

CHAPTER 10 SYSTEMS OF TEACHING

1. INTRODUCTION

The study of the many teaching systems that have been described extensively in didactic history is an important part of didactic research because particular didactic principles such as those of ordering learning contents or particular didactic ground-forms have been elevated to the level of the absolute. The importance of this matter is not so much that certain views of teaching are regarded as the absolute answer to all teaching problems but rather in the finely worked out details that have been tested out and described in thorough and comprehensive ways. Various well-known examples of finely worked out teaching systems are available for study. In this respect one thinks of the didactic designs of Decroly and Montessori, programmed teaching, computer-assisted teaching, conversational teaching and project teaching. All of these approaches and practices can be dealt with only generally within the confines of a book of this nature. In the bibliography sufficient supplementary literature is mentioned that can be studied.

What follows is a discussion of the most important views and practices that in our time still consistently and even radically influences teaching theory. In the past exemplary teaching has also been incorrectly placed here, but its significance for teaching in general and for curriculum theory in particular place it in an entirely separate category; thus, Chapter 12 is devoted to it.

What is of importance in the following discussions of a few teaching systems is that the mutual principles regarding the teaching form as well as implementing the contents must be coherently reflected on and evaluated in light of the theoretical views previously stated. The various systems, to a limited extent, also are mutually comparable to each other because the three important facets of teaching (teaching, learning and contents) are proclaimed to have a very clear relationship to each other.

2. SOME SYSTEMS OF TEACHING

2.1 Programmed teaching

2.1.1 Introduction

The Industrial Revolution of the 19th Century can rightly and historically be described as the beginning of what we know today as the Technological Age. The most important matter to be emphasized in this context is that lifestyles and teaching styles were subjected to drastic change. This change can be characterized as a partial replacement of persons by machines. Advocates of programmed teaching maintain that education did not fully take these radical changes into account. By implication, this means that in the transition from the 19th to the 20th Century the integration of technological development into human existence was largely ignored or overlooked by educators.

During the period 1900 to 1950 an attempt was made to introduce programmed teaching on a small scale in order to make the advantages of technology available for teaching. In the 1920's S. L. Pressey of The Ohio State University in the U.S.A. sought an uncomplicated means to use the results of a test. He hit upon the idea that memorizing uncomplicated contents like arithmetic times tables and series of words could be assisted by means of an aid. His first attempt resulted in a simple writing machine with four keys. On the roll of paper that passed through the machine there were four tasks, only one of which was visible through a window. The tasks were in multiple-choice format and the pupils had to choose one of the four alternatives. When a certain key was pressed, the machine presented the next question. The selection of the key was in direct relation to the accuracy of the pupil's answer. If he selected a wrong key the question remained in the window and the error was registered on the test sheet. In this way the pupil was forced to repeat his selection to the question until the correct answer was given. Pressey's machine laid the foundation for programmed teaching.

By 1950 the period of automatization was reached and in 1955 the Ford Foundation in the U. S. A. started the ball rolling by launching the idea of mass teaching by means of technology. The time was

ripe for this development: there was a teacher shortage and the race for space with Russia intensified after 1958. These factors put teaching under the magnifying glass. These new directions had two important consequences for the practice of teaching:

- a) there was a tendency toward mass technological teaching by means of various technically constructed apparatuses or teaching machines;
- b) there was the possibility of much more individual teaching by means of these technological aids.

In this way the idea and possibility of an automated classroom were created. Although the teacher was still in control of the situation, both he and his pupils were dependent on automatic teaching aids. This means that the problem of writing programs became a matter of greatest concern. To motivate and stimulate all research, the following points were mentioned:

- a) the course of the learning activity, with the possibility of certain guarantees for positive learning effects based on certain theories of learning, had to be studied;
- b) the greater opportunity for individualization when using teaching machines had to be examined.

It is understandable that soon the idea of mass teaching spread to all industrial countries. By 1960 mass teaching was common in England, Europe, Russia and Japan.

As far as the principles of programming are concerned, the following are implied:

- a) a specific way of ordering the learning contents;
- b) the implementation of the stimulus-response theory as it is generally known in behaviorist learning psychology.

As far as ordering the learning contents is concerned, the aim of programmed teaching is to present them systematically, step by step and in an orderly way. This structure follows the course from the smallest parts of the contents and proceeds from these aspects to the whole of the theme. The whole or totality of the parts that are

presented step by step is called the program. Programmed teaching is diametrically opposite to the old textbook method. The aim of the program is to lead the child through every step to which the contents have been reduced in order for him to grasp the whole. In contrast to the textbook, which consists of long descriptions based on certain suppositions, the program first of all identifies the crux of the matter and then presents it step by step until it is thoroughly understood. Once a specific topic has been dealt with in this way, the next topic is presented. The level of complexity of the contents is determined by the aptitude of the child as well as the tempo in which he masters the contents because the answers are provided automatically. The child cannot proceed with the program if he has not discovered the correct answers. At the same time, he is actively involved. In this respect, programmed teaching is anti-classroom and ultra-individually directed.

In summary, programmed teaching is based on four main principles:

- a) *the principle of learning by small steps*: The contents are divided into small units or frames that collectively are the whole of the contents presented in the program;
- b) *the principle of active response*: The pupil learns optimally when he is confronted with small sections of the contents and with which he can become actively involved;
- c) *the principle of immediate reinforcement*: This assumes that the child learns optimally if he finds the answer to a question immediately by means of a certain decision or choice he must make. If his choice is wrong, there is no reward and therefore no reinforcement. The wrong answer actually weakens insight and must be replaced by the correct answer. Only correct answers are reinforced;
- d) *the principle of individual tempo*: It is maintained that each pupil should have as much time as he needs to do the program. Thus each pupil learns according to his own individual tempo.

2.1.2 Linear and branching programs

In the course of time two main directions in programmed teaching evolved. They are known as linear and branching programming.

Although both are based on the same basic principles, there are certain differences.

2.1.2.1 Linear programming

The father of this specific direction of programmed teaching is undoubtedly the well-known American behaviorist, B. F. Skinner. He carried out experiments with pigeons in order to establish certain patterns of behavior that can then be extended to general patterns of behavior. During his experiments he discovered that if a hungry pigeon performed a certain desired activity by itself and was immediately reinforced (by giving it food) the pigeon would repeat the activity. The pigeon established this pattern of behavior because it had practiced small parts of the activity that had been reinforced if they were correct. Skinner considers the response of the pigeon to be the result of learning.

The application of these findings to human behavior and human learning is the basis of programming as explained by Skinner. The contents must be divided into small steps or units for the learner and presented one after the other with a very gradual increase in the level of difficulty. According to this principle it is impossible for the pupil to give a wrong answer because neither the program nor the teaching machine provides for wrong answers. Therefore, the learner is reinforced whenever he gives a correct response. This reinforcement is the basis of Skinner's theory of learning and his explanation of programmed teaching.

According to Skinner's conception, the following matters are considered to have basic meaning for linear programming:

- i) every correct response must be reinforced immediately: it provides the sufficient "stimulus" for the progress of the of the "learning process";
- ii) only behavior that can be determined objectively by means of experimentation is worth the trouble of reinforcing, otherwise the programmer is easily lost in subjective factors; this means that the program cannot be directed at a specific aim. It can take only purposive learning into account and therefore can only provide for it;

- iii) errors negatively influence the learning activity. For this reason the principle of a low frequency of errors must be insisted upon when working through a program. This is achieved by using small and carefully graduated steps or units in the program. By providing the learner with enough prompts or clues, the correct response is insured;
- iv) the course of the learning activity is based on gradual and small consecutive steps. In conjunction with the previous principles, the aim is to lead the learner, according to the way the program develops, to concentrate on the aims of the program. Reinforcement is therefore given only to responses that can realize the aim of the program. In presenting the small units of the learning contents, the probability that the learner will give the wrong response is practically nil;
- v) aid and support to the learner must gradually diminish and be withheld. The learner is provided with precise instructions at the beginning of the program. Aid is gradually reduced so that the learner will later find the correct responses without the help of the program. This is known as the “vanishing” or “fading” technique;
- vi) the pupil’s participation in the program, especially his observation, must be directly controlled. The aim is to avoid, as far as possible, any factor or circumstance that could negatively affect the course of learning;
- vii) learning to discriminate is very important. This is emphasized because concepts at all levels do not necessarily have identical meanings. If a pupil learns, for example, that a certain red bottle contains poison, he must also learn to discriminate in the sense that not all red bottles contain poison;
- viii) the pupil must write while taking part in the program, i.e., he must use a pen. The aim is to create a basis by which the contents of the program can be coupled (as “feedback”) because then the teacher is in a position to analyze the learner’s responses in terms of the aims of the program.

2.1.2.2 Branching programming

After Skinner, it was especially N. A. Crowder who made an exceptional contribution to programmed teaching. In a variety of respects, Crowder's approach represents a variation of Skinner's program in that the designs in his teaching programs are not meant to verify a theory of learning. He considers programming primarily to be a matter of controlling the communication between teacher and pupil. The pupil's response is mainly a means to determine whether the communication has been effective which then provides the opportunity for corrective teaching. This kind of program uses the principle of branching.

Crowder's point of departure is that programming is a didactic strategy rather than a principle of a theory of learning. His aim is to aid the pupil to discover and understand learning contents by means of auto-didactic material. Programming is primarily a matter of presentation and ordering of learning contents as well as an active and thoughtful participation in it by the pupil.

In the relevant didactic literature this kind of program is often described as the "multiple choice program" because the pupil is confronted with a choice among different answers. He must choose the one he considers to be correct. The program is thus composed of different branches. The branch that the pupil follows is determined by the nature and quality of his answers to a certain question or problem. A correct response can therefore lead the pupil into an entirely new structure of the learning contents. The new structure in fact represents the aim of the program.

The following principles are important for branching programming:

- i) the items present are generally of broader scope than those presented in a linear program;
- ii) presentation is normally in the form of a problem (often two or three short paragraphs) that is read by the pupil. In terms of the problem, three or four possibilities are presented in the form of questions or problems relating to the contents;
- iii) the pupil who gives an incorrect answer to certain basic questions is forced to work through a remedial program before he can return to the main program;

- iv) possible mistakes by the pupil are anticipated and the program makes direct provision for them in order to utilize the pupil's incorrect answer;
- v) faulty insight is therefore directly integrated within the structure of the program in an attempt to insure that no aspect of the contents elude the learner's attention;
- vi) the most prominent characteristic of the branching program is not the program's control of the pupil's learning activity in terms of certain psychological theories of learning. It is much rather aimed at correlating the pupil's self-learning to his aptitudes by means of his active participation;
- vii) in a branching program the contents are much more important than in a linear one. For this reason, the ordering of the contents is different because the primary concern is the level of thinking of the learner. Much less attention is paid to "rote learning".

2.1.3 The teaching machine and the programmed text

It is quite understandable that at the time of the development of the policies and perceptions of programmed teaching, the question of the teaching machine and the programmed text would be considered. The techniques of programming raised the question of whether one had any advantages over the other.

It would be difficult to deny that the appearance of the teaching machine to a large measure influenced thinking about programmed teaching. As the matter progressed, many advocates of programmed teaching felt that teaching, as a practice, can be as effective or even improved by means of the programmed textbook. Branching programs are mainly presented in the form of textbooks rather than in the form of a program on a teaching machine. It is also clear that teaching machines had different problems in their design and use. The most important are that the machines were so expensive that schools, colleges, universities and even private institutions could not afford them. The result was that both linear and branching programs were presented and effectively used in the form of textbooks.

An increasing number of researchers in this field emphasize that it is primarily the *person* who is involved in the programmed learning situation. It is the person who is primarily responsible for the effective progress of the learning activity. A machine cannot evoke the learning intention that is so basic to the learning act. On the other hand, it was also discovered that the teaching machine can identify underlying differences between pupils better and exploit these differences more effectively than a teacher, especially if the machine is a computer. A good example of what is meant is that the computer's assessment of the pupil is much more reliable than the teacher's.

Notwithstanding what has been said above, machines can make a contribution to good teaching. At the same time, machines are not a condition to effective programming. Advocates of this point of view are of the opinion that the program determines not only the teaching contents but also the course of teaching. The machine is only a part of the formal course of teaching that in fact is determined by the program.

Advocates of the programmed text maintain that experience has shown that programmed teaching can be introduced without the use of a machine. This is true for both linear and branching programs. However, the introduction of the computer has changed this view dramatically.

It is generally accepted that the costs of presenting programs by means of teaching machines are not justified if the results are compared with programs that are presented by other means. Certain circumstances make the use of machines unavoidable, for example when sound is part of the program—i.e., the pupils cannot work through the program without using a tape recorder. This aspect of programming is generally basic to the use of language laboratories. Although the enthusiasm for programmed teaching is practically entirely absorbed in computer-assisted teaching, contemporary practice indicates that combining various machines and programs still has positive possibilities as in the case of the language laboratory. However, if the pupil is strongly motivated to learn, the arguments against programmed teaching in book format are irrelevant.

In conclusion, certain teaching aids are fundamentally important in programmed teaching. In this context one thinks of the radio, television and film. Television is especially important and all indications are that it will become increasingly so in the future.

2.1.4 The language laboratory

Within the framework of new views of teaching and their systematized and formalized possibilities, the language laboratory and its possibilities deserve serious attention. The way pupils come into contact with a foreign language often precludes the realization of learning aims. It is understandable that the objections regarding language teaching are especially valid for foreign language teaching. Pupils master only the formal aspects of the structure of the language and hardly ever reach a level of competence where the language is used as a means of communication. The aim of the language laboratory is to remove the inadequacies of traditional foreign language teaching. Its aim is to provide a new method of learning to speak the language: this is briefly to present the pupil with the opportunity to listen carefully to the spoken word and then to speak himself in order to use the foreign language as a means of communication.

The language laboratory is located in a special room provided with soundproof cubicles but arranged in such a way that the teacher can observe all the pupils. Each pupil has his own special tape recorder, earphones and microphone. All of the recorders and microphones are linked to a console by means of which the teacher can communicate with the whole class or with an individual pupil. The teacher can also use an overhead projector and films. The tape in the pupil's recorder is double track so that the teacher can give his instructions on one track and the pupil can give his answers on the other. The pupil tests and evaluates his answers himself by making use of the program. If he is not satisfied, he can erase his answers and repeat the exercise.

The advantages of this system of language teaching are briefly the following:

- a) it does not offer the pupils the opportunity only to listen to a carefully prepared lesson, it also provides the opportunity to speak audibly and to express oneself in the language;
- b) the use of language is individual and private and, therefore, is not subject to the criticism of the other pupils. Pupils are not influenced by the mistakes of others;
- c) pupils immediately learn the correct language by listening carefully and repeating words and sentences according to their own needs;
- d) unnecessary repetition by the teacher is largely obviated;
- e) the language laboratory creates special possibilities for individual exercise;
- f) group discussion with the class is not necessarily given a less prominent place in the teaching design;
- g) it makes possible the introduction of a variety of teaching and learning aids.

Criticism against language laboratories includes the following:

- a) the personal contact between teacher and pupil is lost to a certain extent;
- b) there is a danger that the auto-didactic course of the lesson could mean that the pupil does not recognize his mistakes as mistakes;
- c) the language laboratory can be given so much authority that there might be a consideration to replace the teacher;
- d) language laboratories are expensive.

Taking everything into account, the language laboratory is a good example of the positive use of the principle of technologically assisted teaching as a didactic strategy.

2.1.4 The evaluation of programmed teaching

Evaluating programmed teaching understandably reveals opposing and divergent points of view. Advocates offer the following points in support of their views:

- i) it is claimed that the pupil is intensely interested in the contents presented in the program;
- ii) the reduction of the learning contents to very small steps enhances the repetition and drill (memorization) to a meaningful aspect of learning;
- iii) a good program is better than using a poor textbook;
- iv) a good program forces all of the pupils to be intensely involved in learning;
- v) it offers all pupils the opportunity to learn according to their own tempo and to use as many exercises as necessary;
- vi) programmed teaching relieves the teacher of many humdrum responsibilities in the classroom; therefore, he can concentrate on teaching and learning problems;
- vii) the problems associated with homework are largely obviated;
- viii) because programmed instruction has such a strong individualizing character, it eliminates problems related to poor school attendance, moving from one school to another and failure;
- ix) because the auto-didactic aspect is so prominent, each pupil is individually and independently confronted with the contents. Therefore, the pupil is in a better position to evaluate the results of his labor;
- x) programmed teaching saves a great deal of time, money and energy;
- xi) the possibility that a pupil might become the victim of a bad teacher is reduced;
- xii) it creates the opportunity for each pupil to follow any course of study in the school in accordance with his abilities and aptitudes.

Furthermore, programmed teaching is considered to be eminently suited to testing and assessing pupils' learning achievements for the following reasons:

- a) it saves considerable time because answers are corrected by means of scoring keys and computers;
- b) the methods of assessment are fair to the pupil because he is enabled to master certain insight by means of a fixed and highly structured program. He has gained insight by means of small, logical parts that he uses to build up and to understand a greater whole. He is assessed in the same way in terms of the contents;
- c) in designing a test the teacher is enabled to cover the whole terrain of the program and he can ensure that each step in the program has been mastered. Where a pupil can omit certain facts and even choose certain aspects out of the whole on which to base his answer in the normal essay-type examination, he is forced to know everything when tested by means of the program because it has already reduced the contents to their essences. The child is only evaluated in terms of the essences of the contents;
- d) the test is one aspect or part of a greater system; i.e., it is a further learning activity. The pupil learns to use the facts of the program in a different context by means of the test and in doing so is able to construct an overview of the theme as a whole;
- e) pupils prefer this form of testing to the traditional essay-type because they have a better command of the contents after every test;
- f) it largely avoids the negative practices associated with preparing for examinations;
- g) the programmed test is thorough in the sense that all of the facets of the learning contents are tested in a simple and uncomplicated way.

In spite of the persuasive powers of all of the above arguments, it seems that didacticians in general can formulate serious objections about the entire matter. The following ought to be mentioned:

i) the validity of the theoretical foundations of programmed teaching can be brought under strong suspicion. These objections to the theory of the matter do not necessarily concern the idea of a teaching machine since programming can be equally effectively

organized with or without a machine. To see classrooms of the future equipped with machines at which pupils sit and learn like players in a gambling hall in either case is an image that can have disastrous consequences for teaching. An analysis of these theoretical foundations of programmed teaching must occur along two fronts:

- a) in what respect is the theory at its foundation acceptable from the entire pedagogical perspective?
- b) what will be the eventual didactic results of programming in the school and are they acceptable in their *entirety*?

In general it is held that the system of programming rests primarily on the findings of learning psychology regarding stimulus-response-mechanisms and on the theory of the effects of reinforcement. However, on closer examination it appears that the affinity between these two fundamental principles of programming and the generally accepted didactic theory mentioned above are not as harmonious and clear as what is generally assumed. This conflicting or antithetic conception appears clearly from the brief discussion of the following four relevant fundamental principles:

- a) as a didactic system programming rests on the reduction of contents to small units that are presented in a step-wise manner. According to this principle, the learning contents are reduced to small units or frames. However, the question is if this shows an affinity to the theory of reinforcement and if the claim is valid that, as far as the learning contents are concerned, this amounts to forming particular, predictable patterns of behavior. According to learning theory, these principles have their point of departure in the conditioning aspects of stimulus-response-mechanisms that cannot be described other than as behaviorist;
- b) the principle of active response. According to this principle the learner learns optimally when he is active. In order to test this fundamental principle it is necessary to determine how much and what sort of activity is relevant when there is a striving for optimal, effective learning. The question also is whether activity must be seen as filling in a blank space or pressing a key on a machine in answer to a multiple choice

question. The advocates of programmed teaching boldly and emphatically use the word “active” but not very clearly. Possibly this is connected with the old and well-known view of the so-called “learning by doing”. The theory of active responding claims that learning activity progresses more effectively in this way but there is no doubt that some pupils learn just as readily by means of stories, lectures, broadcasts, books, films or other teaching aids. Also there are many questions about the activity of pupils in the learning situation. The learning intention does not always show itself in an observable form. Consequently, one cannot easily make claims about observably active actions of the pupil. Any experienced teacher knows that the above-mentioned observable activity does not guarantee that the learning will progress effectively;

- c) the principle of immediate reinforcement. According to this it is asserted that a pupil learns optimally when he can immediately find the answer to a particular choice that he must make. If his choice is incorrect no reinforcement must occur so that the undesired consequence of it largely can be neutralized by the absence of reinforcement. Precisely the opposite holds true for a correct answer. Also, this principle implies that the program must be compiled in such a way that an absolute minimum of errors are made by the pupil. If this is not the case there will seldom be mention of positive reinforcement and accordingly the pupil will learn little. The problem with this principle is that there is no way of confirming that an immediate reward is reinforcing to all pupils in any given classroom. (Even animal experiments have shown this). Moreover, researchers have found that if they fill the open spaces with the answer and give it to the pupils to read, they do not learn less than a comparison (control) group that must fill in the answer themselves and then receive immediate reinforcement. Finally, this so-called immediate reinforcement very quickly can lead to boredom that puts the claim of effective learning in this way still further in a suspicious light. If with this it is taken into consideration that the matter of immediate reinforcement is directly related to views of motivation in the learning situation, the matter becomes even more complicated. It can be difficult to deny

- that immediate reinforcement will have a large difference in its effect on pupils interested in the learning contents and those not interested. It also must be pointed out that the general fact of experience that a person learns from his mistakes contradicts the generally accepted interpretation of the principle of immediate reinforcement;
- d) the principle of one's own tempo. Advocates of programmed teaching assert that each pupil may spend as much time as is necessary with the teaching program. However, this also really holds for all other forms of teaching. For example, a pupil can spend as much time as needed with a textbook. More strongly stated, the conclusion that each child learns according to his own tempo is merely a statement that functions as a definition. Thus, it does not make sense to say that each pupil learns according to the tempo of another pupil or that he learns as quickly as he can. To say that a pupil could have learned more quickly does not mean that he has not learned at his own tempo. More likely this indicates that he has learned at his own tempo and that he then was free to review things or to involve himself with other things relevant to the topic. In this connection, one thinks of something such as applications. The only fairly valid statement that one would be able to make in this connection is that *at the very least* all learning activities occur at a personal tempo.

ii) an additional important objection to programmed teaching is the question of the depersonalization of teaching. Until and with the arrival of films and television the presentation of knowledge in the school occurred only through personal contact. In this being-together of teacher and pupil authority, restraints of societal aims, mutual respect and trust, among other things, played an important role. In this light, traditional teaching can be described as interpersonal. Modern means of communication and technology carry as characteristics the anomie and impersonal atmosphere in which teaching occurs. Therefore, important aspects are missing in establishing a teaching situation that are necessary for the attunement to the worthiness and reliability (trustworthiness) of the teacher as well as the contents. The person-machine or the pupil-program relationship is not interpersonal. Indeed, this represents an impersonal, even a depersonalized form of presentation the

result of which can mainly be expressed only quantitatively. The depersonalized nature of this way of presenting detracts greatly from many topics and also from the moral and human aspects that it shows. In different respects this strips reality of its human values and involvement. Therefore, it can be concluded that mass communication often provides a quantitatively ethical, Indifferent and dehumanized knowledge and information and because of the way they are made known, they are given an impersonal character. The great danger always exists is also realized in the last quarter of the 20th Century that mass media knowledge is merely “transmitted” and that this “transfer” promotes an ethical and philosophy of life neutrality. The factor of human approval and disapproval is not relevant to this type of collective spread of information. The young, not yet formed person acquires or sees only, or to a great extent, an ethically indifferent side of reality. Thus, youth confront an impersonal and thus forsaken image of society and all of its activities. In its turn, this gives rise to identity problems, inner conflicts, ethical indifference and a weakened conception of norms. These impediments weaken the preparedness of youth against a philosophy of life alienation and adverse views. This presents the educator with the imperative to thoroughly investigate the nature of mass communication and its influence on the psychic life of the child in education. Any reorientation of the teaching event must fully take into account this factor because the mass media of our time very clearly must be seen as a third educative force in addition to the home and the school;

iii) with respect to the consistent use of teaching machines a great number of objections arise: First it can be shown that any teaching machine and its use is limited to certain circumstances (lesson situations) and to certain subject matters. Next to that the machine includes a particular threat to the pedagogical task of the school. What decisions can the machine make about attitudes, values and morals? Are the problems of the school not also the problems of the world? There is no doubt that in some circumstances the school is directly confronted with a loss of pedagogic influence. Teaching does not lead to completing educating and forming but merely to instructing. With this the entire act of teaching easily can become a matter of a merely formal and extreme technology. Understandably, this can easily give rise to the derailment of

supportive and constraining mechanisms because it is assumed that the course of learning of all pupils and its implementation are entirely similar. With this, the highly praised emphasis on individualization falls entirely by the wayside. Further, the question remains whether the pedagogic task of the school can be realized partly or entirely by a teaching machine. Third, there is no guarantee and little indication for the effectiveness of particular designs of the teaching machine and the teaching program. Related to this is the fact that there are few criteria for determining if the items included in a particular teaching program are good or weak. Teaching machines are always separately designed instruments with a limited adaptability and flexibility. It can indeed never be clear whether the teaching machine can “know” if the pupil has mastered the contents or not. Even as a computer, it can only function to the extent that the didactician has provided information beforehand. Lamentably, the human learning situation cannot in such a degree be anticipated and exemplified. Further, the high cost of teaching machines eliminates their effective use in most cases;

iv) serious objections can be advanced against programmed teaching regarding the place and role of the teacher. Ultimately teaching always rests on the teacher because educating is an adult’s intervention with a child. In this respect it is doubtful that programmed teaching can exclude the weak teacher because he also remains a weak teacher in the programmed learning situation. The danger is that the teaching machine can totally take over the teaching by which the teacher is degraded to a mechanic or a technician who only needs to know how to operate the machine. In this way, the teacher becomes all the more superfluous. Even if the question of eliminating teaching machines should arise, some of these objections could be equally applied to the programmed textbook. Pedagogically it is an essential danger that the teacher and his role in the lesson and learning situation can be misunderstood and that by this his educative task can evaporate into nothing. The experience of the technocratic society unquestionably shows that youth have never had a greater need for gifted and dedicated teachers than in our modern times;

v) it is obvious that programmed teaching takes its point of departure from a particular psychological standpoint, namely that

of a behaviorist stimulus-response-mechanism. As a first objection in this respect, it can be mentioned that this view is grounded in the conclusions that stem from animal experiments and that, therefore, hold the position that the activity of learning and its various intentionalities can be explained in terms of patterns of behavior. For programmed teaching the consequence of this is the acceptance that learning can only take its course if the situation is not a problem for the child. Especially in the linear program the possibility of a problem situation is eliminated by unifying small parts of knowledge with the expectation that the whole will be understood in terms of the parts. It is not possible to expect that abstract thinking, generalizations and the acquisition of objective judgments will automatically follow the stimulus-response principle. If one takes all of this into account together with the question that problem solving lies in the ability to recognize problems, to compile and weigh data, to order facts, to arrive at particular and ultimate conclusions, it seems that in this case, the learning psychology point of departure is very naïve. These are all matters that are isolated acts and judgments but matters that are directly related to life outside of the school. In conclusion, it also can be asked if the successful course of learning is only a matter of quantity. In the teaching- or didactic-analysis there always is mention of the *quality* as well as the quantity of teaching as well as of learning;

vi) programmed teaching is claimed to be ultra-individualized in nature. However, on closer investigation various problems appear. First there is little attention to the question of *how* each pupil has arrived at his particular answer. Only the end result is taken into account in evaluating and planning. Also it can be alleged that the teacher has neither the training nor the time to prepare learning contents in this way. Thus he must entrust himself to unknown outsiders who are not familiar with his particular circumstances; therefore, he is compelled to accept designs that fall far outside of the particular school milieu. It is obvious that these designs do not allow for the cultural background, socio-economic status, learning readiness, motivation, philosophy of life and selection of the learning contents of a particular school, a particular group or individual child. All of these matters rest on the assumption that the learning contents and the course of learning are the same for all pupils, and similar matters can be assumed. The statement that

individualization is done full justice with programming is certainly doubtful. If there should be recognition of individual differences, at most this means recognizing differences in the course and tempo of learning. Any opinions on this matter cannot be endorsed that do not place the child in relation to the teaching aim within the field of vision. In this respect the teaching machine or its substitute is a doubtful factor. If all of the above is taken into account while all learning contents that constitute a program are “presented” in the same way to all of the individuals, it appears that the matter is still precarious. Reasoning of such a nature about individualizing the teaching ultimately amounts to teaching for the masses. Indeed, the danger is that the individual only receives recognition in the preparation of the program but after that he is left entirely to his own resources;

vii) other objections to programmed teaching include the following:

- a) the selection of learning contents can present considerable problems for this system because often it is not clear what the connection is between the unique nature of the content and the form in which it must be offered. In the same way, ordering the contents in the program and their reduction to their essences (elementals) are no small tasks especially because they cannot merely be left to chance. Thus, the question can rightly be asked whether the learning contents in the program are not merely made logical? And if the basic points of departure in terms of which earlier findings were presented are taken into account, one is faced with the problem of whether the logical and psychological order in which there is mention of programming activities are identical in nature;
- b) is the interest of pupils claimed by programming an authentic interest or is it only temporary and directed to a quick, correct and rewarding result?;
- c) regarding the way the pupil is involved with the contents, there is much doubt whether he can ever arrive at carrying out a proficient formulation, reduction and ordering of the contents;

- d) in practice it already has appeared that the pupils can become irritated by this system of teaching because it is extremely mechanical in nature;
- e) the danger is not excluded that the auto-didactic principles implemented can be done so to its utmost consistency. Consequently, the school's learning situation as a pedagogic situation declines and the teacher can be easily replaced by one or another teaching aid (at least theoretically). If this is so, his role in teaching is degraded to that of an auditor and supervisory technician;
- f) the idea that learning represents a way of being human has little place in programmed teaching. Within this system the act of learning and the fact of "learning" is a bald psychological concept and it is interpreted as a way of reacting in a mechanistic sense that even exceeds the claims of the school of pure drill or memorization;
- g) specializing aspects at the foundation of all teaching threaten to be lost in programmed teaching;
- h) it would be difficult to deny that the act of learning is entirely isolated from its nature of venturing. The child has no opportunity to venture because the machine (or the textbook) completely thwarts his venturing and exploring attitudes in the learning situation. Seen in this light, learning is no longer a matter of mastering but a mere activity of amassing on the basis, e.g., of multiple choices;
- i) the act of learning supported by programmed teaching primarily involves implementing intelligence and memory. If learning in anthropological and other respects exceed the matters of intelligence and memory, the didactician must be skeptical about a system that does not take into account these enlarged views;
- j) research up to the present has not yet shown that programmed teaching can claim results superior to the usual, traditional forms of teaching.

viii) finally, attention must be given to the question of whether the above objections directed to the linear way of programming necessarily have relevance for the branching way of programming.

Closer investigation shows that it is doubtful that branching programs can escape from the mentioned points of criticism. In this connection, it must be indicated that most persons who have expressed themselves in the literature on the matter have not made a distinction between particular techniques of programming. Therefore, this does not really involve how the program is executed but with its construction as such. A broad evaluation of a teaching program ultimately is of the principles that found it. From the following considerations it certainly will seem clear that:

i) all forms of programmed teaching rest on the same principles. Thus when the fundamental principles of programming come under the spotlight, they hold for the linear as well as the branching variations;

ii) the idea of teaching as a pedagogic intervention of an adult with a child comes under less suspicion with a branching than with a linear form. In addition, with the former the auto-didactic principle is emphasized more and it holds a decided danger for the didactic-pedagogic situation in the classroom;

iii) attempts to try to justify pedagogically branching programming give evidence of several unanswerable questions:

a) without a doubt it can be accepted that the contents (facts) in all cases of the programmed are of primary importance. This does not exclude the danger that the learning contents are given the central place in the didactic situation. And what of the teacher? Learning contents always are only the way along which a child moves to adulthood, while the teacher who knows this way accompanies him in order to try to reach the matter of the *normative* as a final destination. In this respect see the discussion of the theory of the elemental and the fundamental. In this respect the branching form is not free to talk about a distorted didactic image. But notice the important role that the machine also plays in this form of programming. No important place is assigned to the teacher. The prominent matter in this variation of the program system of teaching is the program itself. In response to this, proponents of branching programming claim that eliminating mechanized teaching is never the responsibility of the adults. But on closer examination this means that removing the demand for

responsibility for a matter that the teacher is accountable for cannot be an argument in his defense. A teacher cannot be deprived of his task as a pedagogue and then be held accountable for the progress of the didactic-pedagogic event;

- b) programmed teaching is sometimes called a teaching aid. It is certainly very possible that particular aspects of it can be implemented as teaching aids in the course of a lesson. But if it is announced as a didactic system it can hardly be declared a teaching aid. Thus viewed, branching programs cannot be any more acceptable as aids than can the linear forms. The fact of the matter is rather that programming, in whatever form as all, easily is announced as a fixed, sole form of teaching activity because its nature and mode, its aims and practice create little opportunity for being combined with other principles that possibly also deserve consideration;
- c) as asserted, if branching programming is pedagogically more acceptable than linear programming, it can be asked directly if what is programmed play a less prominent role in the former than in the latter. How does this matter determine the course of the learning activity in either of the two? The programmer and the teacher clearly are not identical persons. If he is *not* the teacher, here there is really no mention of a pedagogical event;
- d) sometimes programmed teaching is called a help- or supplemental-system. That this can be so in certain aspects certainly is possible but it remains a difficult matter to declare a didactic system to be a helping or supplemental activity. In light of the fact that it is often elevated to a fixed form of teaching, the absolute and even categorical pronouncements made about the theoretical foundation, are matters that create little opportunity for combining with other known forms of teaching;
- e) in addition to this, it often is asserted that a branching program in anticipatory ways makes provision for all possible learning problems. However, what in truth is the case is that the programmed anticipates generally *valid* problems, while it is indeed expected of the teacher to design each didactic situation such that it is a definite

particularization of general didactic insights in terms of the unique nature of the contents and the tasks of the situation. Generally valid anticipations of learning problems is a precarious matter because the distinction between teaching and learning problems in orthodidactic research to date are still not clearly demarcated.

2.2 Computer-assisted teaching (instruction)

Computer-assisted teaching is based largely on the same didactic principles as programmed teaching. The main difference is that a highly sophisticated teaching machine (the computer) is used and that all former designs of teaching machines are replaced by it. Because they are so commonly known, the scope and versatility of its possibilities will not be discussed further.

The computer, and especially the microcomputer, has placed teaching in a new relationship to the technology of our time. The system of computer programs does not differ fundamentally from programmed teaching but the technology involved in the former has developed remarkably in sophistication. The computer, as a teaching machine, has developed a versatility that is far removed from the teaching machines of the fifties and sixties and they cannot really be compared. It is not only that the teaching machine (computer) is in every respect a work of wonder but the programs that have been developed are refined to the extent that there is hardly an area of knowledge that cannot be computerized and introduced in the teaching and learning situations in this form.

The general availability of computer-assisted teaching facilities and the introduction of microcomputers has elevated their use as a teaching system. During the last few years, microcomputers (hardware) have become so inexpensive that they are now within the financial reach of teaching. It is projected that by the middle of this decade (1985) a million microcomputers will be used in primary and secondary schools in the U.S.A. It is also noteworthy that the technological development that accompanied the development of microcomputers has created new interests on the part of teachers for the programmed system of teaching. The interest in the use of teaching machines, introduced by Pressey in

1920 and developed by Skinner in 1950, has culminated in renewed excitement for teaching programs presented by means of the microcomputer.

The role played by the computer in the community outside the school is of decisive importance for its evaluation as a teaching system within the school. The dependence of the community on information has made the computer an integral part of our modern lifestyle. In this context it is thought that during this century the computer will eventually be as commonplace as the automobile. For this reason computer literacy (familiarity with and understanding of the uses of computers) will probably be the most important demand made on education. In industrialized countries the pressure is increasing to insure that computer literacy is given the same importance in the school curriculum as are literacy and numeracy.

Advocates of computer-assisted teaching make use of the same rationale as do the advocates of programmed teaching for establishing the use of the computer for teaching and learning. The argument is mainly based on improved learning achievements, the changed attitude of pupils and the shortening of available teaching time:

- a) the computer provides unlimited opportunities for the pupil to exercise insight and skills. It represents a particular supplement to the teacher's attempts in this regard, especially because the pupil works through the exercise individually and in his own time. This activity can be aimed at specific skills such as spelling, arithmetic, calculations, memorizing facts, etc. The pupil receives immediate feedback about the quality of his achievement and the opportunity to repeat the exercise until the computer considers his achievement to be adequate. This factor is important as far as the basic skills in every school subject are concerned. Improvement in the specific area of knowledge is impossible without thorough command of basic skills;
- b) a computerized program can directly focus on the improvement of conceptualization and mastering skills that can then be implemented in the learning situation. Thus, the computer does not offer only exercises but also support in the

mastery of skills. This does not mean that the pupil is only given direct feedback about the correctness of his answers. The computer offers assistance and support because it “understands” the nature of the pupil’s mistakes and provides him with additional or remedial exercises. Because he experiences his achievement individually, he cannot avoid the judgment of the computer about the quality of his learning. As far as the teacher is concerned, this means that the computer can consistently identify the weaknesses of the pupil;

- c) the computer can converse or establish a dialogue with the pupil. This enables him to explore the curriculum as a whole. The pupil can, for instance, instruct the computer to give reading instructions. In this case the computer examines the pupil’s reading skills in order to determine his reading level, to make an analysis of his mistakes and to provide reading exercises in order to raise the level of his reading. During the course of the program the pupil is continually evaluated and given direct feedback concerning the quality of his attempts. If the computer is satisfied with this quality it increases the level of difficulty of the contents and continues its supportive assessment until the pupil has reached the intended level of achievement. This procedure can be provided for all levels of skills in any school subject (this includes basic, intermediate and higher skills). The fact that the computer continually monitors the achievements and can raise or lower the degree of difficulty means that the pupil is given the opportunity to work through the whole syllabus in terms of his own abilities and aptitudes and still reach the necessary level of achievement.

The computer can store certain programs; it can assess the answers of the pupil; it can give direct feedback about the quality of the pupil’s answers and directly provide him with the state of his progress in the available subject. It is obvious that the computer’s individualizing possibilities are endless, especially as far as the degree of difficulty of the contents and adaptations to the pupil’s learning tempo are concerned. Research on the effect of computers on the learning achievements of pupils is so vast and encompassing that it is impossible to give a survey of the findings in a book of this

nature. However, all researchers agree that the computer makes a marked contribution to raising the level of learning mainly because of its potential to individualize and the fact that it can provide remedial programs. Should teaching personnel become critically scarce (for example in developing countries) the computer can be used as an important supplement without supplanting the teacher. In circumstances where adult education is an important consideration in a developmental program (e.g., to provide literacy programs) the computer's contribution is obvious.

Interesting observations have been made in extensive empirical surveys concerning the learning effect that computers seem to have in support of teaching:

- a) teachers who make use of computers feel that there is a marked increase in pupils' ability to develop skills and solve problems;
- b) there is also an increase in the motivation of pupils that indicates interest in the learning contents, the status of the pupils in relation to other pupils who do not take part in computer-assisted teaching and a feeling of greater command of contents in the learning situation;
- c) it is also remarkable that, especially in the lower grades, girls are more diffident and cautious of the computer although this phenomenon disappears as they gain understanding of the apparatus. Generally speaking, it seems that more boys than girls make use of computer programs;
- d) it promotes cooperation among pupils in a wide variety of learning situations. Pupils who have mastered the computer's use often play an important role in involving other pupils in computer procedures and skills and to help them if they experience difficulties;
- e) it enables pupils to become much more independent in the learning situation in that the computer forces them to find their own answers to questions and problems instead of seeking the teacher's help as they would have done previously;
- f) it is very important to follow a coordinated policy and strategy when introducing computer-assisted teaching. Divergent opinions by teachers, differences concerning the application of computers in the organization of teaching and faulty

coordination create confusion, uncertainty and resistance on the part of the pupils.

Computer-assisted teaching is still in the process of development. It is therefore obvious that certain problems are experienced with this teaching system of which the following appear to be the most important:

i) Software

The successful use of computers mainly depends on the availability of good programs (software). It seems that there is a world-wide shortage of didactically developed and educationally sound programs mainly because there are very few educationists who are trained to write programs of the quality and scope necessary for teaching purposes. The development of programs is a very expensive item in the budget of computer-assisted teaching. Because this development is confined to industrialized countries, the shortages and problems experienced in developing countries are even more acute as available programs are not necessarily applicable to the educational circumstances in these areas.

In addition, there are many different computer systems. Programs developed in one system cannot be used directly in another and this limits the use of existing programs and creates insurmountable problems all over the world. However, the expectation is that with the development of microcomputers, these shortcomings should be overcome during the next ten to fifteen years. It is also obvious that since providing programs has been commercialized, the profit motive does not always produce programs of the necessary teaching quality. In fact, a large proportion of the programs offered on the international market is inadequate and of low quality educationally, as well as in other respects. Teachers who wish to introduce computer-assisted teaching as an aspect of their practice should therefore approach the whole matter of software with extreme caution.

ii) Limited funds

The most general problem concerning computer-assisted teaching is that available funds are inadequate. This is possibly true for teaching as a whole. It is unfortunately very expensive to develop didactically effective computer-assisted programs. It has been calculated that it takes a hundred man-hours to produce a computer program lasting an hour and therefore methods must be developed to make the most effective use of those programs that are available.

The following should be considered: a project can be initiated where the teacher undertakes the development of the program with the support of part-time specialists in computer-assisted teaching. Initial success, or even partial success, creates the conditions necessary for personnel of other institutions (universities, teacher training colleges, technikons, etc.) to become involved, thus the quality of the programs, the general experience and the assessment are broadened and deepened to the advantage of both teachers and pupils. There is also a large amount of material available in the so-called popular subjects (mathematics, physics, etc.) that can be bought for a relatively low price. However, very few of these programs are applicable to the African situation and their injudicious use can destroy enthusiasm for computer-assisted teaching and have precisely the opposite effect to what is intended. Homogeneous teaching aims concerning computer-assisted teaching contribute to keeping costs as low as possible and also insure the most effective use of available programs.

iii) Positioning the computer

The question of where the computer unit is to be located to provide the greatest service and support for teaching is often determined by factors with a historical origin. This is because computer-assisted teaching has undergone a certain development and had its inception in a specific milieu. Other factors that may determine its positioning are the persons or bodies that propagate its use and especially the funds that were made available for its purchase. Because there are centers that pay a great deal of attention to audio-visual teaching aids the computer is often seen as “only another one of these aids” instead of being appreciated as a basic teaching system with its own identity. Placing the computer in an audio-visual teaching center is restrictive because of its limited

possibilities in supporting actual teaching. The cost factor in depressive economic circumstances nowadays seems to be the determining factor.

The original aim of computer-assisted teaching was to improve the quality of teaching. It appears that prohibitive costs have forced the users of computers to abandon this aim at this stage to concentrate instead on computer literacy. When this is the case the computer is often placed in the school library to insure optimal access and to effectively disseminate available information regarding programs (software). This positioning also restricts the original aim of the computer as a teaching system to contribute to elevate the quality of teaching and learning. If the computer unit is seen as a computer facility or center, as is often the case, it necessarily means that the purpose of the computer is radically changed. In this case the computer center serves as a source of information and not as a teaching support facility. This is often a serious problem in the attempt to popularize the computer as a factor in teaching.

It also often happens that the computer is installed in the office of a person who is particularly interested in and enthusiastic about them or in a study area where it is effectively used and available to the rest of the staff wishing to use it for teaching purposes. In this case the computer is isolated in the sense that the people originally responsible for establishing it are apt to see it as their personal property.

(iv) Credibility

Credibility is always a problem when something new or a new system is to be established and accepted. This is possibly even more so in the case of education generally and teaching specifically. The instrument as well as the innovator who believed that he can make a contribution to teaching and learning is viewed with suspicion. Skepticism remains until its effect is proven and even then it is only partially accepted. Matters assessed in this case are time saved, auto-didactic opportunities, grater individualization, better exercises, etc. The only way opposition is really overcome in the school situation is by the proof given by the users of computer-assisted teaching in such areas as the quality of the learning effect,

remedial programs, relief from marking books, etc. Cooperation and evolution are much more productive than coercion and revolution. In countries like France and the U.S.S.R. experience has shown that in-service training in computer-assisted teaching is an important factor in establishing the credibility of computer-assisted teaching among serving teachers. The same effect is achieved by arranging regular demonstrations to give the skeptics the opportunity to accept the role of the learner in circumstances that do not reflect their own teaching practice. Using computer games to soften skeptical attitudes has proven to be counterproductive: skeptics consider games to be irrelevant to the teaching and learning situation. It is more effective to concentrate on a specific learning problem in terms of which the learning effect can be directly assessed. As soon as the teacher becomes aware that he is directly in control of computer-assisted teaching, his resistance recedes and he becomes receptive to the idea that his own teaching can be enriched by the computer.

(v) Computer literacy

Although computers are becoming increasingly available, and even if they are to be in school budgets by the end of the decade, the percentage of people who are computer literate is still very small. In fact, this percentage is so small that it cannot be considered to be an advantage. Without an overall strategy to establish general computer literacy at the same level as reading and writing skills, computer-assisted teaching can only remain an ideal. In a country like the Republic of South Africa, taking its educational resources into account, it is an ideal that will be realized only in the future. A precondition for introducing the computer into education, as far as both teachers and pupils are concerned, is that teacher and pupil must at least command a functional level of computer literacy. In itself, this is a tremendous problem for educational planners and curriculum designers.

As is the case with programmed teaching, there are clear advantages to computer-assisted teaching. The following are the most important:

- a) the computer has limitless patience with the pupil;

- b) the computer can generate a limitless number of examples, exercises, problems, etc., in order to exercise insight;
- c) the computer's calculations are immediately available and absolutely correct;
- d) the computer can effectively simulate situations;
- e) the computer's control of the pupil's learning activities is consistent and unprejudiced;
- f) the opportunities to individualize teaching by means of the computer are limited;
- g) because the computer does not become tired, does not want to go home or on a holiday, it can be used anytime and anywhere;
- h) the pupil's progress can be monitored very accurately;
- i) the computer offers the pupil the advantage of expertise that would not normally be available to him.

On the other hand, as with all things, there are certain disadvantages:

- a) pupils often feel isolated in the computer-assisted learning situation;
- b) the typing skills necessary for using the computer effectively are often a problem, especially as far as adults are concerned;
- c) a computer is also an apparatus that sometimes fails. This can be especially disturbing if terminals are linked to a central computer facility;
- d) where the computer is linked to a main frame (e.g., universities) the use of the facility is often so intense that students have to wait for long periods before having access;
- e) if there are not enough terminals or micro-computers available, the learning activities of pupils can be retarded seriously;
- f) computer-assisted teaching is expensive: this is true for both hardware and software.

2.3 Team teaching

Team teaching originated in the U.S.A. and has to be seen against the general background of teaching problems there. It is an attempt to improve the quality of teaching (and the advocates of

programmed teaching are enlisted here) and especially to purposefully and more economically use teachers in light of their continual shortage. Thus, it is a system of teaching where two or more teachers accept responsibility for teaching a particular group of pupils. Consequently, team teaching is not an incidental or informal cooperation between or among teachers during certain periods of the school year but is based on teamwork and carefully coordinated planning in which teachers and pupils are systematically involved.

In broad strokes, team teaching shows the following characteristics:

- a) a teaching team consists of three to seven (and even more) teachers who are jointly responsible for teaching between 75 and 225 children in different grades;
- b) individual teachers are engaged in teaching at different levels depending on their experiences and capabilities;
- c) as leader of the group, the senior teacher must exercise control and observe the effect of engaging new teachers in this kind of learning situation;
- d) the planning, teaching and assessment of the team are stressed;
- e) each member of the team specializes in certain aspects of the contents during each lesson and each is furthermore responsible for helping other members of the team regarding the organization of the specific contents. The specialist is responsible for the actual teaching or presentation of the contents;
- f) all team teaching programs emphasize the effective use of the aptitudes, abilities and talents of every member of the team;
- g) team teaching proceeds from the standpoint that a specific teacher is not responsible for teaching a particular group of pupils in the school. The idea that pupils are continually progressing (changing) and that therefore the learning situation is also continually changing is at the heart of the idea of team teaching. For this reason, all teachers teach all of the pupils;
- h) team teaching programs vary in accordance with class size and the duration of the lessons. Such variations are based on matters such as the teaching aims, the unique nature and

- context of the contents, teaching technologies that can be used and the level of development (readiness) of the pupils in the learning situation;
- i) the size of the class and duration of the lesson are organized in terms of the principle of a flexible and adaptable timetable for both the pupils and teachers;
 - j) the aim of this variation of teaching is also to make the most effective use of mechanical and electronic teaching apparatuses (aids).

In light of the benefits of team teaching the following are arguments in its favor:

- i) the system provides for specialization by teachers that in turn enables the school to make more effective use of all teachers' abilities at different levels of the school program. Therefore, the individual teacher is not isolated from the general educational planning of the school and this enables him to orient himself to the total scholastic situation of the school from the lowest to the highest classes;
- ii) this system satisfies the demands of individualization. Improved organization, experimenting with new teaching methods and an adaptable curriculum naturally contribute to this advantage. The rationale is that the individual pupil and all of his needs are the focal point and concern of the team of teachers. As a result of this individual-directed teaching, differentiation comes into its own right regarding both teachers and pupils. Provision is made for all forms and grades of pupils' abilities and talents. Much room for relevant forms of individualization is built into the system, especially as far as group work is concerned that in itself provides unlimited opportunities in the team situation. All groups that are heterogeneously arranged according to ability and interest, and grouping of gifted and less gifted children in different classes is eliminated by this system;
- iii) the learning world of the pupils is extended to include the world outside of the classroom, thereby providing the child with a fuller and richer experience. In this way close cooperation between school, home and society is established, especially because the parents accept much greater responsibility for the teaching of their

children. Similarly, society shows a greater understanding of and value for the work of the school;

iv) as far as the pupils are concerned, team teaching has certain important advantages. The personal contact between teacher and pupil remains close because there is a strong possibility that the same team of teachers will teach the same group of pupils right through their primary school careers. At the same time the pupil is not left to the mercy of a weak teacher. Various research findings indicate that this way of systematizing teaching does not in any way confuse or affectively disturb the child;

v) as far as the teachers are concerned, team teaching has definite advantages. In the first instance it creates opportunities for promotion and better salaries. In conjunction with this advantage, teachers' abilities, interests and teaching preferences are given careful consideration. Because young teachers work intimately with more experienced teachers, their organization of teaching activities as well as lesson preparation and presentation are improved.

Jealousy and envy among teachers is largely obviated because they are all forced to cooperate with one another and nobody expects to be subjected to criticism by their peers as a result of bad planning and presentation. All non-professional work in the school is done by non-professional staff so that the teachers can devote all of their time to the professional aspects of their teaching;

vi) the close cooperation among teachers, and especially their joint planning of the contents, creates excellent opportunities for integrating different school subjects.

Criticism of the system of team teaching is mainly directed at the following weaknesses:

- a) team teaching demands a thorough and fundamental investigation of the didactic merits (the advantages and disadvantages) of this system. A school that introduces team teaching without purposeful and careful planning will create more problems than it can solve;
- b) great demands are placed on the teacher from all sides. Teaching is often given to large groups that is no mean task. The fact that teachers must cooperate extensively and at a high professional level demands a very adult and unselfish attitude. Discussions within the team are not always orderly

- or productive. Group leaders not adequately formed didactically are often at a loss to keep the problems of the teaching situation within the focus of the participating team of teachers. In this context the individual teacher has a need to know exactly what his task is in the joint teaching attempt;
- c) team teaching is necessarily closely associated with certain principles of ordering the learning contents, e.g., linear and chronological. If there is faulty coordination between ordering the contents and the different forms of presentation (ground-forms such as conversation) during the planning of lessons, the teaching attempt easily becomes ineffective;
 - d) it is an essential problem that too large a group of pupils is given too much prominence in this system of teaching;
 - e) organizational matters demand considerable time and energy from the participating teachers;
 - f) the dynamic nature of team teaching leaves little opportunity for far-reaching habit formation and the proper exercise of insights by the pupils;
 - g) In the final instance, nobody is really responsible for the progress or failure of individual pupils. Everything occurs in the group and the progress of the group is taken as medium to assess the effect of the teaching.

2.4 Project teaching

The word “project” is derived from the Latin *projectum* and can mean a purpose, an aim, a design or plan. Therefore, projects indicate making designs or plans. For practice in the classroom this can mean that the teacher together with the class study a particular theme or formulate and outline a project as a particular problem. Thus, project teaching arises from the need to build a bridge between the worlds outside and inside the school in order to try to attain a greater integration between the life world and the school subjects. In this way an attempt is made to eliminate teaching of its purely mechanical and reproductive character in order to give the pupils the opportunity to examine the phenomena of the life world for themselves, but always with the aid and support of the teacher.

Project teaching can be considered to be a form of symbiotic teaching in the sense that it so strongly stresses the demand of

relevance to reality. However, it also provides for a linking up with other principles of teaching. Integration of the learning contents is an important foundation for the idea of project teaching because various areas of school subjects can be effectively integrated and ordered into a meaningful whole by means of the project. As far as learning contents are concerned, the emphasis is mainly on the essences of the learning material (called “units”) that is the point of departure for realizing each of the aims of project teaching. Project teaching is a conscious attempt to break away from typical classroom teaching and to search for and effectively implement the spontaneous questioning and venturing attitude of the child in the teaching situation.

The steps in project teaching in the classroom can briefly be summarized as follows:

- a) the pupils are introduced to the theme or design;
- b) the various aspects of the project are isolated, identified and formulated under the leadership of the teacher. The different aspects are then arranged and assessed in terms of importance and potential;
- c) the class is then divided into groups. The teacher must insure that the grouping is in accordance with a set of criteria to guarantee equality by taking the aptitude, initiative, independence and other abilities of the pupils into consideration;
- d) each group is given a specific aspect of the project to work on;
- e) the importance of cooperation within and between groups is emphasized—for instance by stressing the importance of exchanging knowledge and insight regarding the various aspects of the theme;
- f) after the previous phase, information is gathered by means of textbooks, the library, magazines or from any other source. The information is carefully systematized, ordered and written up;
- g) the groups then submit a scheme based on the collected data for the teacher’s assessment;
- h) after joint acceptance of the scheme by the teacher and the pupils, the scheme is further worked to form the basis on which the project will take its further course;

- i) each group makes its own written report regarding the aspect of the theme for which they are responsible. The report includes statistics, graphs, sketches, pictures, etc.;
- j) manual work is included as far as possible; e.g., making relief maps, models and schemes;
- k) as soon as the project is finalized, an exhibition is arranged to show everything that the pupils have contributed to the project. The groups exhibit their contributions separately.

Advantages of project teaching are briefly the following:

- i) as far as contents are concerned, the principle of integration comes into its own and as far as the child is concerned, the learning experience is meaningful because the contents are true to reality and life outside of the school. The contents therefore have their own integrity. The solution to problems reflects the reality of life and in this sense the learning world of the child is also the life world;
- ii) project teaching promotes the acceptance of responsibility and it also exercises and the acquisition of critical judgment, accurate observation, reasoning ability, initiative, cooperation in a team or group, respect for the opinion of others, perseverance, openness to criticism, creativity and especially self-criticism. It also promotes self-study that is certainly valuable for every kind of further education/schooling;
- iii) it provides for the demand for individualization. It creates opportunities for differentiation while socialization within the group is an important by-product;
- iv) it clearly demonstrates the complexities of the life world and especially the world of work;
- v) by its nature, project teaching takes account of the discovery aspect of learning and provides a definite motive for the course of learning.

Criticism directed against project teaching is briefly summarized as follows:

- a) the use of the project as a system of teaching is usually hindered by the traditional organization of the classroom. It is also usually in conflict with a fixed school timetable.

- Although a compromise is possible, the traditional school timetable cannot summarily be sacrificed in favor of project teaching. Regularity and orderliness are important demands of the school and of social life. An attempt at compromise between the demands of project teaching and the school can thwart the didactic aims of the former;
- b) as far as the selection and ordering of contents are concerned, the extremes of autocratic planning by the teacher or unlimited freedom of the pupils can create serious problems. Objections to this form of teaching are often raised if there is a lack of individualization as a result of the over-prominent role of the teacher. If the teacher is autocratic the child is not given the necessary advantages of experiencing adulthood, then loss of social values is the result; there is a lack of coordination and the learning activities are incidental. The danger of the incidental selection and ordering of learning contents is very real if children are given unlimited freedom. The consequence is that the learning activities can develop an incidental character. In certain subjects, e.g., mathematics and physics, this can have serious consequences;
 - c) another objection regarding contents is that the curriculum will not be dealt with fully and that certain gaps in the design of learning experiences can occur. As far as the teacher is concerned, the task of identifying and filling in these gaps is difficult. However, it often happens that in an attempt to fill these gaps, the project on which the class is working is extended beyond its boundaries thereby giving it an artificial character that project teaching strives to avoid. The teacher finds it very difficult to order the learning contents in such a way that the various areas of learning or related school subjects are given their rightful place;
 - d) when choosing a project, overestimating the potentialities of the pupils by the teacher or overestimating their own capabilities by the pupils pose a real problem. The result is often that interest in the project wanes because of failure when carrying the project through;
 - e) it is doubtful whether all school subjects can be effectively and purposefully presented by means of project teaching. In the primary school basic skills such as learning to read, write and do arithmetic are clearly unsuited to this approach;

- f) there is no assurance that project teaching is as efficient in the secondary school as in the primary school. Undifferentiated learning contents, because of the demands of integration, must eventually lead to differentiated school subjects in the secondary school. This means that the secondary school is not necessarily the most suitable level on which to implement project teaching. The level of readiness of the pupils must also be taken into account. As a child gets older, his critical attitude tends to outweigh his appreciation. This can be a limiting factor in undertaking a project;
- g) the principle of group-work so prominent in project teaching has its own difficulties and dangers. The most real danger is that the less gifted child loses himself in the group without many or any demands being made of him, or that he makes very little contribution to the project. This implies that the teacher must continually differentiate carefully and control (monitor) the group activity;
- h) effective and purposeful project teaching makes great demands on the teacher. The possibility is real that the teacher may view the project as only an activity for the pupils. This means that the teacher easily hides behind the activities of his pupils in an attempt to escape from his own teaching responsibilities;
- i) project teaching requires a great deal of research material as far as both teacher and pupils are concerned. In certain circumstances the necessary and relevant material is difficult or impossible to obtain;
- j) the attempt to avoid mechanical drill-work and exercise can have the danger of a serious deficiency can arise here. A pupil cannot be exempted from the need to do the necessary exercises and to memorize certain contents simply because he prefers project teaching;
- k) pupils used to project teaching find it difficult to change to schools where other forms of teaching are prominent;
- l) it is time-consuming and often expensive;
- m) teaching by means of projects sometimes favors a broad and superficial treatment of the theme in place of a deeper study of it.

2.5 Conversation teaching

As we know, conversation is a fundamental didactic ground-form. When conversation is overemphasized and teaching is organized exclusively in terms of conversational activities, one can identify a definite systematization of teaching in the same sense as in the case of programmed teaching or project teaching. For this reason, it is best to start with the negative and ask what conversation teaching is *not*. The four following aspects are the most important:

- a) the teaching conversation is different from the enforced revelations of, e.g., psychoanalysis and other forms of therapeutic conversation;
- b) it differs essentially from everyday forms of conversation such as chatting and talking because the didactic imperative is never present in these common forms of communication;
- c) it is not a heated debate about contentious topics;
- d) it is not a concern of specialists. It has no place for rigid rationalization or snobbish teaching formalisms.

Without profound communication, willingness to make contact and become involved in the renewal of the relationship between teacher and pupil, conversation teaching as a didactic form is unthinkable. Ordering, orderliness, tolerance, theme directedness, activity, integration, willingness to compromise and sober objectivity are all demands made by conversation as a form of teaching. The level of readiness of the pupils is also an important factor. The participation of a nine-year-old child in a conversation is vastly different from that of a fourteen-year-old.

Conversation reveals itself as a didactic ground-form in two general ways, namely as a learning conversation and as a class conversation.

2.5.1 The learning conversation

The learning conversation is described as the communication between the teacher and the pupils where the teacher leads the learning activities of the pupils. The aim is mainly to elicit answers to the questions asked by the teacher and the pupils. The younger the pupils, the more bound (restricted) the conversation will be. The teacher is always at the helm and steers the conversation

toward realizing the teaching and learning aims. In this sense, the learning conversation is not a light discussion but an intensive conversation directed by the teacher who intends to realize a clear and well-formulated aim. It is never incidental and therefore occurs only when a particular or unique problem arises.

There are many opinions about the aims of the learning conversation. Some didacticians are of the opinion that different solutions to problems are posed in the conversation so that each pupil can choose the solution best suited to his abilities and needs and with which he has the most success. This point of view is mostly held by didacticians who have been strongly influenced by the theories of the German psychology of thinking. Others maintain that the knowledge imparted and gained in the learning conversation is actually of less importance than the verbal or language formulation skills. For this reason, in the past the learning conversation was identified with language teaching. Another opinion is that the emphasis must be on the mastery of basic patterns or structures of thinking as well as fundamental concepts because they are seen as the main aims of the learning conversation. Unfortunately, it is not possible to discuss these points of view fully at this stage.

However, it is important to note that the learning conversation, as a ground-form of teaching, can be approached from different points of view so that its nature and course can continually acquire a new gestalt with its own aim. Everyone agrees that the question-and-answer has an important role. The conversation is not only brought into play and given direction by the question-and-answer method but it gives its course a particular or desired turn. Consequently the question-and-answer method must meet specific criteria. It must have an immediate, contributing, vitalizing, motivating and discovering character and it must always direct a particular appeal to the child. The teacher's accompanying function is of decisive importance in the learning conversation. Thus, it is understandable that the specialized nature of the question-and-answer method makes stringent demands on the teacher's preparations and designs. The question-and-answer method is certainly one of the most difficult and fatiguing methods of teaching.

Didactically, the learning conversation originated in the research of the German psychology of thinking. The contribution to didactic theory made by this research cannot be stressed enough. The most important conclusions of the effects of conversational learning is summarized as follows:

- i) the learning conversation especially promotes the breakthrough of insight into a problem or its solution;
- ii) various learning methods are used and a transfer of problem solving methods takes place between the various pupils and the individual. For this reason one can speak of better learning methods (methods of solving problems) that lead to more effective learning achievements;
- iii) although one cannot make any binding prescriptions, it is nonetheless true that there is a definite improvement in the achievement of the pupils regarding such matters as thinking as opposed to memorizing. This improvement is especially apparent in less gifted pupils compared to more gifted ones;
- iv) pupils become bolder in their attempts to formulate ideas and to correlate and control data in order to reach certain conclusions;
- v) the learning conversation is a form of group-work and thus includes the advantages associated with such activities;
- vi) it can contribute to relieving the teacher from the drudgery of teaching according to a set form;
- vii) the gifted as well as the less gifted pupil can take part in the learning conversation. The interrelationship between pupils strengthens the contact between them and the class in fact becomes a working community where the gifted pupil provides the necessary leadership.

It is important to mention that criticism concerning the question of methods of solving problems and their transfer in the learning situation has been voiced for a long time. It is certainly true that a pupil can be provided with too many methods for solving problems and therefore become confused when confronted with an excessively broad choice. The fact is that the pupil can experience a lack of understanding of ordering principles that will jeopardize his ability to understand the essence of a particular theory. If didactic theory must take the findings of the psychology of thinking regarding solution methods into account, pupils must not be

exposed to too many methods of problem solving or be drilled in the use of only a specific method. The aim is rather to provide the pupil with as broad a field of thinking as possible so that when he is confronted with a problem he can use a variety of facts, insights, methods of solving problems, etc. In this context one must realize that the danger is very real that in providing the pupil with methods of solving problems, his critical thinking can be impaired.

As far as acquiring insight, the following two important aspects are mentioned:

- a) if the learning conversation serves to direct a child to the learning activity and if an improved directedness is paramount foundation for improving learning achievements, such assumptions stress the value of the learning conversation. However, doubt must be expressed about interpreting the learning conversation as *the* means of bringing the pupil to the acquisition of insight—no matter how valuable it is;
- b) if providing methods of solution in the learning conversation is to lead to insight, it is didactically much more accountable, through the proper reduction and ordering of the contents, to place the problem and its solution in a particular relationship by which an arsenal of solution-recipes and -formulas make the acquisition of insight unnecessary.

If the teacher does not carefully and purposefully control and direct the learning conversation, it can easily degenerate into a pointless waste of time without any real didactic value. In any case, the learning conversation is time consuming. Another real danger is that the quality of the insight of the gifted pupil can easily cause the learning conversation to degenerate into a discussion between the teacher and a small group of pupils.

2.5.2 The class conversation

The class conversation is carried out by the pupils among themselves but under the control of the teacher. Where the teacher consciously leads the course of the conversation in the learning conversation, in the class conversation he remains in the

background. The atmosphere of the class conversation is much the same as a group discussion where a gifted child often acts as leader. The teacher's task is to direct the conversation from time to time in order to insure that the pupils are keeping to the point by focusing on the problem. The aim of the class conversation is to provide the opportunity for the pupils, as a group, to arrive at solutions to a problem.

As in the case of the learning conversation, the class conversation must meet certain criteria before it can be carried out successfully. The teacher's planning and control are of decisive importance. This aspect becomes important in the order of the contents, especially on the blackboard, in the sense that the teacher must build up an orderly framework from the pupils' individual contributions. In addition, the effective use of the class conversation insists on healthy mutual trust, a willingness to listen to one another, proper ordering of the organization and effective discipline.

The basic value of the class conversation is summarized as follows:

- a) the pedagogic value, because it contributes to forming the child as a person;
- b) the social value, because the child learns to take part in a group (also to listen in a group) and to be in continuous contact with the other members of the group;
- c) the didactic value, which has to do with the opportunity to formulate ideas and to gain knowledge and insight by means of self-activity and self-actualization.

As far as the didactic aspects are concerned, the following are favorable for the class conversation:

- i) as a didactic situation, it creates a favorable climate for learning;
- ii) it is characterized by a spirit of spontaneity in the interaction between teaching and learning;
- iii) it is especially conducive to the use of language and to exercising the skills necessary for clear and understandable verbalization;
- iv) it offers a unique opportunity for a joint attempt to formulate a problem and to assess various solutions to the problem in a specific theme.

The greatest danger in the classroom is that class conversation can very easily degenerate into uncontrolled and irrelevant discussion. The success of this system, once again, depends on the ability, preparation and insight of the teacher.