place progressively, consolidation follows a similar course. Mouly (1970, p. 41) describes the process succinctly as follows: "The learner begins by perceiving the overall confi-

guration, at first imperfectly, but by gradual and progressive differentiation of the components he gets a progressively clearer picture of the whole The emphasis is on organisation, relationships, meaningfulness and cognitive clarity." Repetition is thus an integrated complex of events in which the above-mentioned mental activities lead to consolidation.

15.3 SIGNIFICANCE ATTRIBUTION AND ASSIMILATION

The attribution of significance to the world is based on the integration of what is seen, heard, felt, used, etc. The important point is that significance attribution originates in concrete sensory perception. The Thought Psychologists maintain, moreover, that the lowest layer of thought – the concrete-perceptual – must be adequately filled with direct personal experiences of things before the upper layers can function.

No one, whether child or adult, gains full understanding the moment he perceives something and attributes significance to it. The *longer* one looks the *more* one sees, distinguishes and understands. *Prolonged* perception results not only in more comprehensive understanding but also in more effective consolidation of the meaning of the concept, for its various aspects become more distinct and fit into broader patterns which can be linked with the relevant cognitive structure in a significant way. The range of meaning, and consequently the consolidation of meanings, is increased.

Concepts too, should be perceived repeatedly, so that through critical viewing, analysis, differentiation, and further integration, richer meanings may be apprehended. After the first perception what remains in the consciousness is often only a meagre silhouette; with repeated perceptions of longer duration, the silhouette is filled out with more detailed content and the meaning is thus enriched (Clarizio, et al., 1970, p 244). Thus what is consolidated is psychologically significant concepts.

15.4 THE ORGANISATION OF MEANINGFUL CONCEPTS

15.4.1 Jean Piaget

Two very important investigators have emphasised the theme of organisation in relation to consolidation. They are Jean Piaget of Geneva and

Jerome Bruner of Harvard. Piaget insists that experience must be organised before one can adapt oneself to the environment.

If we are to understand Piaget at all, we must elucidate the following concepts which have an important place in his work. His research work has been concerned with the nature and course of cognitive development (the cognitive life) of children. He distinguishes a number of clearly-defined phases which coincide with the child's biological growth. The first phase, which he terms sensori-motor, lasts for two years; then comes the pre-operational phase, 2 to 7 years, followed by the concrete operational phase, 7-11½ years, and finally the phase of formal operational thought, from 11½ years onward. Piaget says that operational thought is based on internalised operations, implying that all thought originates in actions or operations (Boyle, 1969, p. 24). When a child under two is confronted with a problem he acts in one way or another. The organised actions that develop during this and later phases are called schemes (schema, schemata). During the concrete operational phase the child forms mental representations (*imaginings*) of concrete things or actual operations or descriptions of operations which it would really be possible to execute. During the formal operational stage the operations are no longer motor but are thinking operations. The structure of the intellect is made up of internalised operations organised into schemas. As a result of this organisation the person is now adapted to his environment. This adaptation is based upon accommodation and assimilation. Accommodation is the change that takes place in a person's cognitive structure in order to permit the execution and assimilation of new thinking operations, whether concrete or formal. In Piaget's opinion permanent learning consists in the assimilation and integration, i.e. internalisation, of experiences of reality into the cognitive or intellectual structure. Accommodation and assimilation are interactive processes by means of which the learner seeks more effective schemas for adaptation to the changing environment. He thus accommodates his schemas, by extending and combining them, to meet new situations and deal with new problems. Adequate adaptation creates an equilibrium between accommodation and assimilation. The thought schemas are subject to changes resulting from accommodation and changes in the environment. Consolidation thus depends upon the organisation of thought-schemas in such a way that they function effectively in everyday or academic situations. Changes in the environment demand constant dynamic interaction and organisation. Such changes occur constantly, both in everyday life and in the didactic situation (with the presentation of new study material). The tried-and-trusted solutions (schemas) do not suit the new problems. Accommodation and assimilation

take place simultaneously and the organisation that follows results in the development of new schemas.

15.4.2 Jerome Bruner

Like Piaget, Jerome Bruner distinguishes three stages in cognitive development, though his are less rigidly-defined than Piaget's. He calls them the stages of enactive, iconic and symbolic representation. Bruner (Clarizio et al., 1970, p. 286) places heavy emphasis upon the consolidation of what has been learned, for he says that "one of the principal objectives of learning is to save us from subsequent learning". He sees this as achievable through organisation and manipulation. He describes organisation as progressive generalisation, continued until a symbol of the highest possible generality has been obtained. This symbol must now be serviceable for thinking and the solution of problems (manipulation). By way of illustration he refers to Galileo's discovery of gravity and the generalisation of his experiments, resulting in the formula $S = gt^2$ by means of which (through manipulation of the generic symbol) ordinary gravity problems can be solved. Bruner maintains therefore, that successful learning requires a generic image through which mental representations can be organised. This generic image can often be represented by a formula, a symbol, or a small group of symbols. Such representation makes it easier to manipulate the *generic* in the course of thinking. He says: (Clarizio, p. 286) "Learning something in a generic way is like leaping over a barrier. On the other side of the barrier is thinking." The method he thinks most suitable for attaining this ideal is that of learning by discovery. Thus he stresses, not the preliminary products of learning but the process of continuous discovery. He describes discovery as "an internal re-organisation of previously known ideas in order to establish a better fit between those ideas and the regularities of an encounter to which the learner has had to accommodate." For Bruner, then, consolidation consists in the organisation of the concepts that have been learnt until a single comprehensive concept emerges. This concept represents all the others and can be used in this representative way in thinking (i.e. for problem-solving).

15.4.3 Ausubel's cognitive clarity and assimilation

D.P. Ausubel's special contribution resides in his model of the cognitive structure. He says: (1968, p. 475) "Meaning can never be anything more

than a personal phenomenological product that emerges when potentially meaningful ideas are integrated within an individually unique cognitive structure". Meaning does not lie in the symbol that represents it but in the individual. Meaning must therefore be found in a personal frame of reference and then reconciled with or assimilated into the concepts and images that have already been consolidated. Meaningful new material can only be assimilated into the existing functional cognitive structure if relevant anchoring ideas are available. These anchoring ideas must be made to cohere closely with the critical attributes of the meaningful if there are logical connections between it and the ideas already present in the cognitive structure. This general relevance must be apparent to the learner: the new must be related to the old before it can be psychologically meaningful. The significance of the new material depends upon the functionality and content of the existing cognitive structure. When new and meaningful contents have been assimilated into the cognitive structure, both undergo changes with the result that it is subsequently difficult to dissociate the new from the old. In this sense it is possible to speak of forgetting, for incidental factual details cannot be remembered. Ausubel calls this phenomenon "memorial reduction". The new material is so thoroughly assimilated into or identified with or subsumed under anchoring concepts that it does in fact remain functionally available as far as its formal significance is concerned. Ausubel advocates receptive learning with its natural counterpart, explanatory teaching, in the conviction that these ensure successful learning and firm consolidation. He explains his view of this type of assimilation in the following way: in the course of instruction the relevant distinguishing characteristics can be singled out in an organised way; if this is not possible *advance organisers* must be introduced to ensure firm anchoring. In this way the anchoring ideas can be linked with the overriding or encompassing concept. Organisation through hierarchical generalisation makes it possible for ideas to be subsumed under ever-broader encompassing concepts.

In Ausubel's opinion successful learning depends upon the existing cognitive structure, i.e., the organisation, clarity and stability of the individual's knowledge in a particular field. If the cognitive structure is unstable, ambiguous and chaotically organised, learning and retention will be hampered. Once the distinguishing characteristics have been singled out from the relevant cognitive structure, the subsidiary concept can be subsumed under the more comprehensive or superordinate concept. This capacity for subsumption is responsible for the perception of relationships via insight. "Sequential organisation pre-supposes, of course, that the preceding step is always clear, stable, and well organised. If it is not, the learning of all subsequent steps is jeopardized.

Hence new material in the sequence should never be introduced until all previous steps are thoroughly mastered" (Ausubel, 1968, p. 230).

15.5 METHOD OF CONSOLIDATION

The question before us now is: What can be done to establish more meaningful relationships in the cognitive structure, i.e. to give the person more insight? Van Hiele (p. 37) insists that insight is not simply a matter of structuring the perceptual field on the basis of previous experience, but "berust op omstruktureren van het waarnemingsveld" and thus using "struktureren zelf tot bouwstenen van een nieuwe structureren". Prolonged reflection upon and absorption in a problem intensifies involvement in it. In this connection Bigge and Hunt (1962, p. 358) observe that "Man . . . is differentiating and restructuring himself and his environment, he is gaining or changing insights". The solution to a problem situation or to a technical problem is seldom complete. ". . . insight is rarely complete; it is more likely to be a matter of ever-greater clarification of a given point through the clarification of related ideas."

It seems then, that the re-structuring of relationships results in more insight and greater clarity. For this purpose *repetition* is required – not mechanical, meaningless reiteration, but psychologically meaningful repetition which consolidates the meaning and heightens resistance to memory lapses. Everyone knows how important repetition is when one is preparing for an examination; and it is usually essential with regard to the basic rules and concepts for solving a problem. Repetition means doing *again* something that has once resulted in success, but with a different starting-point and thus a different sequence of events. Deliberate repetition requires more intense involvement if it is to result in re-structuring, deeper insight and increased significance.

Repetition does not mean engaging in any radically different or new learning activities. But the manipulation of established relationships in the mind (cognitive structure) does require more intense and more prolonged involvement. It seems that every individual has his own optimum as far as the time required for the formation of meaningful relationships is concerned. The method of revision includes the global method, the partial method, the alternating use of both these, diffused practice and accumulative practice. The general rule for effective and economical learning is that short study-times over a long period give better results than lengthy study times over a short period. The length, meaningfulness and difficulty of the task, the idiosyncracies of individual learners, and the amount of appeal the study material has for the learner will

determine which method of repetition is required for consolidation.

Bruner insists that the first successful relationships must be *organised* by a deliberate process of generalisation in order to obtain the most encompassing and comprehensive symbol. This “generic” or generalised symbol must be amenable to manipulation and must be properly used. Consolidation depends upon purposeful generalisation and on the subsequent manipulation of the resultant generic image. In Piaget’s opinion consolidation depends upon a dynamic interaction between assimilation and accommodation: this interaction results in effective thought-schemes. In advocating receptive learning and explanatory teaching, Ausubel emphasises the significance of the cognitive structure. The fixing of new concepts depends upon the stability and clarity of the anchoring ideas already present in the cognitive structure. The assimilation of concepts is a typical form of receptive learning – which is certainly not the same thing as mere passive absorption. This assimilation is characterised by the endeavour to determine the nature of the relationship between the new concepts and the distinguishing characteristics of the relevant cognitive structure, and by the differentiation of new concepts from existing known concepts, and by the subsequent integration of the former with the latter.

Experience has shown that the most general ideas relating to some part of a subject are the ones that are remembered best. This indicates the manner in which knowledge is stored in the human consciousness, and shows how necessary it is to organise new knowledge or study material hierarchically, with the most comprehensive concept at the top of the pyramid (progressive differentiation). The new knowledge, hierarchically organised, must be amenable to subsumption under more comprehensive ideas which have already been well established in the existing cognitive structure and can therefore act as anchoring ideas. To ensure consolidation the teacher should make it his business to single out these anchoring ideas or, if they are lacking, to organise the existing knowledge both beforehand and in the course of instruction so as to provide some possibility of anchorage.

15.6 THE EFFECT OF CONSOLIDATION

Consolidation describes the state of the consciousness when an optimum quantity of psychologically meaningful relationships have been brought into being with regard to the content of the subject concerned and the learner can say “I understand”. This implies that hierarchically-organised knowledge has been securely anchored in the cognitive structure and that broad generics that are amenable to manipulation are now func-

tionally available. Consolidation in the cognitive structure has the following effects:

- (a) the dissociative strength (with regard to the cognitive structure) of the newly-learnt meaning is heightened;
- (b) the learner's retention and ability to remember the learning results increases;
- (c) the capacity for consolidating and retaining related learning tasks is increased;
- (d) consolidation through repetition not only heightens retention of clear, stable and valid meanings but also intensifies consolidation of related material which has been learnt previously;
- (e) when generics have been consolidated they can be applied in a wide range of situations.

15.7 CONCLUSION

There are intrinsic differences between the S-R and the Field approaches to consolidation. Here we have followed the Field approach. Every learner is a subject who acts. He finds himself in a life space made up of significant relationships with people, things and ideas belonging to the cultural world that surrounds him. Through learning, or rather the attainment of insight, he attributes significance to the world around him: he structures it cognitively in order to make it his own world. An entirely new situation has no cognitive structure at all. Such situations are rare, however. The learner commonly finds himself in unsatisfactory, incomplete and inharmoniously structured situations. When the first successful attempt has been made, whether perceptual-motor or conceptual - e.g. typing thirty words without a mistake or solving a quadratic equation in algebra - the relationships are still uncertain and the insight dim and impermanent. In order to consolidate this success, the insight must be solidly structured. This structuring can be achieved through meaningful repetition, practice and application. Thorndike has proved that frequent repetition does not necessarily ensure consolidation. Repeated learning is essential not only for examination purposes but also for the better understanding of what is already meaningful. This is particularly true when the meaning of the material is relatively autonomous, as is the case with the great variety of facts which must be functional in the study material of all subjects. The repetition of meaningful structures increases the clarity and distinctness of the meanings assimilated into the cognitive structure.

Retention and the actualisation of learning results

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As we have said before, the learning process should not be thought of as hierarchical or step-by-step process that begins and ends with the learning activities of each individual learner. In my opinion the learning process is nothing more than a construct, a conceptual object which may be used as a paradigm to facilitate the drawing of distinctions between various aspects of the events involved in learning for explanatory and research purposes.

Similarly, I shall not attempt an artificial separation between the actualisation of what has been learnt and the act of learning itself, whether this takes the form of insight-attainment or that of memorising. Experience has shown over and over again that imprinting and repetition and recall often occur concurrently and interactively until the learner is satisfied that the quality of his actualisation satisfies his own expectations (or he sees them) with regard to the readiness and fecundity of his knowledge. In many cases actualisation consists in the control the learner exercises over the thoroughness with which study material is consolidated in his cognitive structure.

Sometimes a single perception of a situation is sufficient for complete learning. The significance of what has been learnt is readily available

Retention and the actualisation of learning results

16.1 INTRODUCTION

People learn with the object of getting to know things that they have not known before. Now that we have considered the various factors connected with the consolidation of knowledge in the cognitive system, it would be logical to continue our study of the learning process by turning our attention to the actualisation of the learning result. The learner himself, let alone the teacher, does NOT know what has been consolidated in his cognitive system until he tries to recall or remember it, or to actualise it in some other way.

As we have said before, the learning process should not be thought of as hierarchical or step-by-step process that begins and ends with the learning activities of each individual learner. In my opinion the *learning process* is nothing more than a construct, a conceptual object which may be used as a paradigm to facilitate the drawing of distinctions between various aspects of the events involved in learning for explanatory and research purposes.

Similarly, I shall not attempt an artificial separation between the actualisation of what has been learnt and the act of learning itself, whether this takes the form of insight-attainment or that of memorising. Experience has shown over and over again that imprinting and repetition and recall often occur concurrently and interactively until the learner is satisfied that the quality of his actualisation satisfies his own expectations (*as he sees them*) with regard to the readiness and functionality of his knowledge. In many cases actualisation consists in the control the learner exercises over the thoroughness with which study material is consolidated in his cognitive structure.

Sometimes a single perception of a situation is sufficient for complete learning. The significance of what has been learnt is readily available

and is manifested in the person's behaviour. In other cases consolidation requires a great deal of time and energy, and artificial situations (tests and examinations) are created to encourage the learner's recollection and recognition.

The transference of learning results to related or totally new situations is very closely connected with actualisation. Transfer will be discussed in our next chapter. Here we shall be specifically concerned with the recall (remembering), renewed awareness or actualising, here and now, of study material which was consolidated or established in the cognitive structure on previous occasions. That is why we speak of the actualisation or remembering of learning *results*.

16.2 WAYS OF ACTUALISING

16.2.1 Automatism

In the course of the child's development, learning results manifest themselves continuously. Motor actions such as walking, running, riding a bicycle, jumping and so on become increasingly effective. Linguistic ability improves phenomenally between the ages of one and six years. Structurally and semantically, the child's language corresponds very largely with that of the adults from whom he has learnt to speak. He has learnt enough language to allow him to express his thoughts and communicate with other people. Constant use of learning results in the primary and high schools actualises these results to such a degree that he can read, write, calculate, and handle concepts with increasing efficiency, thus becoming ready for learning of ever-widening scope and increasing depth. The child also learns from experiences outside the school, i.e. at home and in the community in general, from conversations, books, magazines and the radio, and actualises what he learns to a greater or lesser degree.

Ideally, the learner should know what he has learnt so well that it functions readily as an automatism. This applies to both motor skills and concepts. Van Parreren (1962, p. 14) calls the ready automatism thus put into use non-cognitive action structures. He distinguishes between cognitive and non-cognitive action structures of this ultimate variety. Under cognitive acts he includes typical conscious activities such as knowing, judging, considering, choosing, thinking, etc. In contrast to these, non-cognitive acts take place in such a way that the person is unconscious of them. Among these he includes all those ultimate action-structures in which the learning result is readily available and is used

automatically, as in riding a bicycle, playing the piano or using a language.

The ultimate action-structure is an automatism: i.e. it is readily available without the learner's conscious awareness. In my opinion the actualising of automatisms must always be a cognitive act, since it consists in recalling learning results which were highly significant during the initial and developmental stages of assimilation into the cognitive structure. Since the manifestation of the automatism is the ultimate act or the outcome of a learning process – a meaningful cognitive act – the automatism itself must be cognitive in character even if its actualisation requires no conscious act. Ideally, the learner is no more conscious of actualisation than he is of assimilating knowledge into his cognitive structure. The fact that the skill or concept is used in an automatic way does not mean that the person is unaware of the manner in which it occurs. The automatism or ultimate action-structure should therefore be regarded as cognitive in character. Every meaningful automatism which functions readily and is therefore, as far as the learner is concerned, unconsciously actualised, can in fact be actualised consciously and with complete awareness of its meaning. Hence my contention that an automatism is a cognitive action-structure.

Automatisms such as skills, ready knowledge of names, facts, concepts, ideas and semantic and linguistic usage, may manifest themselves in the learner's behaviour in unconscious ways which nevertheless implicitly include cognitive components such as perception, recognition, anticipation, and so on. The ideal outcome of a great many learning tasks is that the result should be capable of functioning as an automatism.

16.2.2 Intentional recollection (recall)

In this section we shall consider study material which has been consolidated in the cognitive structure through assimilation and which must now be actualised once more. The learning results must now be recalled to consciousness: we therefore face the question of recall, recollection or remembering. The person concerned must make a conscious and deliberate attempt to withdraw material which has been organised and anchored in the cognitive structure, along with a great deal of other material, in order to make it available for use.

In the course of our discussion of the cognitive structure we saw that assimilation takes place with the aid of anchoring ideas selected from the study material which has already been consolidated. The new material is anchored to these ideas. Here we must remember that what is

anchored or assimilated is not a particular piece of study material but its *meaning*. And since it is the meaning of the material that is anchored in the cognitive structure, it follows that the specific facts or attributes of which the material was composed will in the course of time become somewhat blurred. Retention is heightened during assimilation or anchoring. Within a fairly short time after anchoring the new material can be dissociated from the relevant ideas in the cognitive structure and can thus be reproduced as an actual entity or series of entities. Experience has shown that the dissociative strength or degree of dissociability is at its maximum immediately after assimilation. Shortly after anchoring, the material can be reproduced fairly completely and with most of the details intact. Immediately after consolidation in the cognitive structure there is a period of obliteration caused by the fading of specific and incidental attributes whilst they are being subsumed under encompassing concepts. The new ideas become spontaneously and progressively more difficult to dissociate from the anchoring ideas, and are thus no longer available in totality. This is what we mean by *forgetting*.

The concept of a "variable threshold of availability" refers to the fluctuating availability of ideas which have been anchored in the cognitive structure. Literal verbal reproduction is maximal immediately after assimilation. Some time after assimilation the factual details will have been particularly obliterated (memorial reduction). Thus, what is reproduced at a later stage (i.e. the learning result) is the meaning of the original study material. As the availability threshold recedes, verbal reproduction becomes progressively more difficult and the learner relies more and more heavily upon the meaning of the original material (the assumption being that the material was meaningful in the first place). At this stage it becomes necessary to resort to hints, references or questions which may act as points of contact to enable the learner to recall the learning results and actualise the relevant concepts.

At this point the theory of assimilation introduces the important concept of a dissociation equilibrium. This state of equilibrium begins to deteriorate shortly after assimilation, and it may happen that the person is eventually quite unable to recall the learning result. If the dissociation equilibrium declines below a critical point (i.e. if the assimilated content fades beyond a certain point) it may be possible to actualise the learning results only under hypnosis.

It is important to note however, that if the meaningfulness of the material has been emphasised in the course of assimilation the dissociation equilibrium can be kept reasonably constant. Material that has been assimilated can be recalled in a meaningful way through testing, remembering or recollection, with or without the assistance of external aids.

Later we shall refer to the Gestaltists' approach to actualisation. Their *trace system* theory accords with their explanation of retention and forgetting.

At this juncture we are confronted with all the problematic aspects of testing and measurement as ways of actualising learning results. The availability threshold of a learning result which has been consolidated through multiple repetitions, or rather significant *over-learning* (i.e. repetition beyond the point of correct reproduction) is near the surface because the dissociation equilibrium is near the surface. Over-learning results in a high measure of correct and faithful reproduction of the learning result. Assimilation requires constant meaningfulness, clarity and a complete absence of ambiguity to ensure that whatever is anchored in the cognitive system is as clear, distinct and meaningful as possible. If this is the case, the indications are that the dissociation equilibrium will remain relatively constant and will consequently not decline too deeply. The availability level will thus remain relatively constant and fairly close to the surface for a long period.

16.2.3 Testing

In the didactic situation the actualisation of learning results takes place by way of exercises or tasks. The pupils may be required

- (a) to reproduce factual learning results in a factual way; or
- (b) to remember (recall) concepts in a meaningful way.

In either case actualisation, not transfer, is required.

Tests which are being set to determine the quantity and quality of learning results should possess certain typical qualities which may be regarded as criteria. They include:

- (a) *Validity*. The degree to which the test measures what it is intended to measure;
- (b) *Reliability*. The constancy with which the test measures what it is intended to measure;
- (c) *Discriminatory capacity*. Any test must make provision for individual differences with regard to achievement. The greater its discriminatory capacity, the more clearly a test will distinguish among the persons being tested as far as their achievements are concerned. A normal distribution of marks yields a maximum discrimination at both ends of the scale;
- (d) *Objectivity*. Objective tests eliminate subjectivity and inconsistency with regard to the assignment of marks.

Tests are usually set in the following forms:

(a) ESSAY QUESTIONS

Questions of this type of test, among other things, the student's ability to organise ideas with the help of learning results, to adduce evidence for what he says, to construct a convincing argument, to evaluate material critically and to express himself clearly and persuasively.

(b) OBJECTIVE TESTS (usually standardised)

These require short-sentence or one-word answers. The learning results that have to be actualised are specific facts, concepts, principles and applications which the student is presumed to have assimilated and mastered. The answers may be either recalled or recognised. Recognition of the correct answer permits of a much lower dissociation equilibrium, and hence a lower availability threshold, than does the recalling of the learning result. The learning result required as an answer may thus have so remote an availability threshold that the student cannot recall or reproduce it of his own accord, though he may be able to recognise the correct answer if he sees it.

16.2.4 Actualisation through re-activation

The psychology department of Amsterdam University has developed a "system theory" which accords with Gestalt psychology. I shall not attempt to deal with this theory in detail but shall merely refer to a few concepts that are relevant here.

Perception occurs in gestalts, that is in meaningful wholes. Perception of the gestalt is the result of insight. That is why the attainment of insight is equated with significance attribution. The human consciousness thus contains a system of organised gestalts. To this idea the system theorists add the concept of a trace which remains in the physical-physiological structure of engrams as the correlative of the gestalt, which is a mental phenomenon. According to this view the recalling of a learning result would occur in the manner described by J.C. Eccles (1953): "We may say the remembered thought appears in the mind, as its specific spatio-temporal pattern is replayed in the cortex." This notion of a physical-physiological memory trace and the possibility of re-activating such traces has been severely criticised. Erwin Strauss (1965, p. 73) says in this connection: "The theory of traces claims that a dormant trace is awakened to new life." It would then be on the level of a miracle, which he finds an unacceptable idea in this context. He goes on to say: "A 'conscious experience', corresponding to a reactivated trace, would also be limited to the actual now, like the reactivated trace. It would not be a

repetition, not a recollection. The 'once before', the 'earlier' or the 'again' do not belong to a single memory-image." In saying this he is criticising only the idea of "memory traces" which can be *activated*. He does not doubt the possibility of a connection between the mental and the physiological, for he says (Strauss, 1965, p. 74): "Meaning and possibility of psycho-physical co-ordination must be examined anew."

It is against this background that we must view the Amsterdam theorist's use of the terms *trace*, *memory trace* and *reactivation of memory traces*. Van Parreren (1962, p. 73) explains that although "trace" is used as a concept, and confusion may result from the above description, he qualifies the usage as follows: "Wij laten al deze (met verwysing na Koffka) en ook de nieuwere fysiologische theorieën ten aanzien van de sporen geheel buiten beschouwing. Sporen zijn voor ons geën fysiologische processen of entiteiten, doch uitsluitend psychologische potenties waarvan wij de veronderstelde eigenaardigheden baseren op de gegevens en uitkomsten van psychologische onderzoekingen."

The learning result exists then, in terms of meaningful organised trace systems (*gestalts*). The trace system can be reactivated only if the person sees some kind of connection between the actual situation and the learning result. The actualisation of a trace can take place only under certain circumstances. Traces of a person's experiences, whether these take the form of intentional learning, incidental learning, or practical everyday happenings – remain in his memory. These traces are not isolated from one another but form an organised psychological field.

In order to re-activate these traces, connections must be found between the new actual situation and the traces of the relevant learning results.

This may be done by deliberately forging a connection, i.e. by consciously trying to think of what one "learned" about some particular subject at a particular place in a particular book. Systems may also be deliberately re-activated by means of questions, tests, and so on. Re-activation is greatly facilitated by instruction that imprints well-organised, definite and strongly related labels upon the mind. Re-activation is easily achieved with the aid of such labels, which act as traces. It is important to note that connections can only be forged if corresponding factors are present.

16.2.5 Infusion

By infusion we mean the actualisation of learning results the traces of which belong to a system which at the moment of actualisation has no real existence (Van Parreren, 1962, p. 124).

In such cases the actualisation of learning results is brought about by infusion. Re-activation is not possible here, because the instructions for the situation data do not refer to any available traces in a relevant trace system.

For example one may, by applying a particular method of solution, penetrate the organised trace system until the most relevant trace is found. This concept of infusion is similar to Otto Selz's concept of anticipatory schemes or thought patterns, which receive direction from the purpose, thinking operation or task with which the person is engaged.

Infusion often occurs in the course of complex tasks, where the question or exercise is not in itself directly related to any trace which would recall the learning result. Thinking is directed by a general approach, method or thought pattern until relevant traces begin to appear. An actual scheme now becomes more active and the relevant learning result is actualised.

16.3 FORGETTING

Few things are more frustrating to a learner than the fact that he forgets what he has learnt, i.e. things that he once knew and would have liked to remember. Forgetting presupposes the existence of learning results that can no longer be recalled. One cannot forget what one has never known. The problem is that things are not always either black or white: there are a great many shades in between. This applies to learning too. Sometimes learning is successful: the study material is meaningful and insight is attained. Repetition, practice and manipulation result in consolidation. With the passing of time fewer and fewer facts can be reproduced. Meanings can be reproduced for a much longer period, but these too become vague. At this stage it would be proper to speak of forgetting.

Sometimes learning is only fairly successful. Insight is attained, but only imperfectly – it is not completely clear, distinct and unambiguous. A reasonable degree of consolidation can be obtained by *over-learning* (repetition beyond the point of correct reproduction), in which case there is a certain amount of mechanical memorising. Because insight has been defective the person forgets not only the facts but a good deal of the original meaning as well. This type of learning and forgetting is very common in the didactic situation.

Mechanical memorising is also very common. Here we are not thinking of the meaningless words, cyphers, symbols or figures that are sometimes used in psychological laboratories. Pupils and students sometimes

do not understand their study material even though it is logically meaningful. And because they do not understand it, it is not psychologically meaningful to them. The individual words are understood, but not the context in which the concept occurs. Correct reproduction may be obtained by over-learning, but because the meaning has not been assimilated into the cognitive structure the person's knowledge of the facts becomes vague and may disappear altogether.

Forgetting then is the phenomenon that occurs when learning results can no longer be reproduced. Various theories have been developed to explain this exceedingly common phenomenon.

16.3.1 Assimilation into the cognitive structure

During assimilation the distinguishing characteristics of the new study material are connected with and subsumed under encompassing concepts which act as anchoring ideas. It is the meaning, not the material itself, that is assimilated. After assimilation the meaning of the new material is gradually reduced by being included in the meaning of the corresponding anchoring ideas to which it has been attached.

When the obliteration stage of assimilation begins, the new ideas spontaneously become progressively less dissociable from the anchoring ideas: they gradually lose their independent identities until they are no longer available and are therefore said to have been forgotten. The meanings of the most comprehensive ideas have the greatest degree of permanence. The meanings of these comprehensive ideas are broadened by the ideas that have been included in them. When the process of reduction sets in the dissociation equilibrium is lowered and the availability threshold sinks. Eventually the learning results can only be actualised with the aid of hypnosis, and later still they cannot be actualised at all. Time however, is not the only factor involved.

When we consider forgetting we naturally ask ourselves what factors tend to promote retention and thus to combat forgetting. Forgetting is no more a mechanical process than are learning and retention.

Throughout our discussion of learning in its pedagogic context we have emphasised the importance of psychological or phenomenological *meaningfulness*. Pupils sometimes learn vague, diffuse, ambiguous or incorrect meanings. The likely consequence is a defective or even an incorrect learning result, which may possibly not be discovered until the result is actualised during a test. Correct and clear meanings in a well-integrated cognitive structure go a long way towards retarding or preventing the process of forgetting.

The cognitive structure is a construct in which provision is made for

personality factors. The permanence with which a person learns seems to be positively related to the degree of ego involvement in his participation in learning activities. Among others, Sawry and Telford (1968, p. 197) mention experiments that indicate the existence of this positive relationship.

Ego involvement may be described as a personal desire to be concerned with something. The degree of ego involvement indicates how important it is to the learner that he should know the study material. Ego involvement is reflected in the fervour, diligence and perseverance with which the person participates in the learning activity concerned. Forgetting is a function of meaningfulness, but also of the degree to which the person is involved in the study material.

A third factor is the *nature of the learner's experience* whilst he is learning. The quality of experience is subjective and personal. According to Sonnekus (1968, p. 23) "belewing is die intensioneel bepaalde subjektiewe, personale (paties-normatiewe) stellingname deur die persoon as totaliteit-in funksie in sy kommunikasie met die werklikheid". This pathic-affective experience is largely responsible for the attribution of connotative significance to the study material. Learning results that are rooted in pathic-normative experiences of this kind are much less likely to be forgotten than are results whose gnostic significance is not supplemented by pathic-normative experiences. Thus forgetting is also a function of the quality of the learning experience. The three *modi* of learning, namely *meaningfulness*, *involvement* and *experience* are the conditions for successful learning; if these are defective, forgetting will be accelerated.

16.3.2 Interference

Here we distinguish between retroactive and proactive interference. Retroactive interference has to do with forgetting that can be ascribed to activities – particularly learning activities – which have followed the consolidation of the study material concerned. The learning result is forgotten under the influence of the subsequent learning activity. Proactive interference relates to forgetting that occurs because the consolidation and retention of the learning result has been obstructed by the previous learning task.

The Neo-behaviorists strongly support the interference theory and have attempted to explain it. Osgood (1953, p. 550) for example, says: "Forgetting is a direct function of the degree to which substitute responses are associated with the original stimuli during the retention interval. This is really . . . a definition of retroactive interference."

The Gestaltists and the Psychoanalysts also offer explanations of forgetting. The Gestaltist view is that forgetting is a process of autonomous disintegration of (memory) traces, resulting from a poor organisation of material. Weakly structured gestalts are formed, thus producing impermanent, chaotic traces which disintegrate spontaneously.

According to Psychoanalytical theory, all forgetting is motivated. It is simply a product of repression. Ideas or impulses that might cause anxiety are pushed into the unconscious and thus forgotten.

16.4 CONCLUSION

One cannot really speak of learning results until they have either manifested themselves explicitly in the person's behaviour in the form of automatisms, or been deliberately actualised. However a great many learning results are informal. These are often the product of incidental learning and intra-dynamic interaction with what the person already knows. These manifest themselves both gnostically and pathic-normatively in the person's cognitive structure, and indeed in his whole life, behaviour and personality.

This unintentional and informal learning is important and occurs throughout a person's life: it should therefore not be left out of account. However for present purposes we have emphasised intentional and formal learning.

In this chapter we have considered the withdrawal of learning results from the cognitive structure for the purpose of actualisation. The learning process is cognitive in character; it originates with the intention to learn and is almost complete when the learning results are actualised. The final stage of completion is reached when transfer – i.e. the application of actualised learning results – takes place. This will be discussed in our next chapter.

In this chapter we have dealt cursorily with a few theoretical explanations of the actualisation of learning results, and we have emphasised the recalling (remembering) of psychologically meaningful study material from the cognitive structure because this type of actualisation is both highly significant and completely justifiable from the pedagogic point of view.

In conclusion we may say that in all fields of study there are certain learning results that must be readily available as automatisms. The person must be able to reproduce these results readily, but they must also be meaningful to him. The intentional actualisation of meanings is

always to some extent dependent upon automatisms. In testing and measuring we must be careful to distinguish between learning results and transfer, and the accent must always fall upon meaningfulness.