CHAPTER 3 **CONCEPTUALISATION OF A MODEL FOR INDIVIDUAL SKILL LEARNING** PAGE

CHAPTER 3

CONCEPTUALISATION OF A MODEL FOR INDIVIDUAL SKILL LEARNING

3.0 SYSTEMS APPROACH

3.1 INSTRUCTION

Most training involves unplanned learning and most education involves some planned, goal-oriented teaching. A simple way of stating one view is that "education is what goes on in schools and training is what goes on in industry." Instruction can be defined as a goal oriented pre-planned teaching process. Pre-planning is necessary to check the process of the learning. It is necessary to test the viability of any route the learner proposes to take, check the progress along the way, and to map it so that the steps can be retraced. Thus the presence of careful pre-planning and testing of objectives is the main characteristics of the "instructional system." Instructional system design is therefore a three phase process of establishing precise and useful objectives, planning viable routes and testing them out. A system describes an abstract concept, having a set of components or elements, each of which has a special function, interacting together towards a common goal. How to write instruction for developing multi-media package for teaching a course is a problem. Whatever be the problem, it has to be solved. One can get better results, if it is done in a systematic way. The components have certain characteristics, and inter-relationships. The output required are dependent on the input characteristics of the system inputs. Controlling

the input characteristics, the output requirements can be changed. The idea of the simple system is expressed in fig. 3.1.

Fig. 3.1 The basic system

3.2 Vocational Training System

The same concept can be applied to the vocational training field. The components of the vocational training system will be content, method, teaching techniques (instructional techniques) materials, aids, media, tests, feedback, validation, etc., and these components must be compatible with the other parts of the system. The harmonious functioning of all the components must be compatible with the input in terms of course prerequisites and trainee's previous experience, and with the output in terms of trainee's subsequent performance and the requirement of his employer. A change in one part will affect the system as a whole. It is therefore obvious that to have a successful vocational training system it must be carefully designed, taking into consideration all the components.

3.3 Instructor and the traditional system

The instructor was and is the main source of information, supplemented by text books. He lectures, demonstrates, questions, and interacts with

the trainees. Many instructors are effective in this mode and could produce good results, when his knowledge and subject matter fit the real needs of the situation. A mediocre or poor instructor would always produce mediocre or poor results. There is always a possibility of the course failure with the average instructor instructing with wrong course materials. In the traditional system, the instructor often relies on his biases when selecting media and methods. More often than not, the instructor is unaware of changes going on in the industry and the environment. He does not keep track of what the trained worker is doing in his environment. Moreover, because of the administrative restrictions, he has little opportunity to make proper trainee evaluation and provide necessary reinforcement or follow up within reasonable short time. His presentation rate may also tend to disagree with the receptive ability of the average trainee. This often results in problems for high as well as low achievers. The process is also not consistent with all instructors, or even between different groups under same instructor. It was thus an efficient procedure with respect to trainee and instructional time.

3.4 The traditional system

Figure 3.2 illustrates the traditional system. The instructor draws from a body of knowledge which he condenses into a lesson plan and delivers

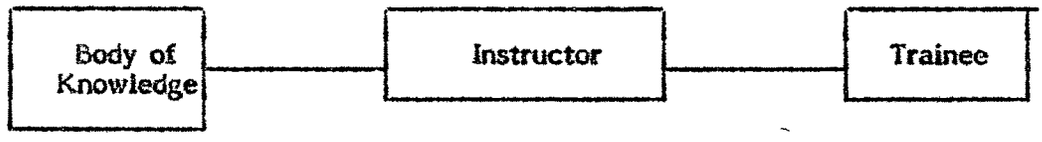


Fig. 3.2 The traditional system

to the trainee. There is no guarantee that there is interaction between the body of knowledge and the trainee. This is not efficient for (a) the instructor varies his 'input' and (b) he is continually varying the internal components on a purely haphazard day-to-day basis. This results in low level output. It is now proposed to discuss a little more about the four important components of a system, before details about the proposed model for skill learning is discussed.

3.5 Components of a Systems Approach to Instruction

An awareness of some of the problems facing those who wish to design instructional systems can be gained from some of the work done by the pioneers in the area. Research till recently used to be to compare one procedure previously known to have produced better results to a new medium. That is, can medium "X" teach as well as medium "Y" or as good or as poorly as this or that procedure. There is a change in this pattern now. Which resource or combination of resource (people, places, media) is more appropriate for teaching? What type of subject to what type of learner, under what conditions - time, place, size of group and so on - to achieve what purpose can be recommended? The systematic design of all the components of instruction, taking into consideration the entire situation in the environment in which, the instruction is to work is important, and a model based on the systems approach is therefore desirable in this context.

Vandermeer (1964) emphasized that a system developed from an analysis of a given situation would be dependent upon one's views concerning the function of the institution. Differing views would lead to different systems, and analysis begin with specification of goals. System design requires

analysis of system components. A searching analysis of the characteristics of the different resource must be made to enable combination into meaningful components, and subsystems of the larger systems called the 'training'and 'institution.' Finn (1963) discusses two concomitant developments - a technology associated with mass instruction and a technology associated with individualised instruction - which are existing even today in our country. These two are united or combined in instructional systems to consider new patterns - staff deployment and logistics of instruction. Finn had stated that administrators themselves will be forced to change their functions as these new technological developments become ever more widespread. Embry (1979) strongly urged elimination of artificial gaps among theory, research and implementation. He indicated that every educator's prime concern is the 'managing of learning,' and that policy decisions concerning media cannot be made by administrators unless more use-oriented research is undertaken.

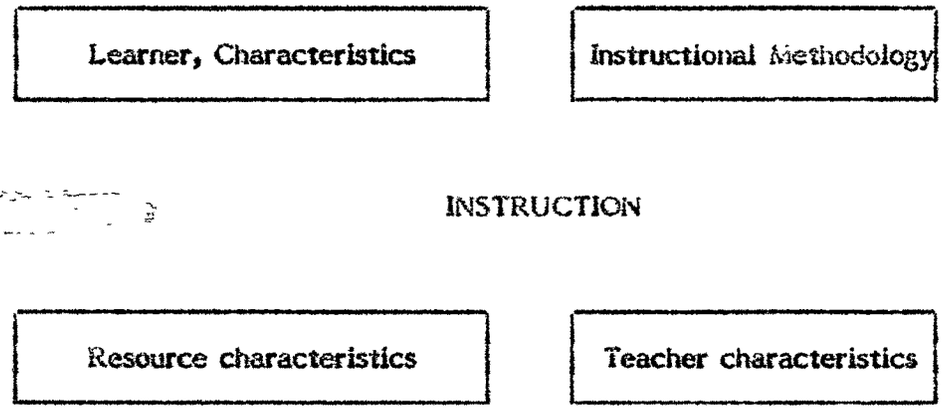


Fig. 3.3 Components of Systems Approach to Instruction

It is clear that systems approach to the solution of instructional problems is a restatement of the ends and means concerning educational and training philosophy in terms of the application of resources (means) to the attainment of the system objectives (ends). The four most important characteristics, namely learner characteristics, resource characteristics, teacher characteristics and training methodology (Fig. 3.3) are discussed in the following paras.

3.5.1 Learner characteristics

Suppes (1964) asserted that, as evidenced by daily classroom practices, the concept of individual differences is yet to be accepted by educators. He stated that improvement in learning of subject matter could best be achieved through research concentrated upon individual differences. Since these differences imply that each learner will proceed at his own pace, only teachers utilising technological methods can achieve this individual pacing. Traweek (1964) found that the instructional effectiveness of different method varied according to differences in student personality characteristics. He demonstrated that students classified as exhibiting such personality traits as withdrawal, anxiety, and insecurity were able to achieve at a much higher level when exposed to programmed instruction than would have been expected if they had been taught by more traditional classroom methods.

3.5.2 Resource characteristics

Logan (1963) indicated that in any learning situation the learner learns not only what to do, but also how rapidly to do it. The pace of any medium effects the learning of those exposed to it. Programmed instruction has

continued to enjoy much attention in educational research. But, some of the ideas as to how programmed instructional materials should be employed are being questioned. Stokes and Baer (1977) challenged the applicability of behaviouristic psychology to problems of human learning. They made a plea for the use of perceptual psychology, clinical psychology, linguistics, communication theory, feedback, advertisement research, and the social psychology of small groups to help change the instructional process and make possible, "a true technology of instruction." Pressey (1963) advocated the use of narrative types of instructional materials as prime sources of information in conjunction with multiple choice format programmed materials which serve as a check to the student of how well he has comprehended the material just studied. Krumboltz (1964) investigated the nature of the responses required in programmed instruction. He found that students who were not required to make (the appropriate overt) response did well as students who were required to make relevant responses. He also found that if a response was required, students learned better when they made non-trivial responses.

Travers (1964) also called into the question the concept that realistic representations were superior to simplified representations. He pointed out that simplified representation may be superior to realistic ones because they contain fewer distracting details and enable the learner to concentrate on the important elements in a given learning situation. If Travers is correct, then the order of presentation may be crucial. For example, it may be inappropriate to take class on a field trip until after the students have studied the topic of concern to them with the help of simplified materials which portray only the important elements. When the trip is finally taken, if at all, the class can pay heed to the important elements and not give undue attention to unimportant factors.

Seymour (1968) found that the quality of language learning was directly dependent upon the frequency response of the language laboratory equipment that was used by the students. The effect of the frequency response was a function of the language being studied. It seems evident from this that the selection of quality equipment guaranteed to meet certain minimum performance standards, is of great importance. Jerome Bruner (1960) contends that it is the structure of the discipline that should provide the content of the curriculum, not chemical properties, historical events, the geological formations, the structure of the metal of the equipment etc. The construction of psychological structure is described by the leading proponents of this approach, Robert Gagne (1970) and Leslie Briggs (1968) both of America (Florida State University). An instructor begins the construction of a learning hierarchy - the term often used by Gagne and Briggs - by stating one of the desired outcomes of instruction in terms of the learner's capability. The question "What would an individual have to know, how to do, in order to achieve successful performance of this class of tasks, given only the direction to perform it?" One or more steps, or sub-skills may be required to perform the skill. The process is continued by repeating the analysis with the generated skills, and so on with subsequent capabilities until a hierarchical structure of subordinate skill is constructed. Though it could be continued indefinitely, the process in practice stops when the level of skills that the learner knows already or possess already. Havelock (1969) distinguishes between the type or form of media as one way and two way media. One way or presentation devices such as lectures, films, televised instruction, books, and demonstrations are characterised by a flow of information from instructor to student without reciprocity. When these media are employed without follow up or discussion sessions, the learner has little opportunity to influence the instructor or change the delivery pattern of message. Never-

thless, when used appropriately no others efficient way to transmit large quantities of information to large number of people in shortest possible time is at present available. Such presentations can be highly motivational and stimulating in many situations. Two way or interactive media such as discussions, tutoring and role plays are reciprocal. Although they are not like the presentation media in transmitting message, they do allow students to play an active part in learning. The student can affect the pace, repetition, and content of the message. The feedback received from students can be used to refine the instruction. The third class of media is the self-instructional media, which include programmed instruction, personalised instruction, audio-tutorial instruction, and computerised learning. While similar to two way media in being interactive, these types of media tend to be more structured. Self instructional media tend to involve regular response ranging from the highly specific in programming learning to the more general projects. They allow a student to proceed at own rate and pace, with own interests, independent of immediate instructional supervision. They do require a great deal of planning on the part of the developer of instruction, who create materials and arrange for resource materials.

3.5.3 Teacher characteristics

McNeil (1962) found that programmed instruction was able to compensate for a commonly accepted sex difference in reading ability. A group of boys learned to read as well as a group of girls when taught by programmed materials. The same group of boys did not continue to learn as well as the girls, when the teaching was done by a teacher in a normal classroom situation. The experiment indicated the inhibiting effect of the teacher upon the learning of the boys. It also indicated the potential role of media in compensating

for the unconscious biases of human teachers. The instructor is the nerve centre of any instructional process, as the student is the target of all instruction. The interaction between the teacher and the student, even when the instruction is mediated is the essence of instruction. Although the student is the principal character, the instructor is the producer director of the drama. The failure to regard each faculty member as a person, with a particular teaching style and an idiosyncratic set of values, characteristics, and behaviours is a serious oversight.

Axelrod (1973) presents a useful taxonomy which offers sketches of teachers typified by their respective content-, instructor-, intellect-, and person-centered styles.

The content centered instructor teaches what he knows. He is concerned about covering the material in a systematic way. His interest is primarily in teaching facts and principles, and students in turn are expected to display their mastery of the material by accurately restating and applying it.

The instructor-centered prototype, teaches what he is. He offers himself as a model, representing certain interllectual or artistic process, which the students are invited to emulate.

The intellect-centered instructor, trains mind. Knowledge for him is a process, not a product. He emphasizes on intellect-rational development and the rigorous use of reason, language, and problem solving skills.

The person-centered instructor teaches students as people. He does not separate intellectual development from other aspects of students' emotional and personal development, and to attempt to do so is harmful. He believes in dealing with the whole growth and development within the teaching-learning processes.

These factors are not for using to judge teachers, but each style has its own implications for treatment of course content and the relationship of teacher to student. The content-centered instructor might choose programmed instruction while the person-centered instructor might prefer role playing or simulation as the strategy. Thus teacher characteristics have a decision making implication.

3.5.4 Instructional methodology

Classical courses on instructional techniques tend to give one, the impression that there is only one worthwhile method of instruction. Most of the courses, concentrate on a method most practicable and apply the 'lecture' method. However, with the development of instructional systems technology and the acquisition of a better understanding of how a person learns, many new methods, techniques and organisational systems have been evolved. An instructional method is regarded as the basic approach to instruction, e.g., lecture, demonstration, lesson, seminar, etc., or to a combination of similar approaches. A technique is a means of instruction complementing a method, e.g., questioning, use of audio visual aids and equipment, etc. Factors influencing choice of a method are the objectives, subject matter, the target population, instructional staff, physical facilities, costs and time.

Technology in itself does not guarantee instructional effectiveness. How to distinguish the more effective methods from the less effective methods? According to Kulik and Jaksa (1977) it is the introduction of some events of instruction such as frequent quizzing, immediate, feedback, and requirement of mastery in student's learning outcomes. Reddy and Joshi (1979) say that the method of teaching and learning employed should promote understanding, applicational abilities, and creative thinking among students. They report, that so far there is no systematic attempt made to devise the methods of teaching at the higher educational level which we have to achieve to attain specified objectives. Harnishfeger and Wiley (1978) report that for long, research especially in teaching, has focussed on isolated and oversimplified factors. This has improvised both research and practice. It is difficult to find theory based models, that integrate the trainee and trainer activities for the skill and related knowledge acquisition, taking into account the different proceses of skill learning. Thus there is a need for developing an instructional model that would take into consideration the nature of the subject content, the trainee, the resource available, principles of instruction and laws of learning, available components of the new technological concepts and their inter-relationship with a view to maximize trainee behavioural change and higher level of performance.

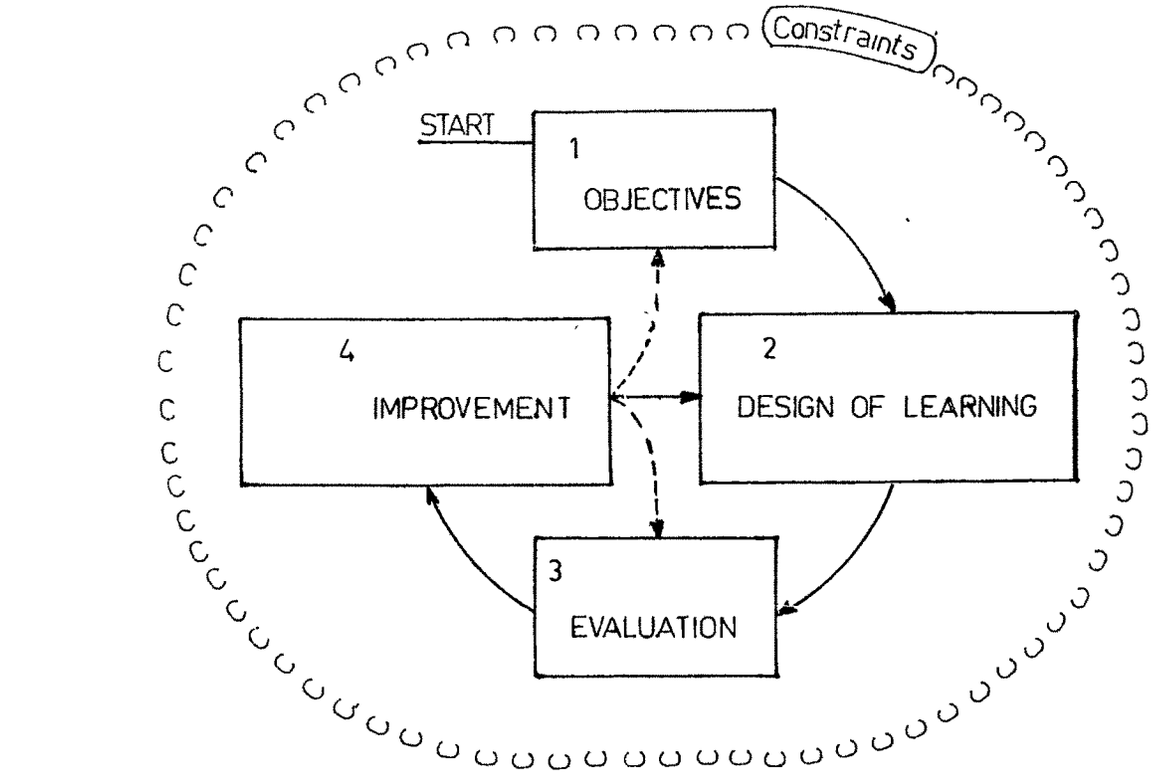
We have been working mostly on intuitive solutions, and this may not always hold good and be successful. Such problems need systematic study considering all the multi-various interactions with possible solution for the ultimate good effect. A rational procedure which accept complexity as an inherent part is all that is required. Systems approach to the design of instruction when applied properly serves in identifying the factors deter-

mining the outcome of the system - it can be called sub system approach to the design of instruction for the course on audio visual education - and the relationship among these factors. This will reduce inconsistencies and inadequacies to the minimum.

But one should be careful in applying systems approach as there will be no purpose to leave certain components, and tackle only few others. The constraints left out will always have a say, no matter how effectively one can control the rest of the components of the system. In fact for effectiveness, one should control all the four aspects discussed earlier.

3.6 Educational Technology Approach : Rowntree - 1974

According to Rowntree, the systems approach and educational technology approach are synonymous terms. He points out that systematic approach would be more apt and less pretentious. Every components of a system relates to everything else and he has given a four phase problem solving approach to design and implement instruction. The figure 3.4 reveals four phases of problem solving, and can be used in planning or developing instruction and the design of learning experiences. He starts with objectives-analyse aims, describe students, specify objectives and design criterion tests. The second phase is the design of learning-analyse the objectives, identify learning sequences, decide teaching strategy, select media, and materials and prepare appropriate learning experiences. The third one is evaluation, try out, analysis, use and monitor the results. The last phase is the improvement phase consisting of revision and review. He cautions that these are not necessarily the only possible steps, and the order is not to be taken as sacrosanct or inviolable.



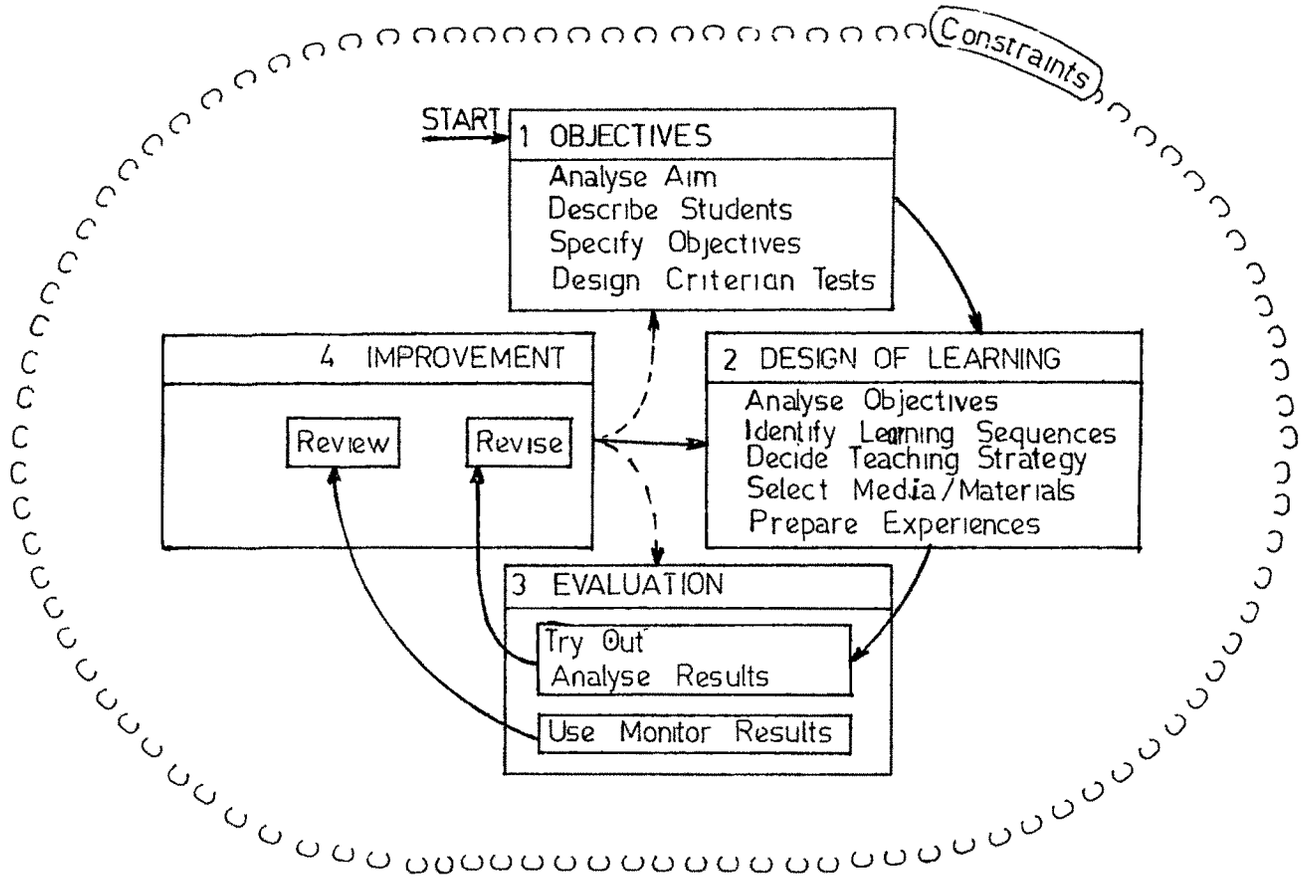


FIG. 3.4
FOUR PHASES OF SYSTEMS APPROACH TO INSTRUCTION : ROWNTREE

Although it is possible to define objectives at first, it may be sometimes necessary to rethink or refine them at a later stage, after some of the later steps. In actual practice, the investigator had faced incidents, when each step was affected by earlier decisions, and they were themselves liable to cause changes in the earlier decisions. Rowntree opines, that the approach does not demand that learning experiences should come through programmed learning, mechanical aids, or any specific medium, on the other hand the instructor should think systematically and in terms of the objective, he chooses the means and media available. No one medium, will be ideal for all objectives or even for all learners.

3.7 Instructional Systems Design : Briggs - 1977

It is the thesis of Briggs (1977) that instruction can be designed more systematically than has traditionally been. The crux of the instructional design, is the change to be effected in student behaviour. Whether instructional design is to be effected by a single person, or a group of persons - teachers, administrators, subject-matter experts, evaluation specialists, media specialists, instructional designers and other specialised person(s)-objectives are stated first, then learning activities are designed to attain the objectives and lastly appropriate evaluation procedures are devised. The three components - fig.3.5 - should not be considered in piecemeal, but as parts of an integrated plan. Second, planning by systems approach implies an analysis of the components in a logical order and careful coordination of the total effort among the planners and various activities is required. Third, the process of planning follows an orderly but flexible sequence. While there is an overall logical order of design steps or stages, one step in the listed

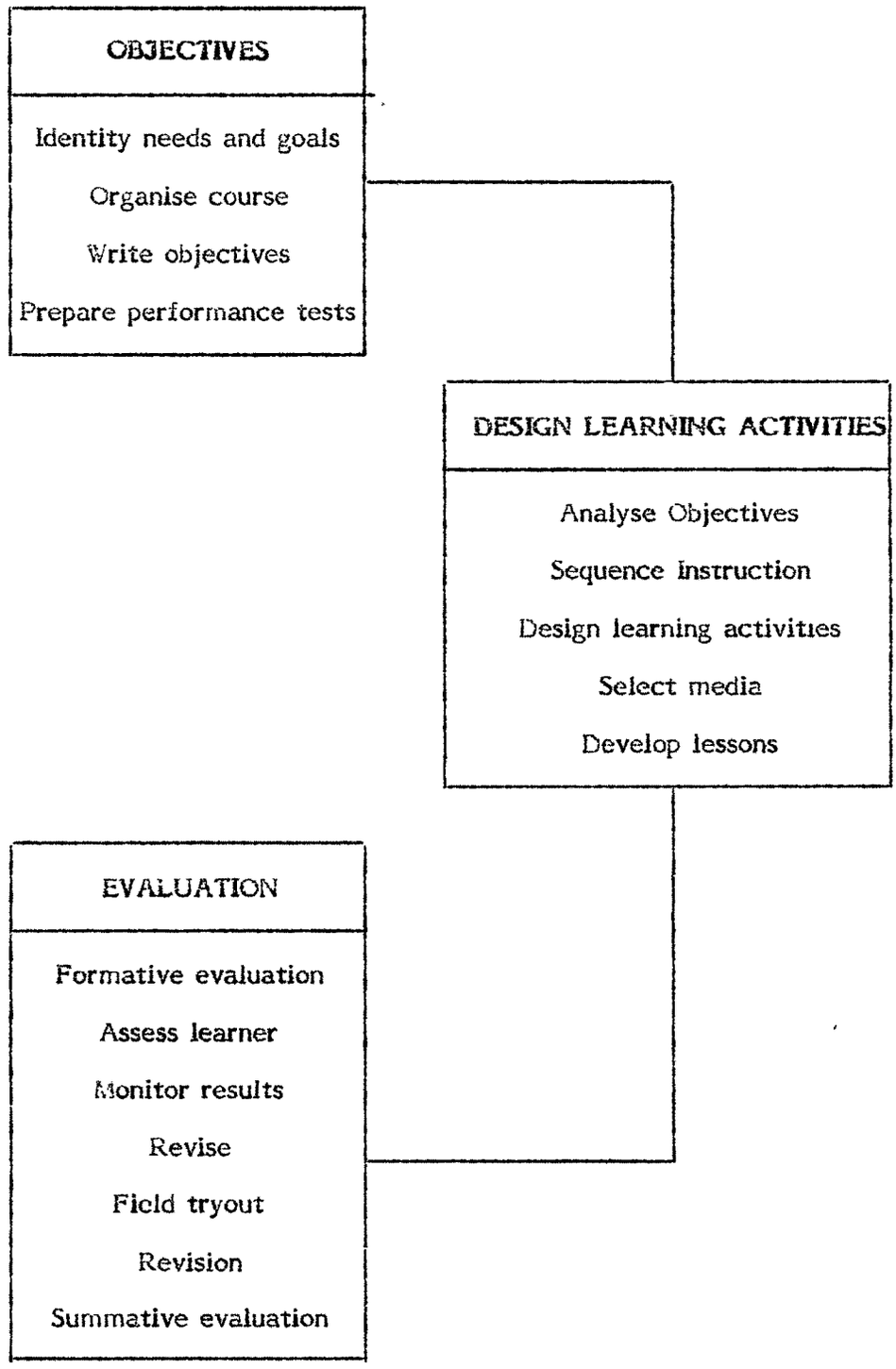


Fig. 3.5 INSTRUCTIONAL SYSTEMS DESIGN : BRIGGS-1977

sequence is not always not completed before the next, in a fixed linear order, and never returned to again. One returns to an earlier step and makes corrections, due to a new insight gained while taking a later step. This interactive nature of the instructional design model is one of its greatest strengths, and is therefore open to self-correction. The fourth, calls for empirical testing and improvement of the total instructional plan, that is formative evaluation. Heavy reliance is called for on actual tryout and revision. The last in the design model requires comparison of the final version of the instruction with alternative instruction; or in the absence of an alternative, the value of the final form of the instruction is to be determined, that is summative evaluation. The total design procedure is called the systems-oriented model for instructional design by him.

3.8 The instructional system : Robert Kozma - 1978

Kozma (1978) presented a conceptual framework for solving instructional problems in Higher Education, intended to correspond to the intuitive notions of teachers. According to Kozma, a great deal of educational research is still needed, but the thinking is clearly moving from 'simple to complex' and from 'static to dynamic'. Thoughts of one best way have been abandoned. The thinking is influenced by a large number of variable in the instructional environment, and they interact in a complex way. In any system, the components are all interdependent, and the alteration of one affects others. Banathy (1968) defines the system as a collection of interrelated parts or elements which can be conceptually separated from its surroundings, and the interrelationship of its parts is determined by the purpose or function of the system as a whole, and the nature and contributory function of each

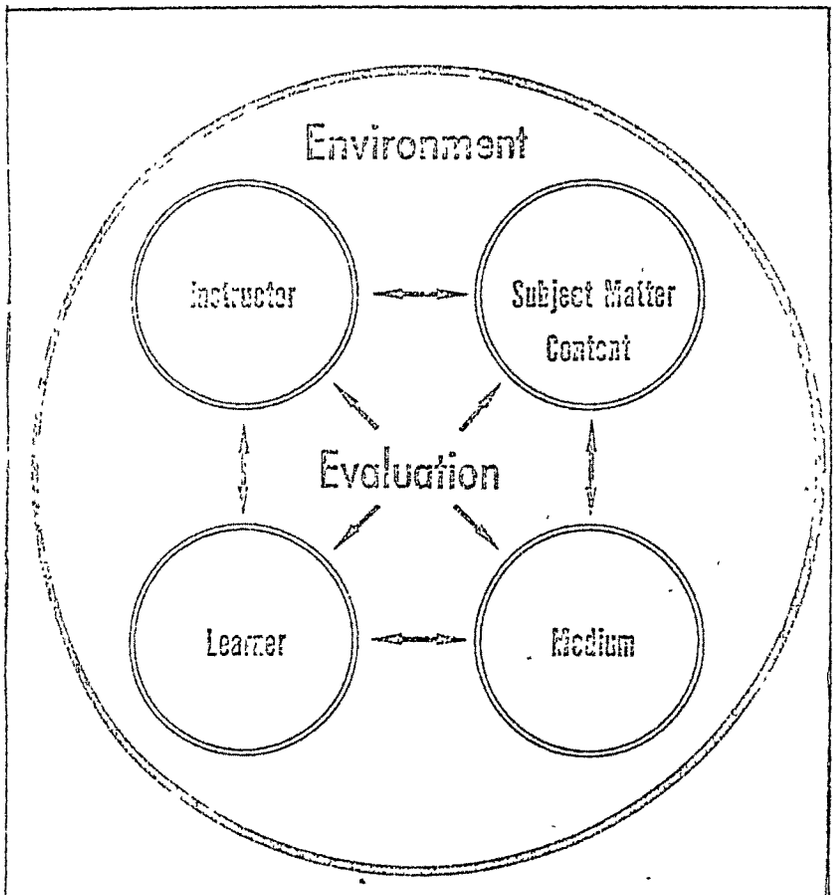


FIG. 3-6 THE INSTRUCTIONAL SYSTEM
(KOZMA-1978)

of the elements. Identification of components of a system is important. Obvious are the instructor and the learner. Certain body of knowledge is given or presented through some form of media. Ultimately, some kind of evaluation takes place. Where does all of this activity occur? Inside a classroom or other learning situation and the macro-environment of the institution and the society at large. The instructional system, conceived by Kozma (1978) is shown in fig. 3.6 and these factors are represented therein, in a simple form. The subject matter is the message to be communicated, whether it be knowledge, values or some other thing. The medium is the means of communication; its function is to facilitate the transmission of the subject matter to the learner, and the student (learner) is the receiver of the message. The teacher (instructor) is the manager of the learning situation or the system who arranges the conditions of learning, selects the course content, and is the source of the message. Evaluation indicates effectiveness of the process. The environment supports the system. The interaction of these elements will vary, depending on the situation. However, there will be some commonality between this as well as other instructional systems.

3.9 The Skills Cycles Approach : Romiszowski - 1981

Facts are information, but learning and memorization of facts may involve certain specific cognitive skills. Concepts are in themselves a class of information, but the learning of a concept may require the use of certain cognitive skills. One has to rearrange his abilities, while acquiring new concepts and store it meaningfully, together with other related knowledge. The skill may be composed of several sub-skills, and one has to assimilate

and synthesise new concepts which require higher cognitive abilities.

Romiszowski (1981) defines knowledge as informaion stored in the learner's mind and is akin to the normal word 'know' that is commonly used. He defines skill, as physical or intellectual actions and reactions to ideas, things or people, which a person performs in a competent way in order to achieve a goal. In practising a skill, one utilizes certain items of knowledge that are stored in the mind. One uses perception-situation, problem, object-to gain new information which is combined with knowledge and one acts on the basis of planning decisions. Any skilled action may have four activities-perception, recall of prerequisite knowledge, planning and execution or performance, of the action.

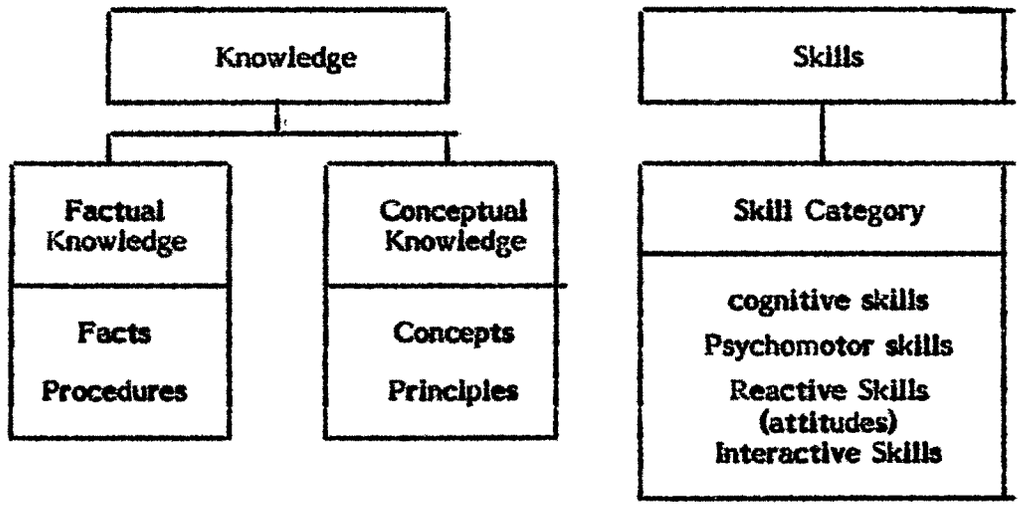


Fig. 3.7: Categories of teaching - Knowledge and skill :

Romiszowski - 1981

Wheatcroft (1973) outlines the cycles of skilled performance as composed of purpose, information processing or reception, perception, decision, action, and remedial action. Romiszowski (1981) simplified the above cycle and refers simply to perception (of others or of self), decision (how to react), action (reaction, interaction) and finally, evaluation (involving modification). He is of opinion that there should be as much need for the selective possessing of sensory information as much for observation. The fig.3.8 represents schematically cycle of physical skill performance. The diagram, states, Romiszowski is an attempt to represent schematically the process of skilled activity. They are three cycles, the top one represents the man (doer) who performs the skilled activity the bottom one is the situation (job and environment) that is, the object, equipment, or system that is being operated, together with its immediate environment. The two sausages-like links are the extensions of man on the left, his senses including any technological aids to his senses such as instruments, meters, and on the right, his limbs, and any tools he may use. The information is collected by the senses about the situation, perception selects the information relevant to the purpose, planning in which the information is perceived and the purpose are compared with previously stored knowledge, in order to generate and evaluate (internally) alternatives for action; decisions as to the chosen action are fed to the limbs; actions are executed and these procedure results, which act as new information to be collected, perceived, and evaluated. The extra element included here is the planning stage. This is an internal process taking place to giving rise to the decisions on what action to take. The planning may include conscious level decisions on composition of the components of the job, sequence of operations to adopt, etc., or it may be unconscious and almost non-existent, as in the case of repetitive high-speed tasks on a mass-pro-

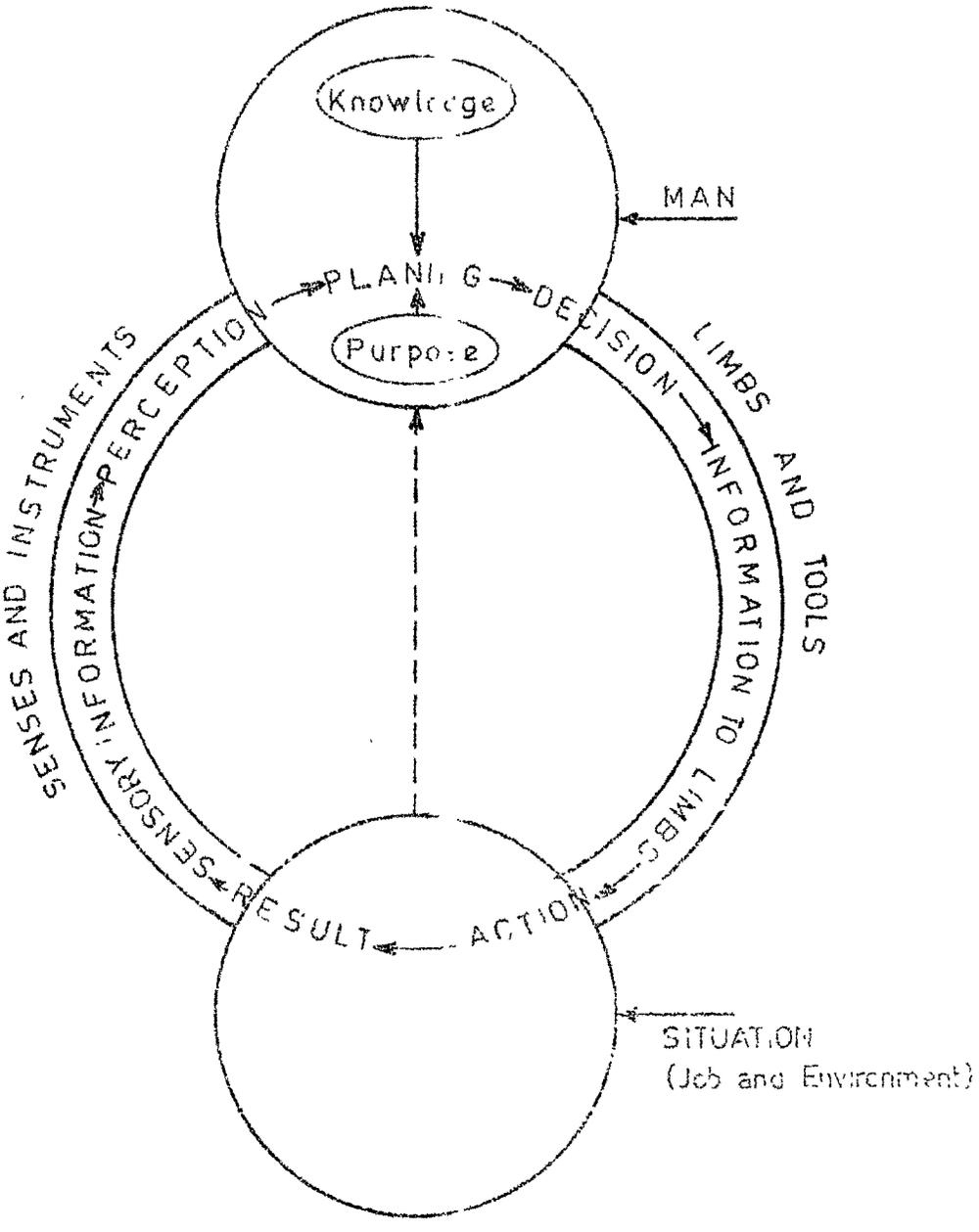


Figure 3.8 THE SKILL CYCLE [ROMISZOWSKI 1981]

duction line. The skill in such tasks lies in the perspcetive activity, manual dexterity and speed of reaction and stamina developed by the operator. The planning element may be complex, yet executed at the subconscious level - a skilled driver coping with heavy, fast and erratic traffic. It is this sub-conscious element of complex nature of the planning element which is the most difficult to pin point and analyse in practice. Skills can be divided into two, simple skills requiring very little planning, and those requiring intensive planning involving complex decisions making at the conscious or sub-conscious stage. Instructional skills for these two categories will be different. Romiszowski says, that for this reason, it may be useful, to make the distinction as part of one's methodology of instructional design.

Individuals differ in the quantity of knowledge that they possess. Skill is the ability to perform. It usually depends on the possession of specific knowledge, and the ability to place them at the perceptual and performance level of development. Individuals always differ when they apply knowledge to practical tasks. So there is always a necessity to provide for the self-learning situations, and practising of skills depending on the individual ability, if learning has to be successful. It is this fact, that has been taken into consideration, in designing the model for skill learning and the experimental multi-media package.

3.10 Other Teaching Models

3.10.1 Socratic closed loop system

The socratic closed loop system, is reported by N.V. Philips' Gloeil-ampenfabrieken - fig.3.9 as the oldest form of teaching and known nowadays

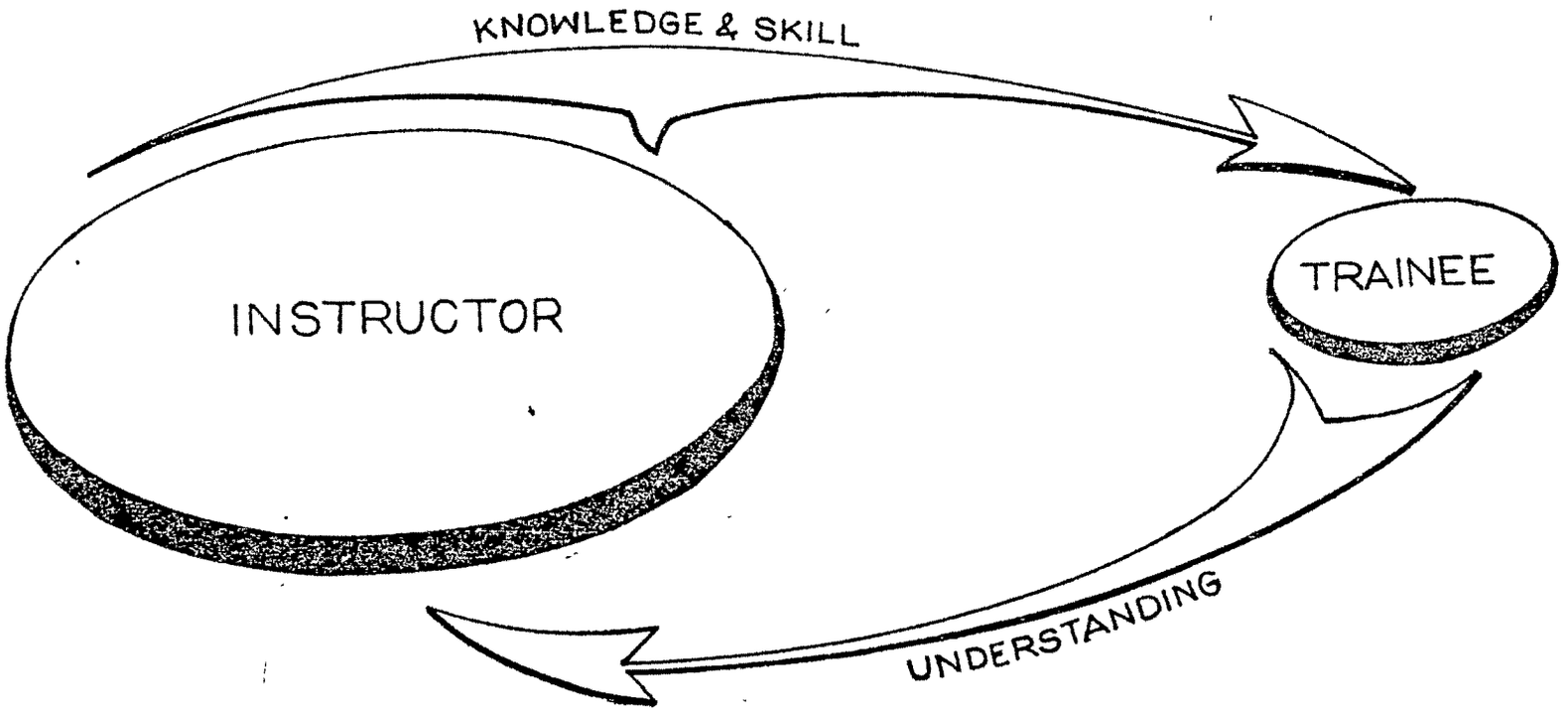


Fig. No. 3.9 CLOSED - LOOP SYSTEM

as tutorial instruction. The tutor and student investigate and test the practicability of a subject by means of discussion and logical disputation. Teaching aids, other than text books and blackboard are not normally used. Tutor and student communicate directly with each other and by their constant exchanges of ideas and reasoning, subject knowledge is transferred from tutor to student and subject comprehension is fed back to the tutor. The tutor is constantly in touch with the student, and is aware of how well the student is progressing, he is able to assess the degree of understanding and adjust teaching method. The tutorial system, is thus closed-loop system in which feedback is given at every point. Both teacher and student know when, and when not, their message has been received and understood. Knowledge of results is immediate and mistakes can be rectified at once.

3.10.2 Open ended system

With the shortage of qualified teachers, and increase in the number of students in each class led to the widespread introduction of audio-visual learning aids. These aids made it possible the ability of instruction to reach wider and bigger audiences from a single source. Whether we use these aids or not, inevitably some of the students in the class will be neglected either because the teaching source is remote or there is no time for individualised attention. How then can a teacher know, whether some of his students have not understood? His interpretations may be excellent, but at a totally inappropriate level for most of his students. This lack of student-to-teacher communication is the dominent feature of an open-ended system, (Fig.3.10) and unless some rapid and efficient feedback from every student is used, the teacher can never readily assess the subject comprehension rate

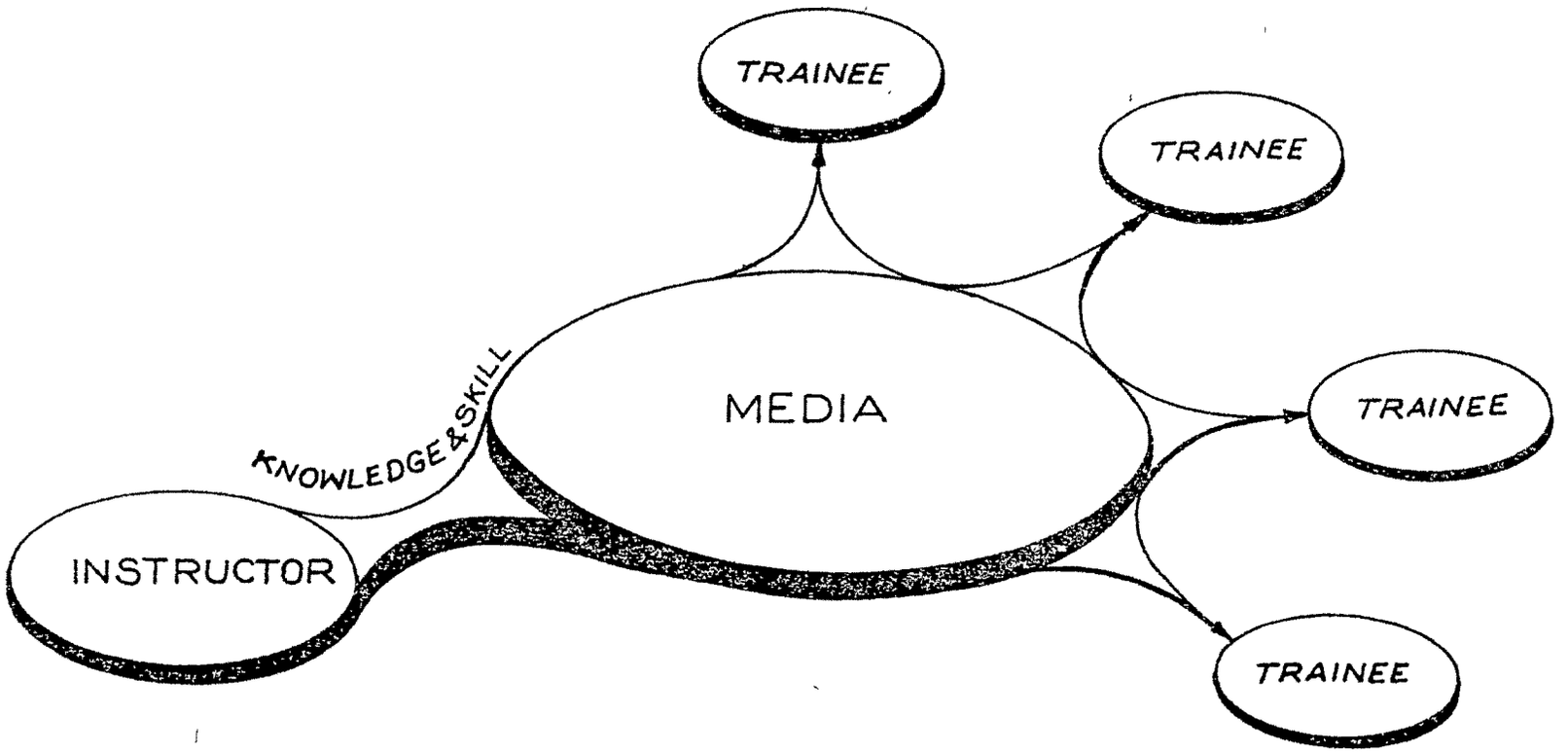


Fig No.3.10 OPEN-ENDED SYSTEM

of his students, either individually or as an entire class.

3.10.3 The feedback system

One may argue that written examinations may serve as student feedback. It can be indication of the comprehensiveness of both the individual student and the class as a whole. But this method cannot be caried out too frequently in actual practice. It may be applied at half-term or mid-half-term. Rectification of mistakes should be done immediately, and not even a little late weeks or months later. The alternative is to allow each student to respond during the session. This calls for elaborate preparation of workbook, and evaluation procedures, which has to be done not by the classroom instructor, but some other agency or team, who may not have the regular teaching load. The remedy therefore is to design instructional systems with individual responses and to provide individual feedback and an accurate evaluation of how well the class, as a whole has understood the particular subject. The fig. 3.11 describes stimulus-response-feedback remedy system. Thus the open ended system can be made into an ideal close loop system. The investigator has tried to develop means of immediate feedback from every student, in the slide tape presentations, every ten minutes, by providing a workbook, and then communicating the correct responses to the stimuli presented.

3.11 Skill Development

3.11.1 Individual learning model

The word model has been used here without a formal definition.

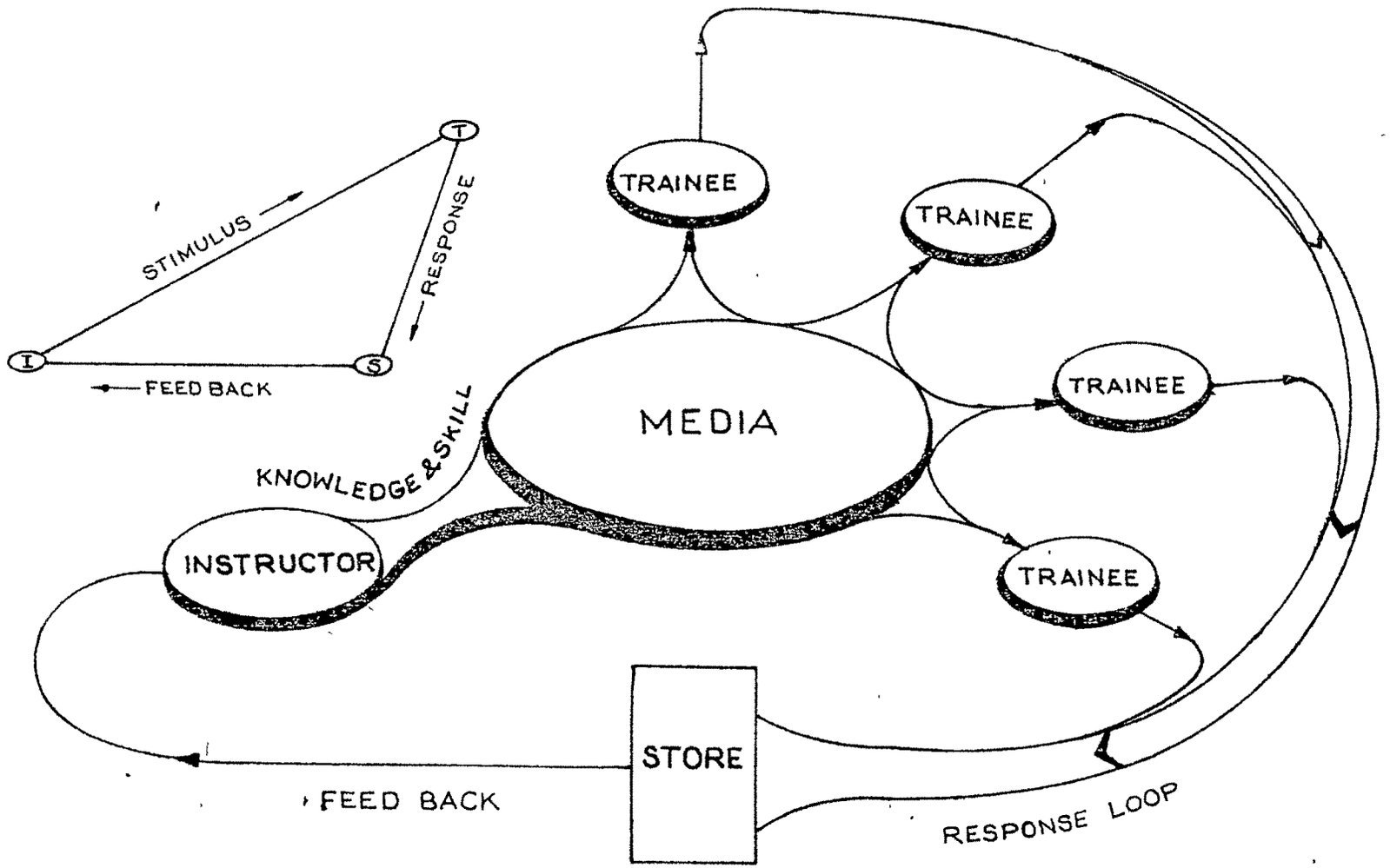


Fig.No.3.11 THE FEEDBACK SYSTEM

A model is a suggested way to do or perform work, and it provides some guidelines. It is a flexible model, but is consistent in its approach. Much of present curriculum, especially in vocational training is based on tradition. There are still technocrats and educators who think that there is nothing special about learning and instruction, and only content or subject matter being taught is all that is necessary and knowledge on the content is sufficient. While knowledge on the content is essential and the first requirement, it is not sufficient. There exists different models that may differ mostly in vocabulary and minute details. It is rare to find models that integrate knowledge and skill with the solutions for the constraints in the practising of skills and perfection of the same, and evaluating the skill development. Most models emphasize only the cognitive development. Jooyce and Weil (1972) while summarising various models for the design of teaching, emphasizes on the social and effective domain and treat cognitive development of the individual as an adjunct. There is no emphasis in these models to create structured situations by the teacher to create student's motor abilities. Many models, show the return of the feedback loop to all other components such as defining purposes of the system, generating alternate strategies, selecting the strategy and try out. We cannot allow to recycle many a time, to optimize the results of instruction because of the huge resource of time and money spent on such a process. It is not possible to apply systems approach in its true sense to the design and implementation of instruction. The word systems, as used hereinafter for the purpose of this model, refers to a systematic approach to the design of instruction. This approach is proposed only when instruction is the chosen solution to an educational and training problem.

3.11.2 Nature of skill development

Skills in the psychomotor domain are either highly conceptual or highly manipulative. Eitherway, it does not exist alone as skills in the motor domain. There are three phases in the skill development and these are considered generally by the International Labour Organisation (1973) as cognitive, organizing and perfecting. In acquiring a complex skill, the learner passes through three phases, and each phase overlap on the other and are not distinct. The transformation is gradual, and progress gradually from one stage to the next. In the cognitive phase of the skill development, the learner conceptualises the skill he is to perform. At this stage, the learner is presented with verbal analysis of the contents, relative theory and the processes involved, the why, the how, and the what of the performance. Procedures can be given through a lecture, or any other medium. Depending on the nature of the skill this phase may involve self-learning through textual material, sound-slide, film, audio instruction, or a live demonstration by the instructor. This phase stresses the mastery of cognitive abilities. In the organising phase, emphasis is on the actual development of the skill. The learning of skill is a chaining process, and the learner starts with the basics first. Higher up in the ladder, the learner tries to organise the chains into an overall pattern. The time for this stage varies depending upon the complexity of the skills for different skills, and lasts until the skill becomes automatic to the learner. The last phase - perfecting - in skill learning involves continuous and gradual improvement of the skill. In this phase the learner increases his resistance to stress and to the interference of outside activities which he is able to perform at the same time. Many skills take several years for perfection.

3.11.3 Conditions of skill development

The International Labour Organisation (1973) has described contiguity, practice and feedback, as the most important conditions for skill development. Contiguity is defined as the simultaneous occurence of the stimulus and the response. Practice is the second and most important condition. It is the repetition of a response in the presence of a stimulus. Practice is a way of rehearsing particular tasks or sub-tasks so that they are performed in the proper sequence and with appropriate timing; preventing the overlooking or forgetting of the sub-tasks; and developing the skill to the autonomous stage of learning. Nolker and Schoenfeldt (1980) points out that effective conditions of practice calls for a motivated learner; dividing the skill into identifiable sub-skills (small elements), practice under realistic or simulated conditions; providing appropriate guidance, immediate knowledge of results and systematic reinforcement.

The third basic condition for skill development, is feedback. Feedback can be divided into two, intrinisic and extrinsic. Intrinsic feedback is the one, the learner obtains through his own actions, while extrinsic feedback is the information he gets from outside , including his instructor about the effectiveness of his actions. Though intrinsic feedback helps highly motivated learners at a later stage, external feedback, it is argued is very important in the early stages of skill development (Nolker and Schoenfeldt, 1980).

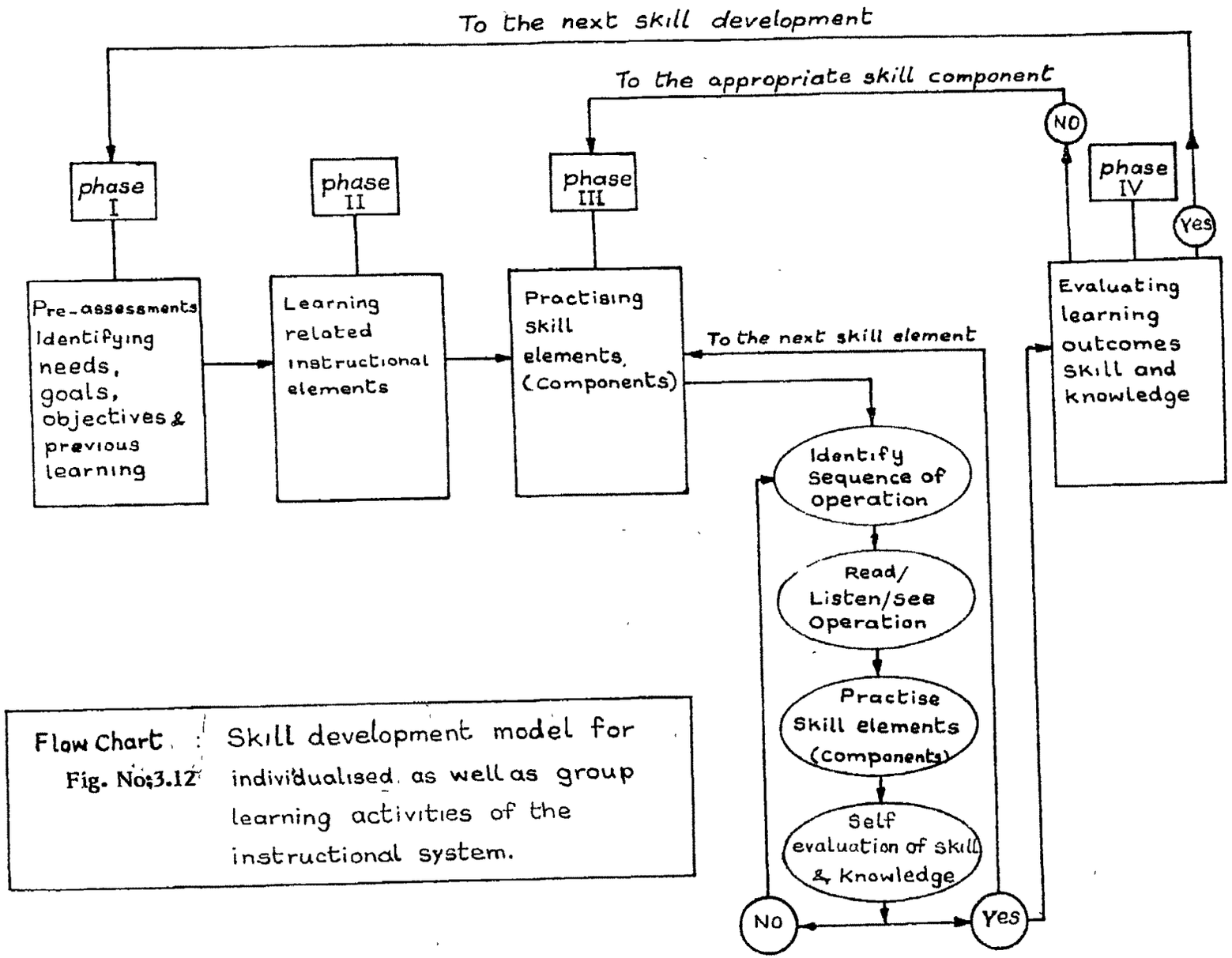
3.11.4 Principles of Skill Development

The instructional principles of developing skills include analysing

the skill in relation to the learner's abilities and level, arrange for appropriate practice, guiding initial responses, correcting inadequate responses (self-correction in the initial stages) and developing independent evaluation capability in the learner, demonstration of the correct response, if and when required and establishing feedback procedures. Step wise, the first step required in developing any skill will be analysing the skill required in terms of stimulus and response units and chains, or in terms of a hierarchy of pattern of chains. The next step is to assess the level of the learner. The third step will be to facilitate appropriate practice to the learner of the various components of the skill. The next step, requires the learner to correct himself, either based on a self-learning instructional material, preferably film or any other visual medium or see the demonstration done by the instructor, or other experienced person. The final step is the provision of basic conditions for skill development, contiguity, practice and feedback. With this background information of the fundamentals of skill development it is proposed to present the model for individualised skill development.

3.11.5 Flow charts for skill development

A model for skill development for individualised and group learning activities is presented in the flow chart fig.3.12. There are four phases in the system, and these four phases are, phase I: pre-assessment, identification of needs, goals (fig.3.13); phase II: Learning related instructional elements (fig.3.14); phase III: Practicing skill elements - components - (fig.3.15) and phase IV: Evaluating the learning outcome-skill and knowledge (fig.3.16).



Flow Chart Fig. No:3.12 : Skill development model for individualised as well as group learning activities of the instructional system.

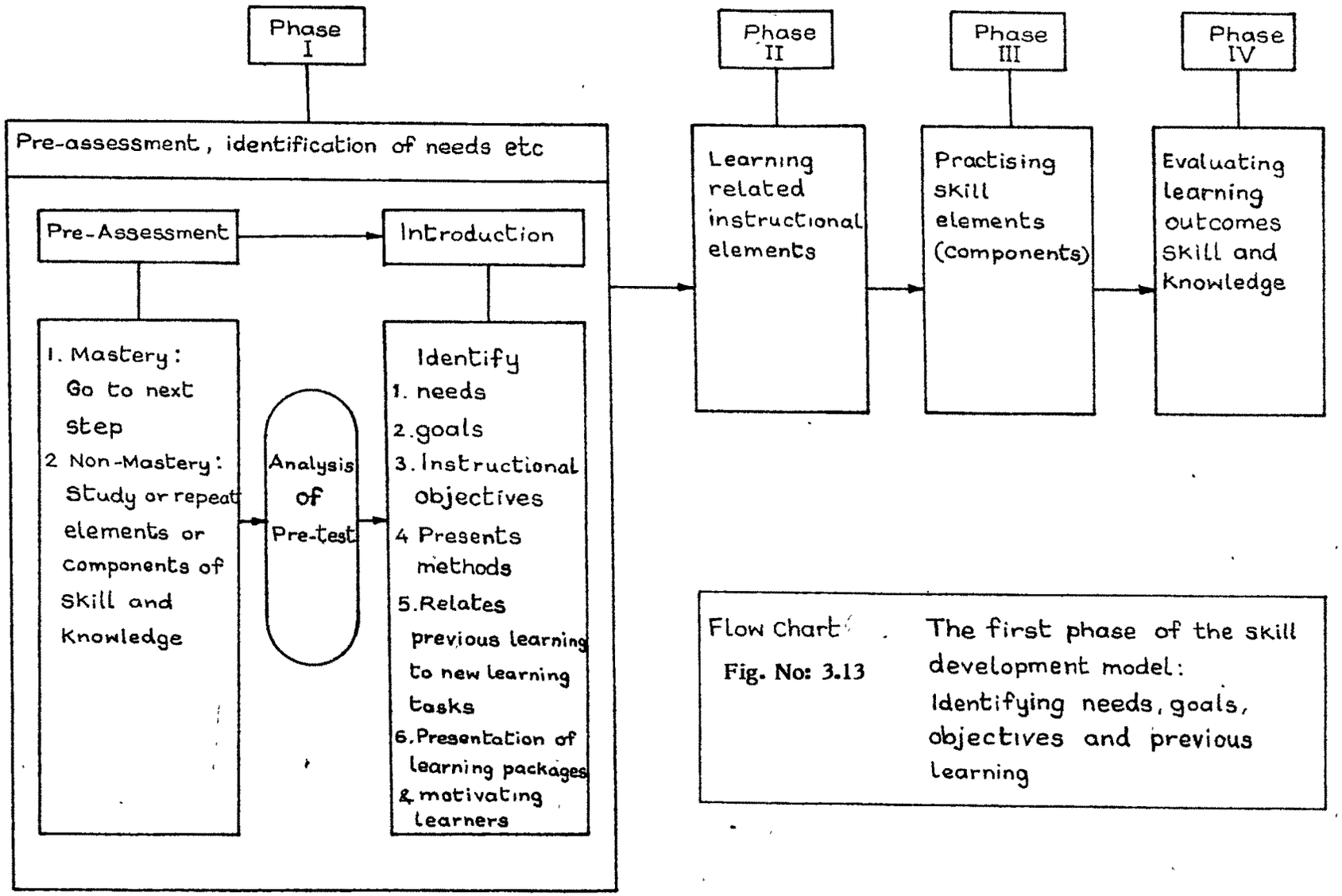
The basic assumption has been, that the skills be it, highly manipulative or highly conceptual, it is necessary to provide cognitive ability for successful attainment of the desired performance standards. It is also the considered opinion, of the investigator that skills can be learned through self study at the initial stages, and later expertise can be acquired during apprenticeship.

3.12 Instructional Procedures

3.12.1 Pre-assessment and identification of goals - Phase I

Phase I is divided into two stages, stage 1, for pre-assessment and stage 2 for identification of needs, goals etc. When an educational and training goal has been set, and when the indications are that the goal is not now being met, or is not being met well, a need has been identified. In the pre-assessment stage, if the trainees are found to have no need for the proposed study, as assessed by the pre-test scores of expected final achievement, then there is no necessity to give training wholly or in the elements or components of the skills and knowledge. Analyses of the pre-test will indicate the actual needs, and if new or modified goals are needed, they are stated, the goal is further analysed to spell out in detail the exact instructional objectives needed to reach the goal. Thereafter the instructional strategy is designed and supporting instructional materials are developed. Only educational and training goals can be met by instruction, others may be met by other means.

In the case of new skills of complex nature, calling for previous knowledge of skills and related instruction, the learners are divided into two



Flow Chart

Fig. No: 3.13

The first phase of the skill development model: Identifying needs, goals, objectives and previous learning

categories, the mastery and the non mastery group. Those who are in the mastery group are allowed to go to the next step, while the non-mastery groups are separated for studying pre-requisites for further learning.

Instructional objectives are stated, once learning goals are identified either by a job analysis or by a consensus process (discussion amongst the instructional developers). The work actually involves stating in broader terms the course over view, then the broad or general objectives and then specific performance objectives are stated working from top downwards. The next step involved is relate objectives to previous objectives (new learning and previous learning), and the sequencing of instruction. Performance objective is a component in the instructional systems approach to the design of instruction whether it is a multi-media package or other strategy. Thus, based on a formal needs assessment , a set of needs are identified, and placed in priority. On the prioritised needs, goals are stated; these goals are translated into more specific terminal behaviours and specific performance objectives are stated, which will help to plan the instruction, to help define the resource needed for the learning package, prepare and conduct instruction. They help media selection, materials required and all activities, including evaluation. The prevailing logic of instructional system design suggests that students provided with performance objectives should demonstrate superior learning to those not provided with objectives (Briggs, 1977). The next step is the task classification into categories of abilities and its subordinate categories. It is necessary to insure efficient learning, and selection of methods and media is very important at this stage. When considering the types of performance, it is essential to relate it with teaching methods. There is no one best teaching method. Different methods enjoy varying degrees of effectiveness depending upon objective, background, the previous learning

of the learner and the attitude of the learner. A variety of methods may be employed to reach different goals. It may be a sequential combination or simultaneous combination of different methods. Several types of obejctives may require several types of methods, and a variety of methods means a variety of stimuli to the learner. Variety of stimuli in turn will mean a similar variety of responses. This variety assists the learning process; it generates interests, motivates, and maintains learners continued interest at the higher point than it would be, if only one type of stimulus were applied again and again (Rowntree, 1981).

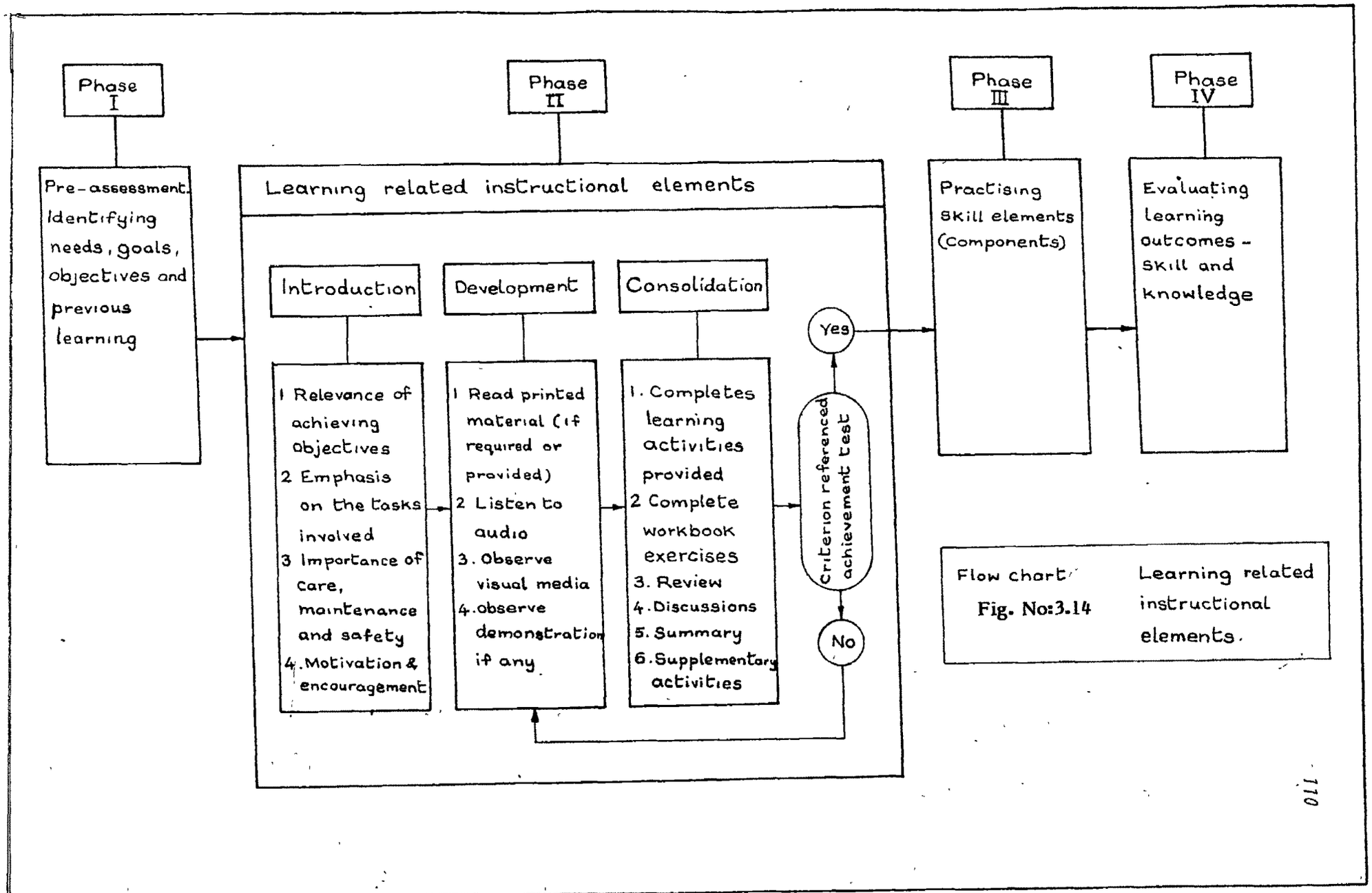
A learning task analysis pertaining to both the present conditions for learning and to the prior effects of learning is called for at this stage. It is necessary to recall previous learning, and this is possible only if what has been learned has been stored as a part of long-term memory, as a result of previous learning. The task analysis has considerable importance for the design of instruction. Analysis of the objectives yield as products, information on tasks to be learned, classification of the objectives, and an indication of essential and supportive prerequisites.

Learning occurs through internal processes. An individual responds to a stimuli in a variety of ways-with his hands, his head, his voice, his smell, etc. Irrespective of the specific content of the objective, rules can be applied to each category which identify those external conditions that will best support the internal processes of learning (Gagne, 1976). One kind of supportive learning condition is itself an internal one. It consists of the already existing contents of memory, that have been established by prior learning. (The different conditions of learning, was in fact related to the

principles of learning, and this is given in the next chapter, while desribing the development of the multi-media package.)

3.12.2 Learning related instructional materials - Phase II

Unlike the regular educational course, where mostly cognitive skills only are taught, in the present course on Audio Visual Education, not only knowledge and knowledge oriented skills (or intellectual skills as classified by Briggs, 1977), but motor skills are also involved. In other words, the instructor trainees learn related information on the pertinent motor skill. This stage of phase II is further divided into three steps: introduction, development and consolidation. Fig.3.14 shows the phase II. In the introduction stage, the learner is informed of the importance of achieving, the major instructional objectives, emphasis is given on the tasks involved and the importance of care, maintenance and safety. Encouragement is offered in learning the particular learning element and the tasks. In the next step, that is the development step, the learners acquire basic concepts of the pertinent skill from the self-instructional materials, and if found necessary take fieldstrips i.e., to real situations where the learners themselves discuss the problems and solve themselves. In the consolidation step, the learning activities are provided to consolidate the elements learned, at suitable intervals. In some of the elements, built in workbook exercises are provided and the answers are confirmed by audio or visual or both to the different questions. In some other elements, one can achieve the cognitive learning, by taking to different activities suggested in the learning elements, and this can be easily built into any learning system. At this stage, the learner is expected to self-evaluate the learning. He will be required to complete



Flow chart Learning related instructional elements.

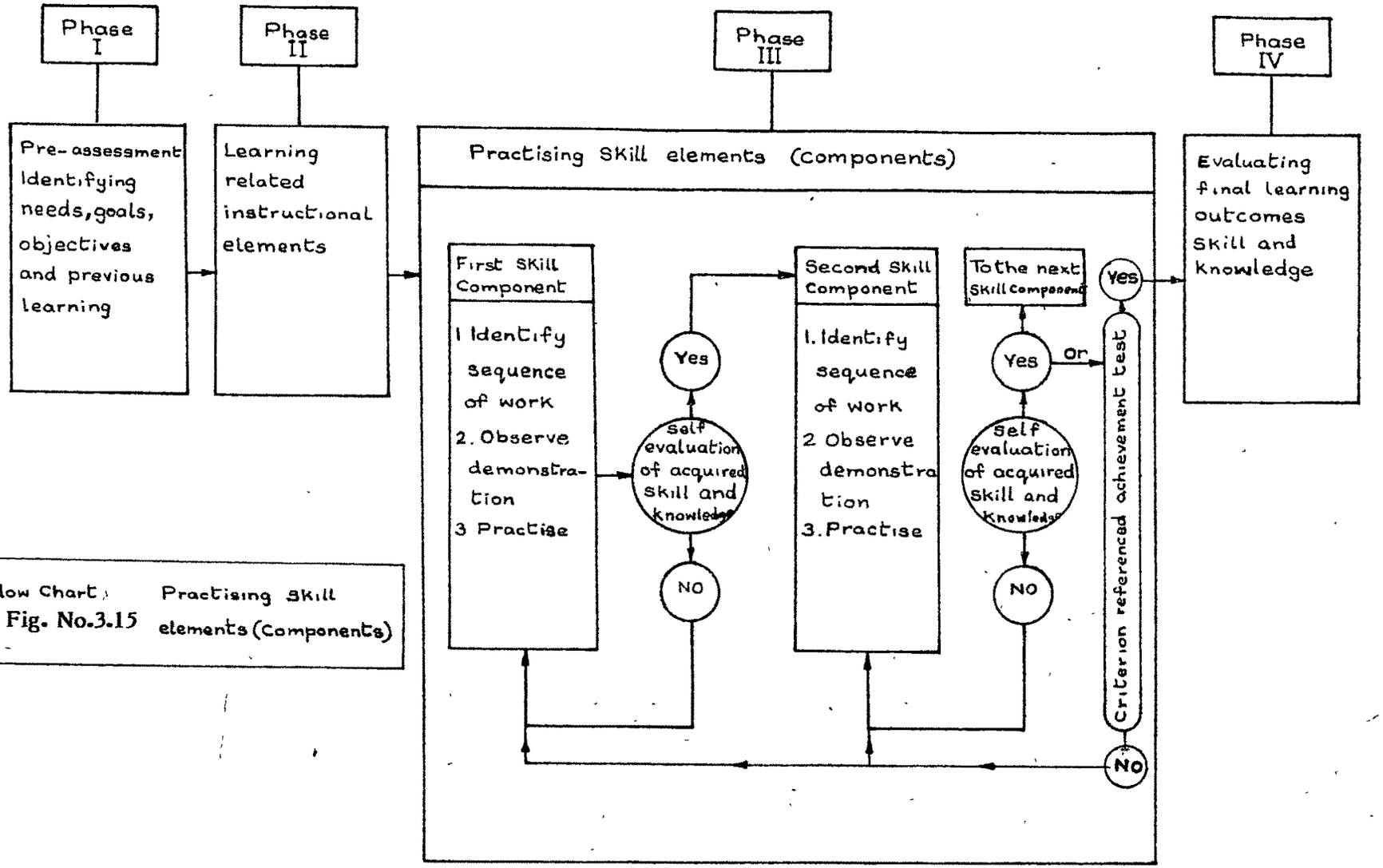
Fig. No:3.14

the learning activities, take the key to different quizzes and evaluate himself, and if need be, repeat the performance. The skill component is described in the next para. Result of assessment test on related information (performance check list) taken by each learner can be discussed, reviewed, and based on the results, the learners are classified into mastery and non-mastery, that is those who achieved complete mastery and non-mastery. Those who achieve complete mastery of the task, in the performance checklists given for the exercise, can be allowed to proceed to the next stage of practising the skills, and others to go back to the development step, to repeat the performance.

3.12.3 Practising skill elements - Phase III

The third stage of the model is practising skill elements, that is the components of the complex skills, is shown in fig.3.15. Usually a basic skill consists of several skill components. Learners, learn the first skill component according to the procedures described, and then proceed to the next.

As stated earlier in para 3.12.2, students are provided with practical exercise sheets. They are also provided with the correct performance checklists. The related information provided for each learning element explains the procedure for doing the exercise. After learning the correct procedure, the learner is expected to fill in the correct procedure, in the performance checklist. After mastery of the procedure, he practises the pertinent skill component with tools and materials according to the procedure specified. Learners evaluate themselves their performance from the correct checklist



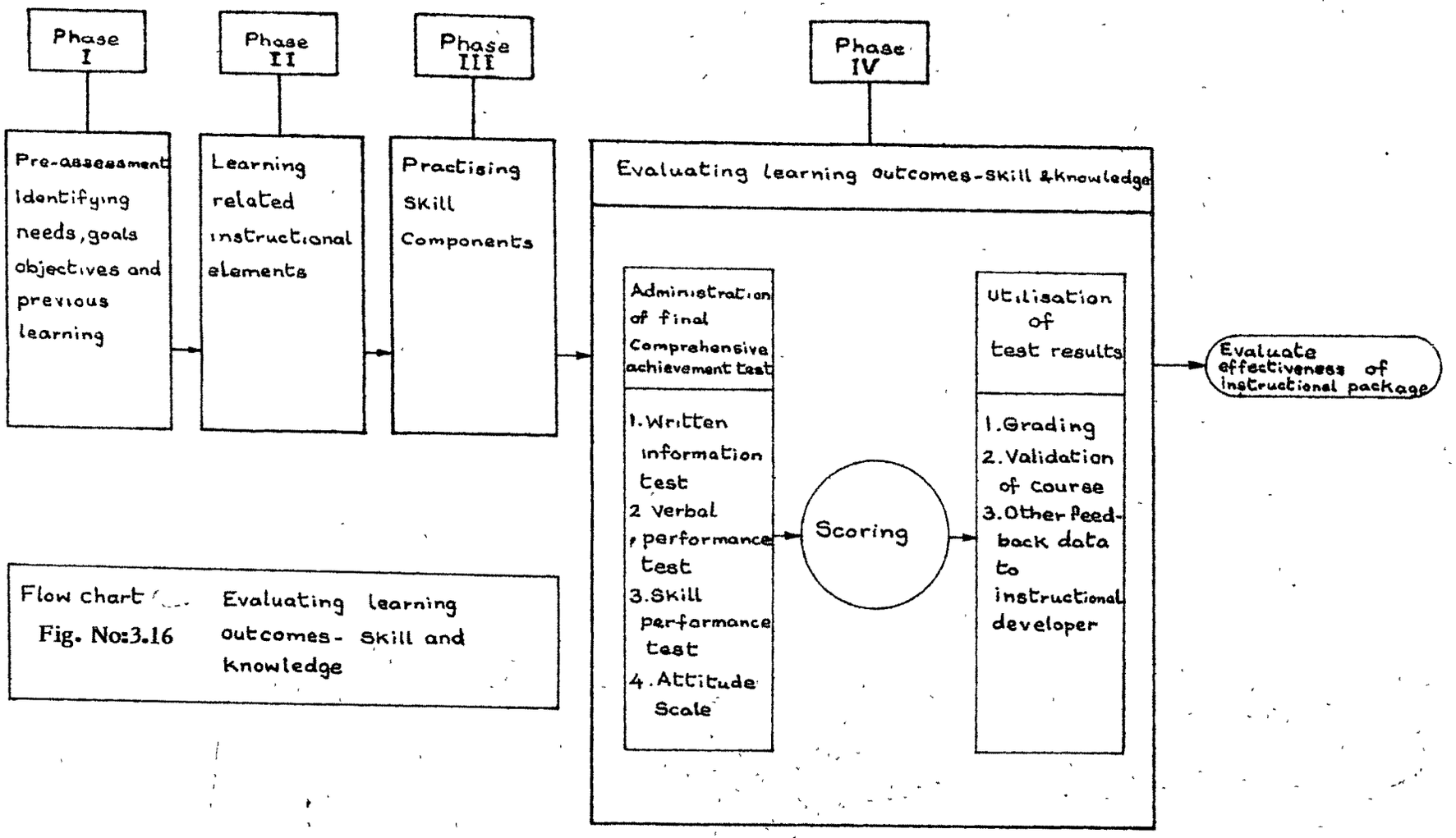
Flow Chart Practising Skill elements (Components)

Fig. No.3.15

provided. Learners whose results, as per their self-evaluation do not reach the mastery level are supposed to continue practising the same skill element until they reach the level specified in the exercise. Those who have reached the criterion level go to the next skill element and those who have not, are to master the skill. This attempt to mastery level performance is suggested for skill performance, as in the skill performance, either one can do the skill well, or not do the skill. There is no question of doing a particular photograph, 50% well, and demand to the client, the price for the same. Through these procedures, the learners acquire the whole basic skill. In actual practice, the skill can be perfected only by continued practice.

3.12.4 Evaluating learning outcomes-skill and knowledge - Phase IV

The fourth and final phase of the model is evaluating the learners' final performance. Fig.3.16 illustrates this phase. A number of learning elements (units) are combined to form a module. Administration of tests are proposed at the end of each module, each objective having a test item. If a number of modules are taken, a comprehensive test must be given on selected objectives, at the end. The tests, are categorised as written for knowledge and performance tests for skill components. The model also proposes a verbal performance test. This may be introduced at the discretion of the instructor, before the practical skill performance test, on identification of the components of the equipment. Though this has been built into the written test, through pictures, some of the subject matter experts, in the skill training field are of opinion, that identifying on a figure and on a real machine are two different things. However this is subject to differing opinions among different people, whom the investigator consulted. At the end of



Flow chart ... Evaluating learning outcomes- Skill and Knowledge

Fig. No:3.16

the course, if it is a single module, at the end of the module, the learner is graded on the performance of the final achievement test. The result of the evaluation on the module and also the course, provide necessary feedback for finding the effectiveness of the instruction.

Designing a course is not the end of the matter. Constant validation of the course is required. The information from such validation can be fed into the system so that necessary changes if any required can be made on the structure of the course.

This chapter has thus described a convincing rationale for the study and a model for skill learning.

The chapter began with instructional system for vocational training, the growth of the system from the traditional system to the present day model of Kozma, Briggs and Romiszowski. The components of the instructional system was then discussed. Then discussions centered on a proposed model for individualised skill development. The fundamental concepts discussed for the development of the model are: phases of skill development, conditions which determine the development of skills, and the principles of skill development. This chapter provides a conceptual model for the development of the multi-media self-learning modular packages for individual skill learning. The next chapter, describes the development of the multi-media packages.