APPRAISAL OF MATHEMATICS CURRICULUM 2006

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Abstract

The selected themes, content standards and expected learning outcomes stipulated in the intended National Curriculum 2006 for grade I-XII provided the basis of the framework for reviewing the mathematics curriculum. Current international thrusts in mathematics education such as the focus on problem solving, emphasis on the development of thinking skills and positive dispositions, use of technology whenever it is appropriate and available, and research on how students learn mathematics are considered in this study. The findings of the study are mainly focused on the data collected on the subject where opinion of mathematics curriculum experts was solicited. The framework and analysis of the intended mathematics curriculum show at a glance what the curriculum possesses, what the curriculum should consider as valuable for the students to learn, what they should learn and how they should learn them effectively. The results of the study loudly speak of an enlightened vision of development efforts and identify some deficiencies in problem-solving, communication and disconnection of mathematical approach towards daily life of Pakistani society. This paper also presents guidelines, synthesises, findings and recommends some key elements for further development and improvement of mathematics curriculum in Pakistan and countries around the region.

Keywords: Appraisal, Mathematics Curriculum, Themes, Content, Standards, Learning Outcomes

Introduction

Mathematics is an obligatory subject up to secondary level in Pakistan. According to the Scheme of Studies (Govt. of Pakistan, 2006), the total numbers of periods per week in a school are 40 and the periods allocated to mathematics per week are 6 which is 15% of the total school work load. The number of school

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days will be now 210 in an academic year and an average school day is of six hours in Pakistan. "This time is more viable as compared to the developed countries such as U.S.A., Germany and Japan whose school days in a year range from 175 to 220. The average length of school stay in these countries varies from 5 to 8 hours per day (Coupland, 2006)".

According to a study at NISTE (2001), "the mathematics curriculum for secondary level has gone through a number of revisions since the creation of Pakistan. The first change in mathematics curriculum was initiated during 1968. This change was termed as modernization of curriculum and included drastic changes in mathematics subject matter, textbooks and teacher training. The 'Sets' were introduced first time in Pakistan at secondary level. The greater emphasis was placed on the practical and scientific application of mathematics" (Government of Pakistan, 1968). Accordingly, "a massive revision of secondary school mathematics was carried out during 1972-73 (Government of Pakistan, 1972). In this revision, the content was made concept oriented. In addition to this, deductive and inductive approaches were adopted for teaching mathematics to the students of secondary classes. The textbooks were implemented from year 1977. Secondary school mathematics curriculum was also revised in 1986 but only a few and minor changes were made in the pervious curriculum (Government of Pakistan, 1986). This curriculum was implemented in the year 1988.

A unified curriculum was developed in 1994 as part of a breakthrough in the history of development of mathematics curriculum for secondary level in Pakistan. This curriculum was developed for all the students opting general as well as elective group (Government of Pakistan, 1994). This curriculum was comprised of four major categories viz: Sets and Numbers, Geometry, Algebra, Information handling and Trigonometry. This curriculum was introduced in 1995. Accordingly, "the curriculum was implemented without any planning and strategy especially towards the delivery of mathematics and in the face of shortage of mathematics teachers, which has always existed in Pakistan". The findings of an evaluation study conducted at NISTE (2000), on this curriculum revealed that "most of the portion of this curriculum was taken from the earlier curriculum made for the students of elective group. The clientele of general group had no option but to study this curriculum. Moreover, the teachers who had been teaching general mathematics, had to teach this course without any preparation. Most of the teachers especially the female teachers did not prove capable of teaching. The comparison of curriculum of 1994 with that of 1986 reveals that it is quite close to

that of the 1986 curriculum. However, the only significant change introduced in the curriculum of 1994 was the inclusion of "information handling".

This situation affected the achievement of students in the examination. According to the results of Federal Board of Intermediate and Secondary Education, Islamabad for the year 2008, "75% of the failing total students failed due to the failure in the subject of secondary school mathematics" (FBISE, 2008). Similarly, in BISE, Rawalpindi, "80% of the unsuccessful students failed in the Secondary School Examination due to failure in mathematics in the year 2009" (BISE, 2009).

The Punjab Education Department developed the science and mathematics curriculum for Classes I-XII in 2000 to overcome the weaknesses of the previous curriculum (Government of Pakistan, 2000). This curriculum was implemented from academic year 2003 throughout the country. The analysis of mathematics curriculum 2000 for Classes IX-X when compared with curriculum of 1994 revealed that "no crucial change was introduced in this curriculum rather this was closer to the curriculum of 1986 (NISTE, 2000). Nevertheless, the sequence of some of the topics in a few chapters of this curriculum was different, whereas, chapter such as 'information handling' was heavily extended. However, the most important among the salient features of this curriculum is the grass root changes towards the delivery approach of mathematics. The main thrust of this curriculum of mathematics was the acquisition of information and skills necessary to become sensible and responsible individuals in highly technological society of the 21st century. This curriculum has been in practice till year 2010. The curriculum 2006, about which this papers is presented, is scheduled to be implemented throughout Pakistan from the academic year, 2011.

Review of Literature

The traditional theories of mathematics have now been changed with the advent of the electronic computer. The mathematics researchers have now adopted paradigms from basic learning theories of psychology, sociology and anthropology for the reason that there is no single agreed upon paradigm is presently available in mathematics education research. According to Anna Sfard (1996) "there are two contrasting views of learning labelled as 'acquisitive' and 'participatory' models. The acquisitive model is mainly based on information processing through which knowledge is acquired as a result of understanding the concepts and acquisition of mathematical skills. In 'participatory' model,

knowledge is taken as social construct which includes: physical and social classroom conditions, teacher's behavior and learning environment, etc. Testing of Trends in International Mathematics and Science Study (Martin, Mullius, Ganzles and Chrowstoski, 2004) was carried out in 46 countries of the world. The test was based on intended, implemented and attained curricula of mathematics. The results of eighth grade mathematics tests 2002/3 show that students of Singapore excelled in scoring higher than all other students of other countries. As a consequence, "the mathematics curricula of Singapore and Hong Kong have come up as better arrangements of courses as witnessed from this study and the Program for International Student Assessment (PISA, 2004a)". According to Wirth & Fleischer (2006) "the analysis of students of mathematics achievements in Germany, Japan, USA, and Netherlands from the PISA, students with higher overall mathematics performance did not necessarily perform better in problem solving while lower overall performing students often showed higher problem-solving skills".

In Singapore, there is a diverse scheme of mathematics curriculum. The students are offered courses keeping in view their capabilities, needs and performance. There was an extensive review of Upper Secondary Education in year 2002 in Singapore where newly introduced curriculum of Junior college level was comparatively broader and more flexible (MOE, 2006). The structural procedures have uplifted the standards and achievements among students of mathematics upto the level that students from Singapore have come up as the highest achievers in competition of 46 countries around the world.

In Hong Kong, new curriculum and assessment framework for all subjects are being developed. There are drastic changes found in new Senior Secondary mathematics curriculum structures of Hong Kong. Mathematics consists of a Compulsory part and an Extended Part which consists of two modules: Module 1 – Calculus and Statistics and Module 2- Algebra and Calculus. The time allocated for teaching is approximately 270 – 338 hours (CDC and HKEAA, 2006). According to the Board of Studies, (NSW, 2006c) Australia, "the level of compulsory mathematics in Hong Kong is more advanced and algebra based whereas in Australia it is 'pure mathematics' flavour".

England is famous for innovations in the subject of mathematics but still there is a big concern in England "about large numbers of students not studying mathematics of any kind after the compulsory years of schooling. This trend has