Mathematics Teaching at Secondary level through Flipped Class approach: A Theoretical Framework

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ABSTRACT

National Policy of Education-2020 recognized that mathematics and mathematical thinking will be very important for India 's futures. Teaching of Mathematics has been challenging issue of School curriculum. It is charged with poorly interested subject; it creates phobia and it is cause of dropout also. Mathematization of young mind is necessary for their all-round development and for preparing next generation with the potential of knowledge creation. The problem-solving ability, hypothetical thinking, convergent and divergent thinking, abstract thinking is to be developed among the learner through teaching of mathematics. Mathematics must be perceived as the combination of process and product both. Nurturing the learner for these abilities have some prerequisites viz. flexibility, autonomy and diverse learning experiences to the learner with respect to time and space both. Learner autonomy has been the prime concern raised by several committee of Education in India. National curriculum framework-2005 emphasizes over learner autonomy along with the utilization of time available to the learner at their home. This sense of autonomy increased now due to the advent of Information and Communication Technology (ICT). Smart mobile has penetrated in human life in all arena with high attraction to the young learners exponentially. The better utilization of learner's time and ICT media accessible to them can be arranged for mathematics learning through flipped class approach at secondary level. The flipped class emphasized on self-study using the multimedia version of the subject contents before the actual classroom teaching. In this approach, teacher provides the contents to learner in advance for self-study as home work. It provides learners free time and space to analyze, synthesize and evaluate the contents in his/her context. Teacher discuss it in next class after justified time interval. This approach will be highly significant in providing free space to learn mathematics with autonomy to learner and nurture their critical ability during pre-active phase of teaching. Aims of teaching mathematics can be substantially realized through this approach. This approach can resolve the educational implications of COVID-19 pandemic also. This paper highlights the role of teacher and taught, selection of contents, and how to realize this approach of teaching in mathematics class online and offline both.

Keywords: Information,Communication, Technology, Education,Learning, Opportunity

Introduction

National Policy of Education (NEP)-2020 recognized that mathematics and mathematical thinking will be very important for India 's future s upcoming fields and professions that will involve artificial intelligence, machine learning, and data science, etc. It urges that mathematics and computational thinking will be given increased emphasis throughout the school years. Mathematics has product and process nature both. Mistakenly only its product has been perceived as subject

during classroom teaching while the process of mathematics is ignored significantly. Mathematization of young mind is necessary for their all-round development and for preparing next generation with the potential of knowledge creation. The mathematization of young mind can be done Mathematics is the process of thinking inductively deductively, convergently, divergently, algorithmic, abstract, analytic, synthetic, hypothetically and problem solving. Today's mathematics is implicated with the trends as of interdisciplinary applications, new contents in itself in result of continuous researches, presence and penetration of ICT in Education, Cyberspace and social media. Flexibility, learning autonomy, Diverse learning experiences, contextualized illustrations linked with real life of the learners with respect to time and space; these are being observed as prerequisite to the mathematics learning.

Mathematics Education at Secondary level

At this stage the ability for abstract reasoning and logical thinking emerges among leaners. Most of the Indian state keep mathematics as compulsory paper in secondary stage of education. National Curriculum Framework-2005 put emphasis on learning by doing, linking with the immediate life the learners, to engaged into problem solving situations, a free space for leaning. It observed that proofs in geometry and trigonometry show the usefulness of algebraic machinery. Hence students must students learn to geometrically visualize what they accomplish algebraically. Geometry can be linked easily with the various structures surrounding the learners. Trigonometry's height and distance, statistics do exist in their real life. Such science can be interpreted and restated in through the deep analytical observation by the Secondary stage leaners. There is need for posing problems to students which involve more than one content area: algebra and trigonometry, geometry and mensuration, and so on (NCF-2005). It is possible when they are facilitated with the free space and time to think and do. NEP-2020 Observed that learning should be holistic, integrated, enjoyable, and engaging. It envisaged that experiential learning within each subject, explorations of relations among different subjects, will be encouraged and emphasized despite the introduction of more specialized subjects and subject teachers. Learners at secondary stage may be characterized as most of them perceived mathematics as product, wants more Autonomy, have significant affinity with ICT tools (HW/SW/Social media), poor connection of real experience of maths contents with their surroundings, Substantial numbers of were found have Mathematics anxiety.

Flipped class approach to Teaching of Mathematics

The above-mentioned thinking abilities to be developed among the learner through teaching of mathematics. Nurturing the learner for these abilities have some prerequisites viz. flexibility, autonomy and diverse learning experiences to the learner with respect to time and space both. Learner autonomy has been the prime concern raised by several committee of Education in India. The various studies show that Secondary school going children are spending substantial amount of time on social media and ICT gadgets available to them or of their parents. The better utilization of learner's time and ICT media accessible to them can be arranged for mathematics learning through flipped class approach at secondary level. Mathematics curriculum at secondary focusses over the basic foundation of geometry, trigonometry, algebra, real analysis along with arithmetic. Its contents are tried to be connected with the real life of learner. Quantity (Numbers), Structure, Space, Change, Patterns are included in syllabi dominantly. NCF-2005 expressed the twin concerns of the mathematics

curriculum are: what can mathematics education do to engage the mind of every student, and how can it strengthen the student's resources? The flipped class approach can resolve these concerns in larger extent. The learners shall be facilitated to explore these features of mathematics in their real and virtual surrounding both.

The advent of ICT has changed the entire arena of human life through its potentials of fast, accuracy and mass reaching capacity in synchronized and asynchronized way. It influenced learner and learners both. Learning is changing drastically from text to multimedia, their learning autonomy are getting impetus by ICT based Open Education Resources (OERs), they are getting ample opportunity of collaboration and cooperation for enriching their learning. Such changes are observed in general and mathematics learning in particular. The integration of ICT in mathematics education with object of mathematization need to be reoriented through the innovative practices like flipped class room approach, in which the learner engaged purposefully before actual classroom activities. During COVID-19 pandemic era home activities are enhanced. Learners should be engaged gainfully beyond the school with their choice of study. The cyberspace has added the virtual space of mathematics. These limitless virtual spaces be occupied by the learners through ICT hardware and software tools. The math learning with above mentioned aims cannot be achieved with the rigid boundary of school. But it needs high flexibility in terms of time and space. The traditional class which are mostly prevailed which includes learner's engagement at his/her home after the class room teaching in very passive and dependent manner. In this approach the teaching method may be child centered but there are lesser autonomy and lesser flexibility he/she get. While Flipped class refer to reversing process of traditional class. In this approach learners are engaged at home first, then they are engaged into rigorous active learning in real classroom (Figure-1).

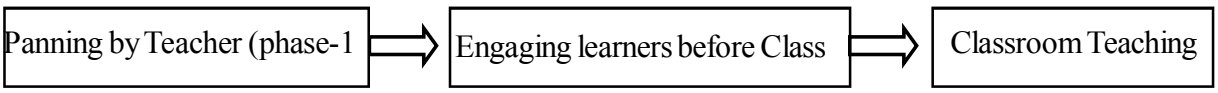

Figure-1. Flow of Flipped Class

It may be termed as reversing process of traditional class. In this approach learners are engaged at home first with supplied learning materials in prior, then they are taught to share their reflection/clear their doubts in discuss in group / Demonstrate in face-to-face interaction in the presence of teacher. This approach shall have following three phases.

Pre-active phase (Pre-Flipped Phase)

In this phase teachers workout following task: Identification of social and physical background of the learners with respect to Mathematics

Identifications of scope and objectives of a particular lesson

Pre-Class content selection

Identification Entry Behaviors of the content selected.

Pre-class exercises (Development of multimedia contents)

Selection of ICT tools/media for communication with the learners.

Pro-active phase (Pro Flipped Phase)

This phase comprises of two sub phase namely Pre-flipped and Pro-flipped. It shall include structuring

the classroom interaction and teaching through child centered approach with following actions.

Pre-flipped includes following activities from teacher ends:

Testing of Entry Behaviors

Enriching the entry Behaviors

Distributing/Supply learning materials (ICT Tools)

OERs/E-Contents/Digital libraries/Realia/Models

Guideline How to do homework (individually Group)

Structuring the classroom seating arrangement for next phase.

After Flipping (Post Flipped phase)

In this phase teachers evaluates his/her efforts and students learning through the following actions.

Feedback on the engagement at home

Structuring the classroom interaction

Group Discussion/Presentation/Demonstration

Observation and recording

Concluding remarks by Teacher

Post active phase includes analysis of observations and feedbacks related to learner's participation and their learning. In this phase records the trends in Mathematical process skills, thinking pattern of leaners, Feedbacks related to learner's participation and their learning. Above all research and development to made approach more effective.

ICT tools requirement for Flipped approach: For execution of the approach teacher will require of Laptop/Smart phone/ Desktop, Internet Connection, Learning Management System, social media, Collaborative Tools for effective communication, for flipping and recording the entire actions of both teachers and learners, also for analyzing the learning and teaching. Teachers must be well versed and trained with Techno pedagogical content knowledge (TPCK) as explained by Koehler & Mishra (2009).

Execution: During first phase of mathematics teaching learners may be asked to collect the realia (Real objects/ learning experiences) related to the topic of ensuing discussion. Also, they may be guided through ICT tool emails, other social media etc. Related learning materials may be supplied using ICT for analysis by learners before they attend the actual class. Their engagement in this phase may be monitored through ICT based alert system. Social media are best meaning for this purpose. The teacher will have to designed home work in such a manner that their learners feel joy and easily able to connect the mathematical concepts using the realia and learning materials available in the vicinity of their habitats. For this, teacher must know the background of learners and well aware with his community environment as well. He/she must have sound Techno pedagogical content knowledge (Koehler & Mishra, 2009) while integrating the ICT. During Proactive phase the process of mathematics be emphasized more than its product. It should be observed by teacher using the video recording of the proactive session. Sometime more teacher of mathematics may be work together as team work so that each learner's reflection on their home work may be observed fully. This phase may be organized either face to face or online mode both. During Post active phase the analysis of recorded observation be done in terms of objectives identified in the pre-active phase. Accordingly, feedbacks be given and improve the structure of flipped class for subsequent teaching.

Conclusion:

This approach requires good infrastructure of ICT at Secondary School with smart class of mathematics, Internet connection, group interaction social media and training to teacher and taught for integration of ICT in teaching learning activities. Parents/guardian must be oriented with this approach so that their inertial attitude may be minimized and facilitate the learner sound learning environment at home. This approach will be highly significant in providing free space to learn mathematics with autonomy to learner and nurture their critical ability during pre-active phase of teaching. During proactive phase they will have an opportunity to express themselves in group discussion and sum up sessions. Aims of teaching mathematics can be substantially realized through this approach. However it requires flexible educational administration and positive attitude toward ICT of both teachers and learners. This approach can resolve the educational implications of COVID-19 pandemic also.

References:

1. Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education, 9(1), 60-70. Retrieved on 04/12/2020 from https://tecfalabs.unige.ch/mitic/articles/koehler_mishra_2009

2. NCF (2005). National Curriculum Framework 2005. National Council of Educational Research andTraining, New Delhi, India.

3. NEP (2020) New Policy of Education. Ministry of Education. Government of India.