Applications of Mathematical Knowledge in History, Geography, Fine-Arts & Physical Education Subjects in Two-Year B.Ed. Programme: Indian Context.

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Abstract:

This study examines the lack of Mathematics knowledge in two-year B.Ed. curriculum from the year 2015. Teachers-Educational Institutions can play a significant role in bringing changes to the Education System and can develop a Nation. Teacher Training Institute is a Teacher-Making Factory, which has been playing an important role in the formation of a nation and a nation for a long time. Here teachers of various pedagogy subjects are trained. For example - Bengali, Sanskrit, English, History, Geography, Education, Biology, Fine-Arts, Physical Education, Physics, Mathematics and Chemistry, etc. Mathematics is one of them. While studying Pedagogy on a specific subject in two year's Bed. Course, students also have to study other subjects and Pedagogics. In general two years B.Ed. courses can be divided into three categories, a) Theory Part, b) Practicum and c) Internship. This study focuses on the practical work and use of mathematical knowledge on the overview of two universities, one of which is WBSU and the other is WBUTTPA in West Bengal, India. The methodology of the study is a mixed type involving an interpretative, interview, observation and study secondary sources, like books, articles, journals, thesis, university news, expert opinion and websites etc. Finally, meaningful suggestions are offered.

Keywords: B.Ed. Curriculum on WBSU, Mathematical Applications, NCTE, Social Studies, Teacher Education, Trainee Teacher, Integrated Teaching-Learning.

1. INTRODUCTION:

Today, mathematics plays a big role in the two-year Teacher Education programme. Mathematics is a subject that helps in creating a mental, practical, and social right attitude of a person. Although most of the people think that mathematics as useful and important but many people are afraid or mentally confused with mathematical problems and mathematical anxiety (Hembree, 1990). A Bachelor of Education (B.Ed.) is a two-year undergraduate professional degree that prepares students to work as teachers at the school level. In changing scenario the Teacher-Education Policy in India has evolved and is based on recommendations contained in various Education Committees or Commissions or Reports. Now for two years, Bachelor of Education (B.Ed.) is a course which is mandatory for a career in Secondary and Higher Secondary Teaching in India. National Council for Teacher Education (N.C.T.E.) is a statutory body that regulates the courses in Teaching in India. Curriculum Framework for Teacher-

Education (NCFTE) proposes humanistic and liberal Teacher-Education Programmes with reflective practices. NCTE (National Council for Teacher Education) became a statutory body in 1993 by Act of Parliament(India) to maintain norms and standards of Teacher-Education and brought out two National Curriculum Framework on Teacher-Education, during 1998 and 2009 (Yadav, 2016). For an intake of two basic units of 50 students each, that is total students' strength of 200, there shall 16 full-time faculty members needed. The distribution of faculty across different curricular areas as a) Principal/ HOD (One), b) Perspectives in Education (Four), c) Pedagogy subjects (Maths, Science, Social Science, Language)(total eight faculty), d) Health and Physical Education (One), e) Fine Arts (One), f) Performing Arts (Music/Dance/Theatre) (One). For pedagogy subjects (Maths, Science, Social Science, and Language) need to eight full-time faculty specified by Kothari in 2017 (Kothari, 2017, NCTE Gazette of India, 2014). Here mathematics faculty play a big role in that curriculum. The success of a Teacher-Education Programme depends mainly on the proper implementation of Teacher Education in real classroom teaching, proper application and experiences (Das et al. 2019). In 2017 R. G. Kothari specified some issues related to teacher education like Practical activities and Qualifications of Teacher Educators. The effective curriculum framework for Teacher-Education focuses on the advancement of Pre-Service Teachers and provides specific training for their school-based subjects. The curriculum is divided into three parts named as Theory Part, Practicum and Internship. In the theory part, perspectives in education, curriculum and pedagogic studies are going to teach. The Practicum part includes Tasks/ Assignments and Workshops. The internship is a sub-part of practicum also. The researcher focused on mathematical needs in the practical part. In that curriculum, there are many pedagogical subjects. Mathematics is one of the pedagogical subjects. Overall B.Ed. curriculum mathematics does not directly involve practical experiences (Lithner, 2008). Mathematics is indirectly linked to all other practical fields. Mathematical knowledge is applied everywhere, so we can never deny mathematics. The opportunity to use mathematics directly without Teaching Methodology is very low in the B.Ed. curriculum. The researcher is here to find out how to apply mathematics in some practical fields.

2. OBJECTIVES OF THE STUDY:

- Examine the Mathematics-activities of Teacher trainees in during the programme.
- Examine the use of Mathematics in History, Geography, Fine-Arts & Physical Education discipline in two-year B.Ed. Curriculum.
- Find out Mathematical application in B.Ed. Theoretical & Practical work.
- Find out the problems and challenges to integration Mathematics and other disciplines in B.Ed.
- Examine the responsibility of Mathematics Teacher Educators.

3. METHODS OF DATA COLLECTION AND ANALYSIS:

This study employs an interpretative approach where qualitative data were collected and analysed by the document study. The researcher collected data from students (Trainee Teachers) and faculty (Educators), interviews of senior faculty and department chairs, and document analysis of program and policy documents. This study secondary sources, like books, articles, journals, thesis, university news, expert opinion and websites etc.

3.1. Population:

The population of the study included some B.Ed. students from session 2015, enrolled in the two years B.Ed. programme under West Bengal State University (WBSU, Barasat) and The West Bengal University of Teachers' Training Education Planning and Administration (WBUTTEPA), Kolkata.

3.2. Sample Selection:

A representative survey sample was collected by using a stratified random sampling strategy. Also using a purposive sampling strategy for collecting purposive sample.

3.3. Purpose of study:

To analyse the practical work related with mathematics and searching a new way to linked up mathematics.

This study was conducted in following dimension as –

- ➢ Present practicum & theory curriculum.
- ➢ Involving mathematics techniques.

- ➢ Roll of mathematics Teachers.
- ➢ Applications of Mathematical knowledge in other disciplines.

3.4. Delimitations:

The study was delimited to B.Ed. programme under WBSU & WBUTTPA in West Bengal.

3.5. Limitations of the Study:

This research method has some limitations. A relatively small number of collected information surveys have been taken (Trainee Teacher and faculty) from the B.Ed. Programme.

4. RESULTS:

If the two-year B.Ed. the course is divided, then it can be divided into three parts. A part of which is a practical field. The researcher mainly focused on the application of math in the practical field. Here are the practical areas used in many ways. For example, the seminar presentation, workshop, assignment, etc. Students complete their curriculum by using all these applied applications. Practical work that students can learn in a various mode like as:

Table: 1 Mode of Transaction involve in different practicum work in B.Ed.

Mode of Transaction			
• **Discussions.**	• Lectures.	• Group Discussions.	• Pair and Share.
• **Audio-Video.**	• Field visits & sharing experiences.	• Symposium.	• Panel discussions.
• **Film Show.**	• Problem Solving.	• Case Study.	• Assignment.
• **Creative literature.**	• Games.	• Exercises.	• Round table study.
• **Reflective questioning.**	• Writing diary.	• Project work.	• Field trip.
• **Seminar.**	• Demonstration.	• Workshop.	• Slide/film show.
• **Action research.**	• School visit & sharing experiences.	• Practical work.	• Reflecting writing.
• **Meditation.**	• Anecdotes.	• Role play.	• One act play.
• **Story-telling.**	• Lab work.	• Observation.	• Web surfing.
• **LCD projection.**	• Designing WBI.		

Students learn practical work through different Modes which are mentioned above. Practical work is associated with all the pedagogical subjects and the entire curriculum. Some specific practical work is involving with soft type mathematics. Although math-pedagogy is fully involved with mathematical knowledge. Some practical work is indicating here:

- ✓ Action research.
- ✓ Mathematics teaching.
- ✓ Qualitative data analysis.
- ✓ Statistical data analysis.
- ✓ Preparation of Graph etc.

4.1 Importance of Mathematics:

Without the help of mathematics, it is not possible to complete these practical works. All students of B.Ed. course are do not belong to mathematics. There are various subjects and students come from different subjects. But all of them have to take the necessary help of mathematics. So mathematics is needed for everyone. Different mathematical methods such as addition, subtraction, division, multiplication are used regularly. In addition to the statistical method, the use of standard deviation, mean, mode, tally mark, quartile, etc. is seen here. There is no such thing that mathematics is not related to the subject. Mathematics is referred to as the 'queen of science'. With mathematics-language, science with mathematics, mathematics with sociology and mathematics-social science all have intimate relationships. It can be said that since the subjects have math-related, then there is a link to mathematics in the practical field of those subjects too. For example, it can be said that if someone wants to determine a mental age, then it would be necessary to calculate. On the other hand, if there is a historical period or analysis of the judgments of a king's reign, then it is necessary to take the help of time-graph, which is a part of mathematics.

4.2 Challenges of Mathematics applications:

The main problem is that everyone wants to avoid mathematics. There is no place for learning different types of mathematics in the syllabus. For example, let's say we can apply it to the practical aspects of geography. Mathematics is essential for the latitude of a place to determine longitude. Also, if we want to convert qualitative data to quantitative data, then we need to get help in mathematics. To learn this great use of mathematics, students have to face problems in many areas where there is no curriculum in place. As a result, mathematical fears were created among the students. In the absence of a proper mathematical teacher, there is a lack of mathematical knowledge among the students. Mathematics is closely associated with all other subjects. Due to the lack of mathematics teachers, students are prevented from creating mathematical mentality. This course does not have any type of practical work that will create practical work about mathematics in composing the curriculum. Although indirectly using mathematics, mathematics is neglected directly. There is a shortage of new phenomena, qualities, skills, knowledge, math-lab, math TLM etc. All students do not currently have access to high-quality teaching and curriculum in that two-year programme. In addition to the technical aspects of mathematics, the cognitive aspect also has considerable importance. Without proper mathematical sense, it is not possible to do anything correctly. The mathematical participation is very rare, with the practical work included in the B.Ed. curriculum. The big question to the teacher is how he will add mathematics to other practical work. Of course, the curriculum needs to be renewed. Challenges of mathematics teaching in a school internship is very worrying (Das, 2019). If we look at the teacher training institutions then we can see that there are not satisfactory results. The lack of proper Teacher educators is also present here (Das, Roy & Biswas, 2019).

4.3 Challenges of Mathematics applications on Other Subjects:

Mathematics has a close relationship with other subjects such as history, geography, life sciences, drawing, sociology, law, and language. Mathematics is closely linked with the teaching of other subjects and with practical work. Let's take a look at the topics that are taught in the two-year teacher training program.

The subdivisions of the subject-based learning provided to trained teachers are as follows:

- Perspectives in Education.
- Pedagogy subjects (Maths, Science, Social Science, Language)
- Health and Physical Education.
- Fine Arts.
- Performing Arts (Music/Dance/Theatre).

There are also significant subjects in social studies are Anthropology, Archaeology, Economics, Geography, History, Law, Philosophy, Political Science, Psychology, Education, Religion, and Sociology, as well as appropriate content from the humanities. Physics, chemistry, and biology are given importance in the division of science. In particular, we can clearly understand the importance of mathematics through different subject-based divisions. Mathematics itself is a subject in the division of mathematics.

At least two languages are mandatory for language splitting. There can be more than two languages. That is to say, education science has been given the most important here. Other topics include commerce, music and drawing. In the fourth semester, several courses have been chosen for the selection of special subjects or optional subjects. Ex:

     i.   Health and Physical Education.

     ii.   Peace and Value Education.

     iii.   Guidance and Counselling.

     iv.   Work and Vocational Education.

     v.   Yoga Education.

     vi.   Environmental & Population Education.

4.3.1 Mathematics and History Subjects:

To know and interpret history properly, one has to take mathematical help. Different applications of mathematics are needed to indicate the era of history, the change of time-periods and the particular time-period. Historical era are like a dot in the period of king's kingdom. Those points are regarded as dates in history. Historical times-periods is identified as a milestone that we make meaningful through the year. In such a way, we can accurately define the time-location, time-duration and interpersonal time distances. Knowledge of mathematics such as Line-Graph, Histograph, and Circle-Graph etc. helps to make one interested and understand about history.

For example, let's look at the applications of mathematical graphs. Use of Mathematical Line-Graph for understanding the significant historical era.

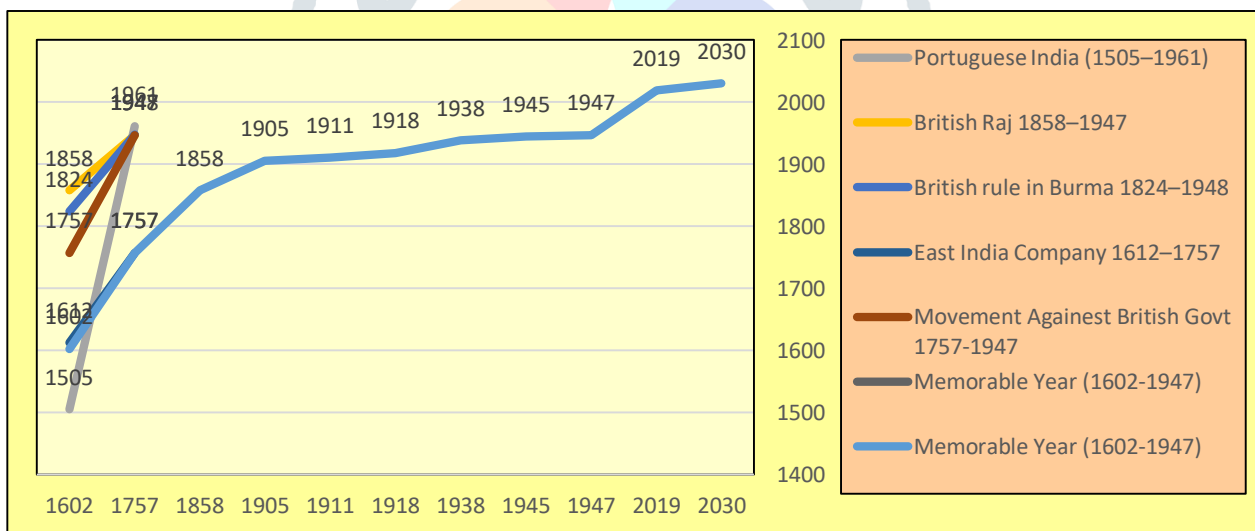Fig. 1: Historical era/ years expressed through Mathematical Line-Graph

Fig. 1: Significant British time period explained by Line-Graph

Significant events of the British period are revealed through a mathematical chart. From this Line-Graph we can understand the historical significance of the dominant India.

4.3.2 Mathematics & Geography:

Many theories of geography are based on mathematics. The application of mathematics is especially seen in establishing various theories or law of economic geography and natural geography. Modern mathematics alone is needed to determine latitude, longitude or local time difference in different countries, sea currents, and river currents, depths of the sea, coal mines and minerals. Among the essential knowledge of a geography teacher's mathematics are Algebra, Geometry, Trigonometry, Probability, Set-Theory, Arithmetic, etc.

Again, if we say ' Orange', that is, in the shape of a flat, we will take the geometric image of an ellipse.

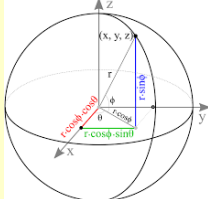Fig. 2: The subject of Geography is expressed through Mathematics.
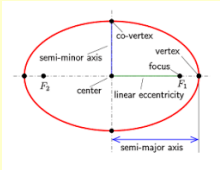
Geographical Figure	Real Example	Mathematical Shape
Earth	Foot Ball	Sphere
Earth	Egg	Ellipse

Fig. 2. : A real example is the geographical shape of the Earth through football & egg. Generalized through Geometric shapes sphere & ellipse.

So it can be clearly said that mathematics is intimately involved with geography. Without the knowledge of mathematics, it is not possible to explain geography in any way.

4.3.3 Mathematics & Fine-Arts:

Artistic works or paintings also show beautiful, balanced expressions of various geometric shapes. Knowledge of geometric shapes and symmetries is required in all aspects. The architecture and sculpture of ancient Greece became famous because of its advanced geometry and its advanced application in Greece. Golden ratios of mathematics are seen in various architectural paintings. People must have geometric knowledge to draw their faces. Again, through the concept of symmetry, we perform different computations. Mathematics dots (Points), Lines, Circles, Semicircles, Quadrilaterals, Rectangles, or different types of Curves, etc. are all used in the art of drawing. For example, the mathematical sense is to be utilized to accurately depict Rangoli, Orli Art, any replicas or landscapes. Now we take an example:

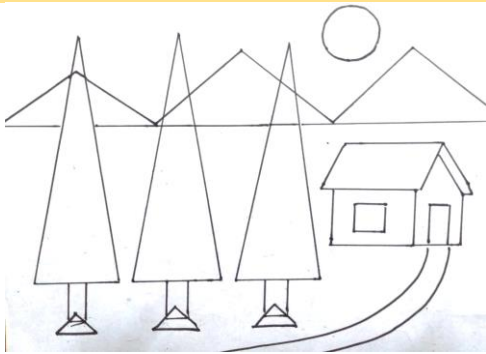Fig. 3: Natural scenario compared with Geometrical shapes.

Real Natural Village	Mathematical Expression
Look at the: Sun, Hills, Trees, Roads, Hut, Window, Doors.	Check: Circle, Triangle, Parallel line, Curve-line, Squre, Rectangle.

Fig. 3: Natural scenario with Trees, Mountains, Sun, House & Roads are similar to Triangles, Quadrilaterals, Rectangles, Squares, Circle, and Straight-lines & Curve-lines.

We now carefully observe the above image of a natural village. As you can see the first picture on the left has a village picture. Looking at the picture to the right, we can understand how the concept of mathematics has been applied here.

4.3.4 Mathematics & Physical Education:

Physical Education and Mathematics are closely related to each other. Health is an asset, so, first of all, we know that health should be kept healthy. Most of the equipment used for gymnastics in the gym is symmetric of some kind of geometric image in mathematics. Such as wheels, dumbbells and rods etc. Mathematics is needed to determine the results of gymnastics or body exercises. The results must be expressed in numbers. It is important to take the help of mathematics to determine the speed of running, the duration of the walk, and the amount of physical exercise. Fig. 4: Equipment of Gym.

The equipment we can see for maintaining physical fitness is due to preparation and the special use of mathematics in shape. Moreover, free-hands exercise also involves the use of mathematical numbers and arithmetic calculations. Yoga education and mathematics are interrelated. There are many patterns found in ancient India. Students should be taught mathematical sense when engaging with practical work. On the other hand, Yoga Education has a good mind and body in meditation and free-hand exercises. This allows students to develop the ability to apply math skills more efficiently, both physically and mentally.

5. DISCUSSIONS:

It is hard to notice that there are many practical activities, but the math relationship with them is very low. In this case, only teachers can help to connect mathematics in different cases. But it is not possible to use mathematics as it would be with the curriculum if it does not add to it properly. Mathematics has not been given clear guidelines for any two years B.Ed. course. This will create a lack of proper math mentality. There is a lack of appropriate curriculum as well as proper Teacher educators. Independent students and teachers have no guidance on reading and writing as well as training. Acceptance of the NCTE guidelines and accept the approved courses of the university as text. What is the mathematical curriculum for students with special students or special needs? Teachers can give guideline-maps about how mathematics can be more enriching and linked to other topics. But in the syllabus, it needs to be mentioned. There are various Mode of Transaction but proper steps or formats are absent. In the two-year teacher training programme, the teaching will be self-fulfilling if you integrating with other subjects. The applications of mathematical knowledge must be accompanied by practical-work according to curriculum. Mathematics has a close connection to History, Geography, Fine-Arts and Physical Education. It is unacceptable that other things will be fulfilled when the correct application of mathematical sense.

6. CONCLUSION:

In the classroom, the simulation activity prevents the creative thinking of mathematical activities (Lithner, 2008). The secondary and higher secondary level math teaching curriculum occurs in three main aspects: domain-specific training, educational knowledge (teaching methods), and practical activities. There is, in fact, no such time that mathematics will be specified. Mathematics is required but will not be used. Mathematics has not been given place in any place in the syllabus. If mathematical knowledge and mathematical usage are mentioned in the syllabus, students will get more importance in mathematics. If you can connect mathematics with the use of technology, mathematics will be more appealing to students. The curriculum will become richer if connecting the experimental work with the practical fields that are in the syllabus.

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