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Research Paper

Mathematics teaching for 21st century skills

* Dr.K.H.Yadav
Principal (offg)
A.G.Teachers College, Ahmedabad
Email- khyadav1971@gmail.com, Mob.-9377333302

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Abstract

Globalisation has put new demands in every field and new skill set are coming into existence. Future is becoming more and more dynamic and rate of obsoleting is increasing exponentially. But there appears a great divide in the development of new skill set and rate of obsoleting skills. Education system is becoming questionable. Ultimately it is the responsibility of education to nurture skills in the future generation. This demands relooking to the classroom teaching. National Education Policy (NEP2020) has put an effort to create a vibrant environment for learning. NEP2020 demands to focus on learning rather than teaching. It is essential to know how students learn. Subjects have their core element and teaching should reflect it. NEP2020 advocates foundational literacy and numeracy. 21st century skills are to be imparted and subjects are the medium. Learning 21st century skills requires 21st century teaching. Various subjects are taught in school and they serve as a medium to inculcate 21st century skill set. Mathematics is a subject with extensive and diverse application and so multidisciplinary approach is much needed to impart the knowledge. Teachers are the stakeholder who shoulders the responsibility to take the policy at grass root level. So it is very important to know about student and teacher's perception regarding mathematics and mathematics teaching.

This paper identifies teachers and students perception regarding mathematics and mathematics teaching and how mathematics classroom can serve as a laboratory for the development of 21st century skills.

Introduction

21st century is moving ahead with dynamic nature. Change is in the air. The world is changing rapidly, connecting, adapting and evolving. Our style and approach to teaching aren't synchronised with contemporary world. Pandemic has given momentum to change. Pandemic has taught a lesson to prepare individuals for the unseen. 21st century is often mistaken as technological development. Digital world has great power to inculcate new skill set among future generation if taught properly. Learning 21st century skills need 21st century teaching. NEP2020 advocates to prepare global citizen. This philosophy demands imparting 21st century skills among learners. We have to prepare our students for unseen jobs and unseen future. Subject teaching needs to fairly motivate in this direction. But the current scenario is very upsetting. Currently released study- Annual Status of Education Report and PISA 2019 report highlights that learning outcomes in school education are rock bottom. NEP 2020 has been rolled out since one year which advocates for learner centered classroom, personalised instruction, meaningful integration of ICT, preparing students as producer of content, multidisciplinary approach to subjects etc. The core element of NEP 2020 is to nurture future generation as global citizen by inculcating 21st century skills among them. Teachers are literacy designers. Policy has to be taken at grass root level by teachers. So it is essential to study the preparedness of mathematics teachers regarding 21st century skills and classroom ecology.

Preparedness of mathematics teachers

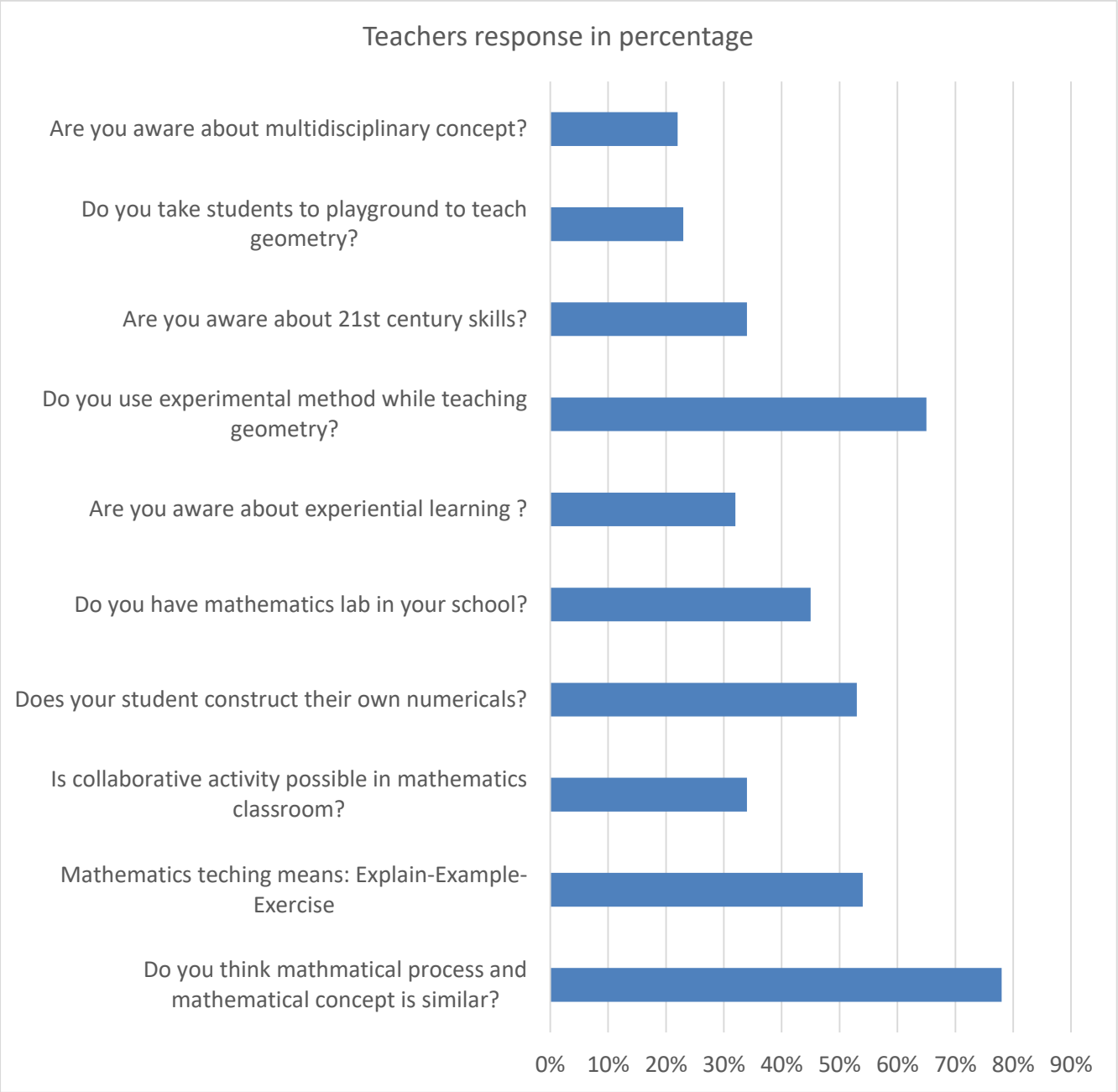
In order to study the preparedness of teachers regarding NEP 2020 and 21st century skill a survey was done. A sample of 38 primary school mathematics teacher was taken for the following survey. Questionnaire was prepared to judge the current scenario of teacher's understanding about mathematics teaching and their preparedness about suggestions offered by NEP2020.

Table-1

Response percentage of teachers in "Yes" for the questionnaire

No.	Questions	Response (Yes)
1	Do you think mathematical process and mathematical concept is similar?	78%
2	Mathematics teaching means: Explain-Example-Exercise	54%
3	Is collaborative activity possible in mathematics classroom?	34%
4	Does your student construct their own numerical?	53%
5	Do you have mathematics lab in your school?	45%
6	Are you aware about experiential learning?	32%
7	Do you use experimental method while teaching geometry?	65%
8	Are you aware about 21st century skills?	34%
9	Do you take students to playground to teach geometry?	23%
10	Are you aware about multidisciplinary concept?	22%

Following chart shows the result of the teachers' responses in percentage for the asked questions:



Result analysis

Result shows that 78% of teachers believe that mathematical process and mathematical concepts are similar to each other. 54% teachers say that mathematics teaching follows "3ex" pedagogy. 34% believe that collaborative activity can be designed in mathematics teaching.

53% teachers assign students to construct numerical in mathematics class. 45% teachers have mathematics laboratory facility in schools. 32% teachers are aware about experiential learning. 65% teachers use experimental method for teaching geometry. 34% teachers are aware about 21st century skills. 22% teachers are aware of multidisciplinary approach.

The results are alarming. Meticulous strategies need to be framed and implemented for better classroom practices. Classrooms need new ecology where teachers and students have positive mind-set to embrace new technology and trends in the system.

Classroom practices to be adopted

To transform contemporary teaching –learning process following can be incorporated by teachers:

- **Teach through disciplines**

  Linkage with daily life examples should be a part of lesson plan in mathematics teaching. Classroom content is to be connected with real life examples. Mathematics has wide range of application and association with other subjects. So multidisciplinary approach of teaching needs to be promoted in the class. Pedagogies selected for different chapters should have variety to satisfy diversity of classroom. Mathematical concepts and process are two distinct thoughts and both are essential (Savendria,2007). Neither can be replaced. Teacher's prime focus is on mathematical process and so conceptual understanding lags behind. This has to be taken care in the classroom teaching.

- **Doing mathematics**

  Experiential learning needs to be promoted in mathematics teaching. Mathematics teachers need to discontinue with the pedagogy of "3ex"model (explain, example, exercise) in the classroom. Teachers need to understand that mathematics is far more distinct than simple sum calculation. Activity oriented teaching, sensitising students towards mathematics, making students feel mathematics around them are the key points to be taken in consideration. Model making, use of TLM, gamification in mathematics teaching, toy making, puzzle solving etc are the means for doing mathematics. Hence mathematics just taught as subject needs to be reinvented. Mathematics is abstract by nature and geometry as a branch of mathematics is

closely associated with the thinking development and design. Geometry is a subject of visualization. Students find it

difficult when taught in abstract manner. Experiential teaching should be the pedagogy for geometry teaching. Experiential learning promotes out of the box thinking which an essential component for 21st century skill.

- **Collaboration and communication in mathematics**

  Collaborative activity is needed for mathematics learning. Collaboration doesnot mean simply work distribution. Collaborative activity is connecting thoughts. Group activity needs to be framed and each student has to contribute cognitively. Collaboration and communication go side by side and there has to be a learning outcome from collaborative activity. Conducive environment needs to be created in school or classroom for commencing group activity. Teacher has tobe very careful ingiving instructions and during the assessment.

- **Error zone in mathematics classroom**

  It is very needed to give students liberty to try out in mathematics. Students are very hesitant while making mistakes. A safe space needs to be created for them while exploring. This will develop their thinking skills and insight for the subject. Errors made by student is the window into student's thinking. When teacher explains any concept or process, students absorb as per their perception. Misconceptions formed never come out if students are not given chance to speak in the class. Error analysis is very important process to be carried out by a teacher during free space zone.

- **Assessment for learning in mathematics**

  It is necessary to move towards real understanding and learning and away from the culture of rote learning. (NEP 2020-Assessment and examination reforms, 2020) The assessment should be competency based and multiple modes of assessment should be involved. Assessment of learning is to be replaced by assessment for learning to concentrate on the learning process of a student. Higher order thinking skills are to be assessed in mathematics.

- **Promoting creativity**

  Innovative pedagogies help in creating a conducive environment in the classroom to promote creativity among students while learning mathematics (Jenifer, 2017). Students need to unlearn "3ex" formula of mathematics learning. Teachers can ask

students to construct numerical in mathematics. Teachers can ask students to construct a question paper which can be given to other students for practice. Model making, chart making, converting data to another form, constructing games etc are the ways to promote creativity. Mathematics is an abstract subject and hence it has great application range. Mathematics needs to be felt around the world of student for better applicability.

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**** Corresponding Author***

Dr.K.H.Yadav

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