PROMOTING EXCELLENCE IN TECHNICAL EDUCATION THROUGH MASTERY LEARNING

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If one happens to analyse the process of learning, one is bound to come across a couple of variables which affect learningh-task variables, individual variables (the learner and the teacher both), Method variables and Environmental variables - To mention a few. With a view to making learning meaningful, efficient and effective, the teachers need to adopt suitable methods and techniques of teaching. By so doing, they try to create proper conditions for meaningful learning to occur in the learners. The choice of methods and techniques of teaching thus depend on -

1. the nature of the learning task(s),
2. the capability of the learners,
3. the size of the class,
4. the resources available,
5. the locations of learning (classroom, laboratory and workshop etc.), and
6. the time available.

In the broader context of technical education, among all other variables of learning, the nature of the learning task is of crucial importance. The major disciplines of knowl-edge and learning could be classified into two categories :

1. Natural Sciences - encompassing subjects like - mathematics, physics, chemistry and the like and

2. Social Sciences - covering subjects like arts, humanities, and languages.

Any kind of learning involves the following ingredients:

1. acquisition of knowledge & skills,
2. retention of what is acquired, and
3. transfer of wjat is acquired and retained to a new sityuation - application.

Keeping in view the above, teachers of mathematics and sciences have tended to sequence their teaching units linearly so that the material in each unit transfers directly to the next unit. Teachers of arts, humaninties and other social sciences have tended to sequence their units hierarchically so that the material in each unit transfers, but not

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necessarily to the next unit. It may transfer to a subsequent unit (Block, 1980).

The disciplines of Engineering and Technology are replete with applications of mathematical and scientific theories, principles and laws. Hence, these are regarded as applied sciences which by their very nature of content demand a different methodology of teaching and style of learning altogether. It is in this specific context, that the concept of Mastery learning as a strategy of teaching and learning assumes special significance. The disciplines of science and technology demand the attainment of mastery of basic concepts, principles, rules and relationships so as to enable the learners to apply them to find solutions to practical problems.

The paper discusses the concept of mastery learning. How it works (preconditions and procedures) and how well it works in the field of technical education.

Mastery Learning - a concept :

Mastery Learning is an effective set of individualized instructional practices that consistently help most students to learn excellently, whether the approach is group-based and teacher-paced (Block and Anderson, 1975) or individually based and student-paced (Keller and Sherman, 1974).
The assumption in mastery learning is that all the students can master a great deal of what they are taught in educational institutions if the ......"instruction is approached systematically, if students are helped when and where they have learning difficulties, if they are given sufficient time to achieve mastery, and if there is some clear criterian .of what constitutes mastery" (Bloom, 1974 and Bloom, 1976).

Benjamin S Bloom (1968), who is supposed to be the chief exponent of mastery learning concept, described a model whereby upwards of 90 percent of students in any grade could be expected to master the content taught in the class. Educational institutions operated on the assumption of the normal distribution of student achievement marks. Educationists went on teaching the "bell-shaped curve" as the "sanctioned" approach to marking. Bloom maintained that one expected things which occured at random or by chance to be distributed normally as a bell-shaped curve. Keeping in view, the amounts of money, time and effort put into the educational institutions by students, teachers, administrators, tax payers and the curriculum planners, it did not seem reasonable to expect student achievement to happen randomly or occuring by chance (West and Foster, 1976).

The concept of mastery came into being as a result of the input-output ratios observed by those concerned with educational activities. In other words, it was felt that the output in terms of student achievement should be commensurate with the amount of inputs pressed into service in the form of human efforts and material resources including time. The notion of mastery learning, which means that the attainment of a specified basic competency in any subject matter is within reach of virtually every student, becomes all the more important in the context of teaching and learning subjects pertaining to sciences and technology as the concepts learned in one unit transfer directly to the next unit. Yet another factor which goes in favour of mastery learning is the phenomena of individual differences among the students in any classroom or teaching learning situation.

Major Requirements :

Some of the major requirements of Bloom's mastery strategy involve -

*   the supplementation of regular instruction with frequent formative evaluation procedures to find out where individual students actually are.

*   A variety of alternative instructional methods and materials to try to bring as many students as possible upto predetermined standards of excellence.

A mastery strategy involves -

1. deciding what constitutes mastery for a given course of study.

2. what procedures are appropriate to use to obtain mastery, and

3. what evidence is to be accepted that mastery has been attained.

In other words, the steps mentioed above involve instructional objectives, instruction procedures and evaluation of learning outcomes.

How does the strategy function

Mastery learning is designed to be implemented where time allowed for learning is relatively fixed and where the size of the target student group. is fairly large. The strategy is aimed to minimize the time made available for a group of students to learn excellently. In order to make the strategy fully functional, the following two steeps need to be followed.

1. the precondiontions - these take place

outside the classroom as well as in advance of actual instruction; and

2. operating procedures - these occur inside the classroom and while the instruction is going on.

Preconditions for Mastery Learning :

The practising teacher adopting this approach is required to take certain steps which are as follows :

1. The teacher should define what content all students will be expected to learn i.e. stating the course objectives;

2. He should prepare a final or summative examination (Bloom, Hastings and Madaus, 1971) covering all the objectives, for the students to take towards the end of the course; and

3. The teacher should arrive at a summative examination score which is indicative of mastery. Students performing better than the standard set are graded as 'masters' and the others as 'non-masters'

The teachers of technical institutions might use their previous course achievement tests for guidance as to what each student is expected to master. Administration of one or more such tests throughout the course might be useful for grading purposes. Instead of grading students as masters/non-masters, it may be useful to fix an absolute grading scale where mastery may be indicated by grade A and non-mastery by grades B, C, D, or F.

Planning before teaching :

This is a stage where the teacher needs to

take certain steps before entering the class-room and embarking upon actual teaching. Some of the steps are as follows :

1. Breaking the course to be taught for mastery in to smaller learning units which correspond to chapters given in the text book or to a set of topics.

2. Sequencing the units already broken. As the teacher has broken the whole course into smaller units, it is time for him / her to rearrange these units into a whole. Sequencing could be logical, psychological or chronological as the case may be.

   Teachers of mathematics, science, engineering and technology should sequence their units in a linear fashion as the content of each unit transfers directly to the next unit. This is done, of necessity, in view of the fact that most of the basic concepts, principles, and laws form part of pre-requisites for the newer concepts, principles and laws to be taught.

3. For each unit, the unit feed back correction procedures are, then, developed. This is the most important component of this strategy. These procedures serve to monitor the effectiveness of the group based instructions as well as provide for the learning difficulties of some students.

With a view of meeting the crucial requirement mentioned above, the teacher is required to take the following steps.

1. The teacher should prepare a brief, ungraded diagnostic progress test which is also regarded as 'formative' evaluation test (Bloom, Hastings and Madaus, 1971) for each unit. These tests are meant to provide feedback to the teachers and the students alike about the progress students make as a result of learning.

2. The teacher should specify a performance standard on each one of the formative tests which, once met, indicate unit mastery. A score between 80 to 90 percent on these tests indicates that students don't face problems.

3. The teacher should develop a set of alternative instructional materials and procedures or "correctiveness" keyed to each item on each units formative test. These correctives could consist of small group study sessions, tutoring by classmates, or alternative learning aids like text books, work books, A.V. materials and educational games. These modes of learning provide an opportunity for the learners to learn unmastered materials.

Operating procedures for Mastery Learning :

The teacher is now well set to enter the classroom and commence his teaching. At the outset, he should appraise the students of the procedures to be used. In other words, the students should be informed of

- what they are expected to learn,
- how they are expected to learn, and
- to what level they are expected to learn.

This sort of orientation would go a long way in enhancing students' confidence and motivation to learn.

Teaching for Mastery :

It is time now for the teacher to start teaching the first unit using group based teaching method, as these units have already been broken and adequately sequenced. Immediately after completing the unit, the teacher should administer the formative test on the unit to the whole class. With a view to saving teacher's time, the students themselves should be made to correct their own tests or the test booklets are exchanged for correction by the neighbouring student. After that using a show of hands to discover the test results, the teacher should declare the masters and non-masters. Those achieving mastery standard on the unit should be made to serve as tutors for thier non-master colleagues. The non-masters would then be required to use correctives to complete their unit learning.

The teacher should announce to the students as to when he would like to begin group based teaching for the next unit. Just like the earlier unit, the cycle of teaching, diagnostic progress testing, certification of unit-wise individual correction is repeated unless and until all the unit have been taught. The cycles is paced in such a manner that the teacher is in a position to cover just as much content as would ordinarily be covered.

The teaching-learning strategies are executed by those involed in mastery learning in three stages as has been indicated earlier in the paper i.e orientation stage, teaching stage and evaluation stage.

How well does the strategy function ?

Mastery learning is an innovative technique which represents a particular commitment about education. Many questions have been raised as to how well it functions. It is difficult to indicate the extent of its success or otherwise in terms of actual percentages. Depending upon the factors affecting learning discussed earlier, mastery learning strategies may not work quite as well as has been advocated by its exponents, but they can work very well if both the teachers and the learners so desire.

Reserach findings :

Block and Burns, (1976) have reviewed some 40 studies of students' learning outcomes under mastery and non-mastery approaches. Their findings are as given below :

1. The students taught through mastery learning approach learned more effectively than others taught through different approaches.

2. The students taught through this strategy learned more efficiently than those taught through other approaches. In the mastery taught classrooms, individual differences in rate of learning were significantly less in as much as the slowest learners were found to learn as fast as the 'fastest' learners.

3,. Students taught through mastery strategy liked learning and teaching themselves better than those taught through other methods and techniques. They were found to respond more positively than their counterparts on measures of interest in and attitudes towards the content learned, of self-concept, of academic self-confidence, of attitudes towards co-operative learning and of attitudes towards teaching-learning process (Block 1980).

Conclusion :

The theory, Practice and research concerning mastery learning approach might appear to many as old and conventional. The approach is worthwhile as it is systematic, practicable and learning oriented, promotes cognitive and affective growth of students and above all have faith in students' capacity for excellent learning. All of the above have been accepted by educators as the attributes of teaching profession.

In the context of technical education, the mastery learning approach assumes greater significance as the society makes heavy expenditure on this system and more so, it is directly linked with the economic and industrial progress of the nation. It becomes all the more relavent in the sphere of technical education system, as the strategy also provides for the development of desirable attitudes in the students in addition to cater to their cognitive growth.

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