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A Brief Study of Programmed Learning and its utility in Science

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Abstract: Programmed learning is a set of principles and techniques for designing effective learning situations. A programme is a mean of ensuring that students achieve the intended objectives which is accomplished by carrying out analysis of set objectives and the learning tasks. In the present study, the models of programmed learning and the leading concepts of programmed learning are taken in sight along with the development of programmed learning science in the developing countries. This descriptive study is carried out through the research based on information from articles, web-based journals and websites to understand the utility and progress of programmed learning in science.

Keywords: Programmed learning, Teaching, Learning process, Learning material, Curriculum, Feedback, Evaluation etc.

Introduction:

The contribution of programmed learning in education is evident from a number of ways. It has kept attention on various critical aspects of learning situations such as emphasis on learner centred learning and need for student activities along with the importance of feedback and objectives. The acceptance of the thinking of systems like objectives of system, analysis of substructures and their relationship, internal modifications and evaluation along with system evaluation has been promoted with the help of programmed learning. The impact of programmed learning can be observed from teacher training to micro and macro levels of innovation. But the image of programmed learning encouraged initially has confounded to a large extent by the penetration of its concepts in wider fields of educational thinking. Also the recognition of programmed learning is made difficult by the changes occurred in preparation and presentation techniques. The measurement of success of the programmed learning can be achieved by the degree upto which it is absorbed in the general framework of educational practices and policies. This is self contradictory as it has lost its identity as it becomes one in the many educational media and methods. Programmed learning is a set of meta principles for

selecting, developing, organizing, modifying and evaluating more specific techniques, approaches, methods and media. This is unlike project method, audio-visual hardware and television. So, such influence and assimilation is inevitable.

It is a fact that programmed learning may be thought of as an instructional method, a set of techniques, a philosophy, a medium and a methodology of system. They can lead to uncertainty when the introduction or effectiveness is considered and evaluated. There are many motives for introducing and using the programmed learning such as to individualize learning, overcoming the shortage of teachers, enhancing effectiveness of learning, improving the teacher training (both pre and in service training), providing models of methods of teaching, introducing a specific curriculum reform, helping in reorganization of teaching, to initiate the approach of system, acting as a tool of research in educational investigations.[1]

Programmed learning was defined by a set of characteristics and principles which are as follow:

1. It involves active responding from the learner.
2. It consists of a progressive and logically ordered sequence of small steps.
3. The construction of materials for programmed learning is governed by analysis of objectives which are formulated in operational terms.
4. Learner should be proceeding at his own pace.
5. The knowledge of correctness of responses is immediately received by the students.
6. During responding, students make few errors and the programme is modified.

All of these principles are considered invalid now and many programmers show a suspicion disregard of these pricnciples. The new characteristics of programmed learning are taken into account which are:

1. Objective formulation and criteria for successful achievement.
2. Task analysis and design of learning situation.
3. Validation of learning situation and instruments for evaluation.[2]

Objectives:

The objective of the study is to understand the programmed learning. The models and leading concepts in programmed learning along with understanding of co-operative learning are to be taken insight. The objective of this study is to seek the utility of programmed learning in science education.

Method and Materials:

This study is descriptive in nature and it is based on the knowledge from various secondary sources available on web. The data is collected from various articles, websites and journals published at different times.

Results and Discussion:

- **Models of programmed learning:**

There are four models of programmed learning. The first and earliest of them was 'adjunct' method. This method insisted on frequent diagnostic tests with immediate feedback or results. The instructions accompanied by the corrective feedback. The background concept of adjunct is Thorndike's connexionism. It is presented in the form of prints and lectures with normal teaching. The accommodation of individual differences is not a part of this method. 'Branching' or 'Intrinsic' programmed instructions provide the set of rules for constructing programmes.[3] It provides corrections followed after remedial sequence and it provides way to skip a section if not required. The background concept of branching is eclectic. The scrambled text is the mode of presentation. The branching programme cannot deal with some tasks but they are moderately easy to prepare. 'Extrinsic' or 'Linear' programmes are based on particular accounts of learning and they include many prescriptions for shaping, extracting and reinforcing responses.[4] They are based on operant conditioning. The 4th model is 'Mathetics' shares a behaviouristic analysis of learning with linear programming but it develops a radical approach to construct a system learning.[5] Mathetics has different set of rules as in this the unit of learning is operant. Mathetics is used in industrial training as its aim is to provide mastery of any complex task to the learner.

- **Leading concepts in programmed learning:**

The leading concepts in programmed learning are mastery learning, criterion-referenced evaluation, learning hierarchies, taxonomy of learning, task analysis and feedback and objectives.

1. *Mastery learning:* Mathetics is clear about the goals of mastery. The other methods such as the 90-90 criterion have emphasized on the attainment of high level performance. But the use of unit tests, remedial branching, criterion frames and the procedure to validate has attempted to ensure the mastery. In mastery learning no student proceeds to next instructional unit till he masters the previous one and it happens when programming is released from a particular constraint.[6,7]
2. *Criterion-referenced evaluation:* The present distinction of criterion and norm referenced tests has come from programmed learning. The diagnostic and remedial tests designed by Schonell shadows the notion of designing individual remedial teaching pattern. Meanwhile the criterion referenced tests indicate the results of mastery achieved or not and the norm referenced test ranks the students based on the merit. The emphasis now changed towards the diagnosis means analysis of the subordinate tasks and it insists the readiness training.[8]
3. *Learning hierarchies:* The evaluation of mastery learning is done through criterian referenced tests. This implies that to reach a terminal objective, one need to master the subordinate tasks in a particular order. This was elaborated by Gagne. It also has received a limited support from the research and it seems to be perfect for science education in which hierarchical arrangement of knowledge can be achieved. For example

the law of conservation of linear momentum which absorbs mass and velocity. While velocity reveals the concept of speed and direction and this process goes on.[9]

4. *Taxonomy of learning:* The levels of horizontal or vertical sequence of absorbed concepts in ideas of hierarchy are characterized by their position in a learning taxonomy. For example the concepts are integrated by a principle. Concepts are kind of abstractions which are formulated in the form of rules. Taxonomy of learning process is a guiding tool to construct the initial version of a learning programme with the specification of the type of knowledge and capacity required to get the content for a curriculum and for achieving the objectives. It determines the sequence of learning activities.
5. *Task analysis:* There is difference between the educational task analysis and subject matter analysis such as those in which programmed learning used to involve. The analysis attempts to link the terminal objectives with the involved structure of knowledge and capabilities. For example, a task analysis will specify particular kind of activity to provide the capability to generalize a scientific principle and makes it applicable to a new task.
6. *Feedback and objectives:* There are two kinds of feedbacks distinguished by programmed learning. One is the feedback for student means learner and other for the instructor or programmer. The feedback to the learner has two functions of providing him the correct way to proceed and give him reinforcement. Meanwhile the feedback for the instructor arises from the performance of the student or learner. The required modifications are done to the method of learning if many students get unsuccessful at the predetermined nodal points of the learning method. The faults in the process of learning activities are diagnosed through investigation of errors made by students. This assessment applies to progress checks and the effectiveness of the programme in achieving the objectives set.[10]

- **Programmed Learning and science education in developing countries:**

The use of programmed learning in the science education is evident from a number of curriculum development projects from Unesco. A lot of important lessons on programmed learning method are derived from the experiences in India, Egypt, Africa and some countries of south-eastern Asia. They present an overview of the problems and a number of approaches for them. Some attempts are also made to organise production, training, information services and experimentation in research and development centres.[11,12] But in some other cases, programmed learning has faced many crises as sometimes programming and curriculum reforms have gone together.[13]

It was found in a report that programmed learning methodology was unable to accommodate in the existing system of teaching science and mathematics. It was mainly due to toughness of implementing the new role of teacher as a manager of learning resources rather than focal authority.[3,14]

In India, there is a different prospective as there were well established association for programmed learning and many university centres for training and research programmes. There are serious attempts being made to adapt methods and inventing new techniques for matching the local bodies. An example of that is the introduction of television teaching in 1966.[15] The programmes were presented on roller blackboards and orally to whole class. It was found good

to be used similar to a single programme use. In health fields, several programmes are constructed from a sequence of images to teach the illiterate adults. The group interaction has played important part in such activities. The introduction of group study is also done for requiring groups to discuss and discover the solutions and provide answers to presented frames.[16]

The programmed learning is not tied to any approach or theory inspite of its development from particular viewpoints means it can be adapted to any system with any sort of background. But the existing weaknesses in the system are not allowing the one type programmed learning to adapt to the change in teaching system otherwise the benefits of programmed learning have been proved which involve a minimum change in teaching style.

Conclusion:

In summary, in order to give a prospective, a number of general points can be made about programmed learning. The first is that programmed learning is a general methodology for clarifying objectives, constructing learning material and situations with sequence and conducting overall and continuous evaluation. It is not an approach which can be an alternative to other methods. The second is that it is constantly improving and changing its techniques due to its pragmatic nature. The programmed learning is a dynamic system in which targets and objectives are analyzed and set. The learning situations are planned and developed. As in the science education a lot of curriculum development is done which is involving programmed learning and it can be analyzed from teacher training to micro and macro levels of teaching and research. The success of programmed learning of science in many developing countries may vary due to flexibility in approach to adapt to the specific characteristics of the students as well as to the style of schooling. That is why programmed learning seems to be time consuming process but it has made progress to adapt.

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