AN INTERNATIONAL REFERRED RESEARCH JOURN

S.S.M.

A WAY TO SUCCESS.....

R.A.E.

JAIPUR INDIA

RESEARCH ANALYSIS AND EVALUATION

रिसर्च एनालिसिस एण्ड इवैल्युएशन

www.ssmrae.com

EDITOR

Dr. KRISHAN BIR SINGH

www.ssmrae.com

Problems related to Participation in Mathematics in 10 + 2 Standard of Arts and Science Streams: A Comparative Study in Goalpara District of Assam

February,2013

* Abdul Wahed ** Sahin Ahmed

* Bikali College, Dhupdhara, P.O.-Dhupdhara, Dist-GOALPARA (Assam)
** Goalpara College, Goalpara, P.O.+ Dist- Goalpara (Assam).

A B S T R A C T

There is a consensus that the participation, achievement, dropout and curricula aspects are the main hurdles for expansion and generalization of mathematics education despite its immense importance as one of the disciplines in all streams of learning. To assess the ground reality in respect to the above issues, especially in 10 +2 standard in rural area of Assam, an in depth study is felt necessary. The study about these issues are sought to induct in Goalpara, one of the backward Districts of Assam which has 5 colleges and 4 higher secondary schools offering mathematics in +2 standard. Information regarding the issues are collected from primary as well as secondary sources. For secondary sources official records from concerning authorities are gathered. The primary information are gathered from 30 respondents [mathematics teachers]. On the basis of the information gathered in this way, this paper attempts to highlight the status of mathematics education and to find the rate of participation, achievement and dropout in +2 standard.

KEY-TERMS: The study uses the terms given herein in the sense of its own limitations. 10+2 standard: Higher secondary [11th & 12th] classes. Enrolment: Total number of students in a particular class. Participation: Take part in the study programme of mathematics and appeared in the examination. Achievement: Passed in mathematics. Dropout: Difference in the number of participation in 12th class from 11th class of preceding year. Excess: Negative dropout. Curricula: Plural of curriculum which is confined only in the syllabus of mathematics in +2 standard. PGT: post graduate teacher

Introduction:

Mathematics develops our power of thinking, reasoning, judgment and generalization [Sidhu, 1995].Therefore, it plays an important role for scientific and socio-economic development of a country. The needs and requirements of the modern civilization based upon computer, sophisticated technology and global commercialization demand for skilled labour with sound mathematical knowledge. Poor participation and low enrolment factors in mathematics will decrease the skillful labour in the society. Importance of mathematics in the changing scenario of the society and the ongoing gloomy situation necessitates studying the present status of mathematics education. Under this perspective an attempt has been made to assess the status of mathematics in terms of participation, achievement and dropout in higher secondary classes. The study also tries to search the reasons for the deteriorating enrolment in the subject as a whole and in particular to Goalpara District of Assam.

The choice of the topic is disposed on the current world trend and research emphasis on the short fall of the qualified person in the society with sound mathematical knowledge as required by industry and business sector of the country [Report of the Royal Society, 2008; Kounine et.al. 2008]. In a study of international comparison of post-16 mathematics education in 24 different countries Hodgen et. al. [2010] revealed that England, Wales and Northern Ireland have the lowest levels of participation in upper secondary mathematics. To eradicate such problem they along with Noyas [2011] suggested to offer different types and level of mathematics in post-16 curriculum within the context of current and projected social and economic needs. Thus, considering socio-economic necessity and demand for STEM[science, technology, engineering and mathematics] many countries such as Germany, Hong Kong and New Zealand have already been introduced compulsory basic mathematics into upper secondary level [Hodgen, et.ai., 2013].

Mathematics education is still lagging to fulfill the social need in our country. In view of the importance of mathematics which is deeply involved with all the issues affecting society [Ambrosio, 2003] and considering the deteriorating situation many researchers [Varadarajan, 1983; James, et.al. 2012] suggested that the curriculum of mathematics should be dynamic and related to everyday life. It needs to be reframed by a different philosophy and set of values, so that it can fulfill the need, hope and aspiration of the majority students [Noyas, 2007]. Thus curriculum, pedagogy and assessment should be designed to enable all students to be able to use mathematics in their professional and everyday life.

In the context of our country there is a saying that the curriculum of higher secondary mathematics has been framed giving priority and importance to the need of the science students only and ignoring the

necessity of others. As a result poor participation in mathematics has been experienced year after year in arts stream. The observation demands to find out the answer of an important question why the arts students don't come forward to take part in the study programme of mathematics in +2 standard. For answering this basic question, this paper sets the following key research questions.

Research Question:

The study proposes to address the following research questions in relation to the status of mathematics in +2 standard of arts & science streams-
1. What are the rates of participation and achievement in mathematics?
2. Whether there exists any relationship between participation and achievement in mathematics?
3. Whether the number of dropout is significant?
4. Is the existing syllabus of mathematics feasible for all the streams?
5. Are there any need of separate syllabus for arts & science streams?

Methodology:

The study programme of mathematics in +2 level is available only in 9 institutions comprising 5 colleges and 4 higher secondary schools in Goalpara District of Assam. Moreover, there are 173 Secondary & higher secondary schools in the district offering compulsory mathematics programme up to 10th class. All the institutions as mentioned above constitute the population for the present study. Secondary information regarding participation and achievement in mathematics in +2 level are gathered from official records as provided by the concerning authorities of the 9 institutions. Stratified sampling technique is applied to gather primary information through a pre tested teachers' questionnaire.

There are 20 [Prof. & PGT] mathematics teachers in +2 level. Besides these 20 teachers another 10 mathematics teachers are selected randomly from 161 graduate mathematics teachers working in the district. Thus, the sample size taken is 30 number of mathematics teachers. From these 30 respondents primary information are gathered regarding their views in the mathematics curricula of +2 standard. This study is descriptive in nature and common statistical tools such as, correlation coefficient, mean, S.D., paired t-test, and percentage are applied to analyze the data.

Analysis:

4.1 Participation and Achievement:

For both the streams the percentage of participation and achievement in mathematics are found year wise separately from the field survey report [see appendices-i & ii] and their averages for 10 years [from 2002 to 2011] are given in the following table-1 for direct comparison.

See Table 1 In table-1 it is found that the average rate of participation in mathematics for 11th class is 11.15% and average rate of achievement against participation is 38.21%, whereas in case of 12th class average rate of participation and achievement are found 11.43% & 62.39% respectively. Another remarkable finding of this table is that the arts and science streams witnessed two different tendencies regarding participation and achievement in mathematics.

In arts stream the rates of participations in mathematics are very low [1.66 & 1.30] whereas their achievement are high [40.42 & 44. 97.]. But in science stream the rates of participations are very high [96.60 & 91.87] though their achievement are low [37.66 & 59.38]. There is a common consensus that necessity increases participation and interest increases achievement, so it can be conclude that the arts students study mathematics for the sake of their own interest rather than stream necessity.

On the other hand science students study mathematics for the sake of stream necessity though the subject may or may not be interested to them.

In this paper attempt is made to investigate whether there is any relationship between the variables participation[X] and achievement[Y] for both the streams. Taking X as independent variable and Y as dependent variable correlation coefficients are calculated taking 10 pairs from 2002 to 2011 for 12th class

$$r = \frac{N \sum d_x d_y - \sum d_x . \sum d_y}{\sqrt{N \sum d_x^2 - (\sum d_x)^2} \ \sqrt{N \sum d_y^2 - (\sum d_y)^2}}$$

only [see appendix-ii]. The abstracted results by the following formula are given in the table-2
Where, d_x and d_y are deviations of X and Y series from their assumed mean.

Table-1

Participation in Maths against Total Enrolment. [Mean of the percentages]						Achievement in Maths against Participation [Mean of the percentages]					
11th class			12th class			11th class			12th class		
Arts	Sc.	As a whole	Arts	Sc	As a whole	Arts	Sc.	As a whole	Arts	Sc.	As a whole
1.66	96.60	11.15	1.30	91.87	11.43	40.42	37.66	38.21	44.97	59.38	62.39

Source: Appendices-i & ii

Table-2

Participation	Calculated Correlation coefficients between X & Y					
X	Arts			Science		
Achievement	r	P.E$_r$	$\sigma = r \pm$ P.E$_r$	r	P.E$_r$	$\sigma = r \pm$ P.E$_r$
Y	0.71	0.11	0.60, 0.82	0.81	0.07	0.74, 0.88

Table 3

Calculated value				Tabular value of t at 5% level of significance
Arts		Science		
σ_{D_i}	t	σ_{D_i}	t	
7.775	4.514	27.161	-1.490	1.833

Source: Appendices-i & ii

In table-2 calculated correlation coefficient r [=0.71] for arts stream is found positive and it implies achievement increases with the increment of participation. Since the value of r is more than six times the probable error [P.Er=0.07], r is significant and it can be expected to lie between 0.60 and 0.82. Again, r2 =0.49, which implies that 49% of the total variation is explained i.e. half of the variance in achievement is due to participation. The result of table-2 for science stream is found similar with that of arts stream. In this case also correlation coefficient r [=0.81] is positive and it is more than six times the probable error. Thus the value of r is significantly high and it can be expected to lie between 0.74 and 0.88. Again, r2 =0.66, which implies that 66% of total variation in achievement is due to participation. Thus, for either case it implies that if participation in mathematics can be increased achievement in mathematics will definitely increase.

4.2 Dropout In Mathematics:

In Assam, promotional examination of 11th class is conducted by the institutions recognized by Assam Higher Secondary Education Council [AHSEC] and the council itself conducts the 12th class final examination. In the promotional examination of 11th class some candidates are retained and some successful candidates give up the subject mathematics in the 12th class which yields dropouts in the subject. In the study dropout for the ith year is calculated using the formula

$$D_i = X_i - Y_i, \quad X_i \in X \text{ and } Y_i \in Y, i = 2001, ... 2011 \tag{2}$$

Where, X and Y are two sets of participations of same stream in 11th and 12th classes respectively [see appendices-i &ii]. In case, the difference is negative it can be termed as 'excess' which happen when repeaters participate more in mathematics in 12th class. To test the significance of dropout in arts & science streams

paired t-tests are conducted in the study using the formula-

$$t = \frac{\bar{D}\sqrt{n}}{\sigma_{D_i}} \text{ where standard deviation } ? \quad \sigma_{D_i} = \sqrt{\frac{\sum D_i^2 - n\bar{D}^2}{n-1}} \tag{3}$$

At 5% level of significance the tabular value of t for 9 degree of freedom is 1.833. For arts stream in table-3, the calculated value of t is found 4.514 which is greater than the tabular value. On the other hand for science stream, the calculated value of t is found -1.490 which is negative and less than the tabular value. Thus, dropout factor in mathematics is significant for arts stream but it does not play a significant role in science stream in which excess in the participation is observed. Actually what happens in arts stream is fear psychosis due to vast syllabus of mathematics in compare to other subjects of the humanities group and it occurs at the first step [11th class] of their entry to +2 level. As a result they give up the subject mathematics in the next year [12th class] and become dropout in the subject.

4.3 Feasibility of The Syllabus:

People from all sections of the society in their various occupations and professions require at least some of primary ideas, concepts and principles of mathematics. The development of science and technology emerges number of new disciplines such as bio-mathematics, bio-medical engineering, genetic engineering, and genomics etc. which open up more avenues for the students having sound mathematical knowledge. A great deal of mathematics is used in social sciences and humanities which include statistics, theory of probability, matrix algebra, operational research, mathematical modeling, network theory, graph theory and so on. Therefore curriculum and syllabus of mathematics should be dynamics and related to every-

Table-4

Present syllabus of +2 standard		Need of separate syllabus for Arts & Science streams	
Feasible for all the streams	Not feasible for all the streams	Yes	No
8	22	25	5

Source: Field Survey

APPENDICES:

Appendix-l: Enrolment, Participation & achievement in Mathematics in 11th class from 2001 to 2011

Year	Arts			Science			Grand Total		
	Enrol	Particip	Achiev	Enrol.	Particip	Achiev	Enrol	Particip	Achiev
2001	1701	44	18	236	208	78	1937	252	96
2002	1659	52	18	253	253	57	1912	305	75
2003	1931	40	09	205	200	43	2136	240	52
2004	1892	36	19	205	198	52	2097	234	71
2005	1822	27	09	187	180	24	2009	207	33
2006	2031	35	12	235	220	112	2266	255	124
2007	1829	29	12	212	193	68	2041	222	80
2008	1977	27	13	191	189	91	2168	216	104
2009	2338	28	15	230	227	120	2568	255	135
2010	2643	28	12	248	242	128	2891	270	140
2011	2612	27	11	324	310	164	2936	337	175

Source: Field survey report

Appendix-ii: Enrolment, Participation & achievement in Mathematics in 12th class from 2001 to 2011

year	Arts			Science			Grand Total		
	Enrol	Particip	Achiev	Enrol	Particip	Achiev	Enrol	Particip	Achiev
2001	1598	21	09	250	230	136	1848	251	145
2002	1667	26	09	282	263	119	1930	145	128
2003	1603	32	15	289	264	180	1892	296	195
2004	1873	29	14	229	202	93	2102	231	107
2005	1985	15	09	230	195	98	2215	210	107
2006	1766	22	06	181	161	102	1947	183	108
2007	1599	20	07	228	212	123	1827	232	130
2008	1755	23	14	240	238	172	1995	261	186
2009	1842	21	11	223	211	126	2065	232	137
2010	1921	25	12	264	239	162	2185	264	174
2011	2426	22	08	330	313	197	2756	335	205

Source: Field survey report

day life so that it can fulfill the needs of majority of the students in their higher study and professional career. To justify the feasibility of the mathematics syllabus in +2 standard an opinion poll was conducted among the mathematics teachers and the findings are shown in the **table-4**. In the table-4 it is found that out of 30 mathematics teachers 22 are in the opinion that mathematics syllabus in +2 standard is not feasible for the entire streams. Moreover, 25 mathematics teachers forward their views that there is necessity for reframing separate syllabus of mathematics for arts and science streams in +2 standard so as to increase the rate of participation in the subject.

5. Findings of The Study:

The study thoroughly deals with the status of mathematics and its findings are reported as follows: In arts stream the rate of participation in mathematics is found very low but the arts students can achieve if they participate in the study programme of the subject. On the other hand science stream witnessed high participation rate in mathematics though their rate of achievement in the subject isn't as high as expected.

In both the streams Participation and achievement in mathematics are positively correlated. Rate of achievement increases with the increment of rate of participation in the subject.

Findings of the result indicate that number of dropout is significantly high in arts stream but repeaters make it excess in science stream. Another key finding of this paper is that the syllabus of mathematics is not feasible for all the streams and majority of the teachers forward their views to reframe curricula separately for arts and science streams.

Concluwsions:

On the basis of the above findings it can be conclude that the status of mathematics in +2 level is not satisfactory in the district. The study held mathematics curriculum responsible for this general degradation of mathematics education. The syllabus of mathematics in +2 standard is designed keeping in view the interest of the meritorious science students for their further study of advance science, engineering and technology. But the syllabus can't profoundly fulfill the

need, hope and aspiration of the arts students for their professional career. Indeed, there has been including some topics in the syllabus, which are less important to their life, field of study and work.

Therefore, majority teachers opined for change in the curriculum so that status of mathematics in all aspects can be improved. However, the study has own limitation in its wide and depth. The study covers only a small part of the country and reframing of curriculum is a national agenda. Therefore, to arrive at a consensus of opinion on reframing of mathematics curriculum in +2 standard there are immense necessity of further study and research covering the whole state and nation.

Recommendations:

The study recommended to reframe mathematics curriculum on need base of the streams so that the rate of participation can be increased and dropout can be minimized. For generalization of mathematics education there should be either provided with separate syllabus for different streams or made basic mathematics compulsory [as already done by Germany, Hong Kong and New Zealand] up to higher secondary standard.

REFERENCE

1. Sidhu, K.S. 2005. The Teaching of mathematics: Sterling Publishers Pvt. Ltd.,New Delhi. ISBN: 81-207-1747-3
2. Royal Society 2008 Science and mathematics education 14-19: A 'state of the nation' report on the participation and attainment of 14-19 years old in science and mathematics in the UK, London: p.17 From http://royalsociety.org/ uploadedFiels/Royal_society_content/influencing_policy/Education/R
3. Kounine, Marks, & Truss. 2008. The Value of Mathematics. London: Reform: p.5. From. www.reform.co.uk/content/4504/ research/education/the_value_of_mathematics
4. Hodgen,J., Pepper,D., Sturman,L.,& Ruddock,G. 2010. Is the UK an outlier? An international comparison of upper secondary mathematics education: Nuffield Foundation. From www.nuffieldfoundation.org/sites/default/files/fiels/Is the UK an outlier Nuffield Foundation_v_FINAL.pdf
5. Noyes, A. 2011 "Participation in mathematics: What is the problem?" Improving Schools, SAGE journals online. July 14 (2):p.12, from http://imp.sagepub.com/content/12/3/277.full.pdf+html
6. Hodgen,J., Marks,R., & Pepper,D. 2013.Towards universal participation in post-16 mathematics: lessons from high-performing countries: Nuffield Foundation. From www.nuffieldfoundation.org/sites/default/files/fiels/ towards_universal_participation_in_post_16_maths_v_FINAL.pdf
7. D'Ambrosio,U. 2003. The role of mathematics in building up a democratic society. http://www.maa.org/ql/qltoc.html
8. Varadrajan, V.S. 1983. Mathematics in and out of Indian Universities. The Mathematical Intelligencer 5 Pp38-42
9. James,A. & Balasubramaniam,P.S. 2012. Teaching of Mathematics. Reprint of First Edition Neelkamal Publications Pvt. Ltd. New Delhi..
10. Noyes, A. 2007. Rethinking school mathematics, London, paul Chapman publishing.