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An Overview of Mathematics Laboratory in School Level Education in Nepal

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Abstract

The article explores the discourse of mathematics laboratories concerning classroom teaching. It focuses on the mathematics teachers' knowledge and awareness about the use of mathematics laboratories and their importance, especially in school-level education in Nepal. The study is descriptive in nature. It is chiefly based on the review of previous literature. This article presents a short glimpse into mathematics education, teaching mathematics, and an outline of mathematics laboratories precisely. It also discusses the different aspects of the mathematics laboratory. The mutual support for transforming knowledge through classroom practice in teaching and learning mathematics to overcome the constraints has also been discussed. Also, it provides ways of sharing experiences by working together with the use of varied modern tools and technology in the classroom practice that helps to encourage the students to take part in the learning process actively and make them clear different mathematical concepts as well. It also suggests the establishment and utilization of a mathematics laboratory for the concerned mathematics teachers and administrators of the school to facilitate and conduct effective mathematics teaching.

Keywords: *mathematics education, mathematics lab, school-level education, teaching mathematics*

Introduction

Mathematics is a common area of study that everyone needs in life. It is an integral part of the school curriculum almost the globe. It is considered one of the foundations of formal education systems as interdisciplinary languages and tools as well as the study of quantity, structure, space, and change (Roy, 2011). Mathematics is the science of well-defined objects and concepts that can be analyzed and transformed in many ways through “mathematical reasoning” to arrive at conclusions of which we are convinced (OECD, 2018). Coping with life's challenges is an important requirement in all areas of intellectual activity and human development (Ihechukwu & Ugwuegbulam, 2016).

The word "mathematics" comes from the Greek word "mathema" meaning study, science (Richard, 2014) even in classical times; it took on the narrow, descriptive meaning of

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"mathematical investigation". Mathematics is an important subject with broad application in everyday life but is often considered a difficult subject in school (Kaur, 2017). From the beginning of formal education, students begin to develop negative attitudes toward math studies, which gradually turn into a form of mathematical anxiety (Hornigold, 2015). Many students find mathematics a difficult subject (Capuno et al., 2019). Despite the importance given to mathematics, many students struggle to understand the subject (Mazana et al., 2020). According to Piaget (1971), mathematics should be visualized as a means of teaching children to think, reason, analyze and formulate logically, and should be viewed as a companion to all subjects related to analysis and reasoning. In this context, mathematics laboratories can promote mathematical awareness, skill development, positive attitudes, and learning by providing experiences in different areas of mathematics (Capuno et al., 2019). This suggests that the mathematics lab is a very necessary aspect to visualize mathematics so that students can effectively understand the concepts, facts, and principles of mathematics. It also increases student engagement and makes learning practical and easy. The main purpose of this study is to reflect the meaning and definition, purpose, necessity, and importance of the mathematics laboratory, its equipment and materials, installation method, management and maintenance, and the influence of the mathematics laboratory on school education. Before presenting a discourse on the various aspects of the mathematics laboratory, this article introduces the initial plans for mathematics education and teaching to make it clearer and more meaningful.

Mathematics Education

Mathematics education has a high status as a research field. It refers to teaching and learning mathematics to develop a wide spectrum of our lives equipping young people with different skills and solving critical problems in their daily life (Golding, 2018). It is a common platform for better learning and teaching mathematics. This includes teaching, learning, and assessment aspects. Mathematics education, called the history and pedagogy of the field of mathematics, is characterized by an interesting and rich past and a vibrant and promising future (Clark, 2020). Mathematics classes help learners develop mathematical thinking, understand processes, apply mathematics to real-world problems, and foster a positive attitude towards mathematics research (Kunwar, 2019). It is primarily concerned with the actual needs of the individual, society, and human beings as a whole. Therefore, we must pay attention to the needs, hopes, fears, expectations, emotions, etc. of people, whether students, teachers, or researchers. Teaching mathematics is a highly interdisciplinary field by its very nature. This means that a wide range of research methods can be used in the field of mathematics education. The teaching of mathematics has a reflexive relationship with its object of study. These are not considered absolutes, but rather enabling their change and development are multiple goals of the research. Mathematics lessons are, of course, always embedded in diverse cultures and their histories (Dofler, 2003). Mathematics education needs to pay special attention to the perspectives of teachers, their teaching situations, and the constraints they face (Bishop, 1998). Thus, as Kunwar (2019) puts it, the teacher's perspective, his three-dimensional model of mathematics teacher knowledge (content knowledge, pedagogical knowledge, and technical knowledge), makes teachers more knowledgeable and can be effectively communicated.

Mathematics focuses solely on the courses or content and teaching mathematics. It includes general educational instruction, tools, and methods that facilitate practice based on the effective delivery of mathematics instruction. Also, it is a concern to the curriculum and pedagogical decisions (Clements, 2012). Mathematics education focuses on the needs, interests, and potentials of learners in society. As such, it considers psychology, culture, and social aspirations with as much rigor and attention as it does mathematical content and processes

(Lowrie, 2015). It also has a stronger foundation in the field of education than mathematics. It is also closely related to the pedagogical knowledge of mathematics teachers and their content knowledge concerning to contents of mathematics (Fried & Dreyfus, 2014). Teaching mathematics includes not only psychology but also sociology, anthropology, philosophy, and ethics (Lerman, 2014). Of course, the emphasis is on teaching and learning mathematics. As Jorgensen (2014) suggests, we may need to construct a transformative paradigm of knowledge production that completely disrupts current (and past) educational and classroom-based practices. Mathematics education includes a truly engaging and empowering curriculum that can be applied to classroom practice (Wright, 2021). Mathematics education, therefore, addresses not only mathematics teaching methods, but also curricular structures, classroom conditions, teacher perspectives, and other limitations faced in translating knowledge into classroom practice.

Teaching Mathematics

Teaching is an intellectual task and requires expertise, including the substantive knowledge and pedagogical skills necessary for effective delivery (Ball et al., 2008; Suzuka et al., 2010). Paradigms for teaching mathematics in the current context are being re-imagined to help students succeed in life outside of school. In this regard, before teaching mathematics, every mathematics teacher should develop the qualities such as thinking habits, skills, and dispositions necessary to be a successful mathematics teacher. As Ma (1999) noted, teachers need to have a deep, flexible and adaptable knowledge of the mathematical content. As reported by Kazemi et al. (2018), three types of knowledge are essential for teaching mathematics teachers at the school level: knowledge of mathematics, knowledge of students, and knowledge of teaching practice (pedagogy). Mathematics knowledge includes mathematical facts, concepts, procedures, and the relationships between them. Knowledge of mathematics involves reflecting on the goals of mathematics education and provides a basis for identifying and prioritizing those goals. Mathematics teachers should have clear concepts and precise knowledge and skills to solve math problems and tasks (Capuno et al., 2019). Effective teaching depends on a teacher's subject knowledge.

In math classes, student knowledge is a nebulous concept. Student knowledge includes not only specific knowledge of mathematics but also general knowledge of how to learn and develop various mathematical ideas over time (Heather et al., 2008). Also, it includes the student's attitudes toward learning mathematics, their interests, and their assumed state of knowledge about the math problem in question (Capuno et al., 2019). This includes knowledge of specific mathematical concepts and processes and general problems related to the students that have their learning experience. Teachers can understand and learn from students by engaging them and examining their activities and how they understand specific material. Classroom practice or pedagogical knowledge is the source knowledge from which teachers transform knowledge (Heather et al., 2008). This includes knowledge of the syllabus, knowledge of the assignments, the tools, and the selection of appropriate methodologies for teaching mathematics. This is the general practice part of the curriculum and includes a variety of methods, materials, and instructional management for the effective delivery of the subject matter. Teaching practices should cover all students from a variety of educational and other backgrounds.

Similarly, (NCTM 2000, p. 11) provides six core principles of guidance and guidance for imparting mathematics knowledge to school-level mathematics teachers.

- **Principle of Equity:** Good mathematics education requires equal opportunity, high expectations for all students, and strong support.
- **Principle of Curriculum:** A curriculum is more than a collection of activities. It should be consistent, focus on important mathematics, and be articulated

throughout the grade.

- **Principle of Teaching:** Effective mathematics education requires understanding what students know and need to learn, and challenging and supporting them to learn well.
- **Principle of Learning:** Students should learn mathematics with understanding and actively construct new knowledge from experience and previous knowledge.
- **Principle of Assessment:** Assessment should support important mathematics learning and provide useful information for both teacher and student. It should not be made just for students. Rather, it should also be implemented for students to guide and reinforce their learning.
- **Principle of Technology:** Technology is an integral part of mathematics teaching and learning. It influences the mathematics taught and improves student learning.

Therefore, in the current situation, mathematics teachers should consider the above six principles when teaching mathematics in the classroom. All students must have the opportunity and appropriate support to learn mathematics "regardless of personal characteristics, backgrounds, or physical challenges (NCTM, 2000) and focus on conceptual understanding as well as procedural fluency. Where conceptual understanding helps students to avoid the degree of errors in particular and procedural fluency denotes the knowledge of procedures, knowledge of using appropriately, and performing skills flexibly, accurately, and efficiently (Al-Mutawah et al., 2019). Students' motivation and active participation in mathematics classroom learning are essential. Similarly, the use of emerging technology permits the students to focus on mathematical ideas, and reason, and to solve problems in ways that are often impossible without the use of such tools. Evidence flourishes that emerging technologies give rise not only to new ways of seeing and understanding the natural world but also to new ways of being in the world (Oliveira et al., 2019). Such technologies are used as a facilitator for new knowledge and knowledge-making tools for a specific purpose. Such essential tools and technology help to motivate the learner and keep them engaged in the learning process. Research shows that a teacher with a positive attitude toward mathematics can be more successful in knowledge delivery (Kunwar, 2022). Thus a teacher has a positive attitude toward teaching mathematics. In this area, I found a gap regarding the awareness of essential aspects of mathematics laboratory, its importance, and its consequences in teaching and learning mathematics in the classroom at the secondary level. Thus, this study intends to overview the meaning and definition of mathematics laboratory, its purpose and importance, materials, setting, administration, and impact of mathematics laboratory.

Methods and Materials

The methodology of this article is mainly descriptive in nature guided by a qualitative design. In this paper, the researcher has adopted mainly the desk study method to explore the different aspects of the mathematics laboratory. It is based on the desk review of the published and unpublished literature including the World Wide Web. The articles and research of different contexts were reviewed meticulously. The related reference books were also viewed thoroughly and cited carefully including individual views to some extent. This article also consists of some experiences and input of the concerned researcher as a consequence of his long duration of mathematics teaching experiences.

Results and Discussion

The result of the study has been discussed based on the following headings.

Meaning and Definition of Mathematics Laboratory

A mathematics laboratory is a place to learn and enjoy mathematics through informal exploration. The mathematics laboratory goes beyond the place with such materials and exceeds the space where students create experiments, and practice (Ewbank, 1971). He further states that a mathematics laboratory might mean not a place but an environment of reflection and creativity. It is a learning space with different materials where students could come anytime and engage in the activities. Thus, Rathod & Amin (2020) defined a mathematics laboratory as 'it goes beyond the display of teaching material collection that is available to be contemplated. It must be a dynamic space that promotes the exchange of ideas and pedagogical practices in mathematics. A mathematics laboratory is not considered a place (e.g., a computer classroom) but rather a methodology, based on various and structured activities, that aims at the construction of meanings of mathematical objects (Reyset al., 1973). In this way, the teacher facilitates the students in their activity. The facilitation could be done either by probing questions, giving an extra resource, or asking to follow up with other students. In the mathematics laboratory, different kinds of materials are placed to handle or use easily by the students. As defined by Adenegan (2003), the mathematics laboratory is a unique room or place, with relevant and up-to-date equipment known as instructional materials designated for the teaching and learning of mathematics and other scientific or research work, whereby a trained and professionally qualified person (mathematics teacher) readily interact with learners (students) on a specified set of instructions.

Nowadays, the term, mathematics laboratory has been used synonymously as 'mathematics corner'. Indeed, it is not synonymous however mathematics corners can also be used in the lower grades for similar purposes. Where different mathematics equipment and local materials can be kept and can be used when it is needed in classroom teaching. The mathematics corner may contain some of the equipment found in the mathematics laboratory but will not be as full and well organized and assembled as what we found in the mathematics laboratory. According to Dewey (1938), the environment of the laboratory is a workshop in which the apprentices learned by doing, seeing, imitating, and communicating with each other, in a word practicing.

Mathematics laboratory provides an idea or a concept presented in a simple & appropriate form and a way that is suitable to the learner's ability and aptitude to provide the best understanding of it (Bruner, 1966). It is a place where students can explore mathematical objects, shapes, and symbols to learn and verify mathematical facts and theorems through a variety of activities using different materials (Yeasmin, 2018). The constructive activity and the teaching-learning philosophy of the psychologists and educationists like John Dewey (1859-1952), Maria Montessori (1870–1952), John Perry (1850-1920), and Felix Klein (1849-1925) helped to generate and develop the concept of mathematics laboratory. The teaching strategy and methods proposed by them and their reflections on the ways to teach mathematics contribute to this movement to innovate the idea of the school laboratory. The importance of mathematics laboratories has been increasing in recent years. The mathematics laboratory is the area wherein different kinds of teaching-learning materials needed to help the students learn are kept and also the learning activities may be carried out by the teacher or the students themselves to learn and explore the concepts through relevant, meaningful, and constructive activities (Rathod & Amin, 2020).

Purpose of Mathematics Laboratory

The purpose of setting mathematics laboratory in school is to provide the opportunity for the students that they can learn and explore mathematical concepts and verify mathematical facts

and theorems through a variety of activities using different materials. Such activities may be carried out by the students or the teacher. These activities help the learner to explore or learn and stimulate interest and develop a positive attitude toward learning mathematics. It makes teaching mathematics interesting, quicker and easy, and better understanding. The main purposes of the mathematics laboratory that can contribute to the learning of mathematics are as follows:

- To make a clear concept about the abstract mathematical ideas
- To emphasize learning by doing through readily accessible rich manipulative materials
- To develop confidence in students for learning mathematics
- To generate interest and a positive attitude toward the subject
- To make the students divergent thinkers and become autonomous learners
- To make children look for a pattern and make them curious for asking questions
- To provide the opportunity for exhibiting the relatedness of mathematical concepts with everyday life

Need and Importance of Mathematics Laboratory

The essential equipment and materials concerning the mathematics classroom learning activities are kept in the mathematics laboratory. The main aim of the mathematics laboratory is to provide facilities for effective teaching and make learning easier through the use of concrete materials and real objects to grasp abstract mathematical concepts (Rathod & Amin, 2020). It is also expected that the mathematics lab helps mathematics learning quicker and better understanding as well as improving mathematical reasoning. It also makes learning effective and more interesting to the students by adopting the practical way of acquiring knowledge and skills about mathematical contents and facts. It is a multi-sensory approach to learning. So, it enables the students to arouse their interest in mathematics and to apply mathematical facts and principles in actual life (Rathod & Amin, 2020). In developed countries, a mathematics laboratory is an integral part of the curriculum. However, in Nepal, the real practice of mathematics laboratory has not been utilized properly and also not formally provisioned in the school-level curriculum. Some schools and colleges have set up mathematics laboratories in their efforts and initiations. However, the importance of mathematics laboratories is increasing day by day to make mathematics learning effective and learner-centered.

In the present context, the term "laboratory method" is commonly used to refer to an approach to teaching and learning mathematics. It provides the opportunity of learning by doing as well as learning by observation. It is based on the psychological principles of learning. This approach makes the learning process more active, dynamic, interesting, and meaningful too (Rathod & Amin, 2020). In this method, the students can participate actively using manipulative materials and can do group work themselves. The children can also work informally, move around, and discuss and choose their materials and method of attacking a problem, assignment, or task. Some major importance of mathematics laboratories are stated below:

- Helps to create motivation and interest in the students
- Helps to implement students centered methods in teaching mathematics
- Helps to engage the learner with active participation
- Provides the opportunity to learn mathematical facts, concepts, and principles more effectively and clearly
- Helps to promote the creativity and reasoning of the learner

- Helps to create favorable attitudes toward learning mathematics
- Encourages and develops problems solving ability and skills
- Helps to create the math-maniac learning environment
- Helps to reduce the fear of learning mathematics
- Helps to inspire the learner to innovations and explore their potentialities
- Helps to learn students with dyscalculia and learning disabilities.

Materials in Mathematics Laboratory

The major materials that can be used in the mathematics laboratory have been discussed below.

Concrete Materials

Concrete materials can be used to connect with simple arithmetical and geometrical topics such as sticks, pebbles, ball frames, number cards, balances, coins, weights, measuring tapes apparatus, etc. These materials may be wooden, metal, plastic, or made of other materials.

Charts and Papers

Several mathematical charts, graphs, flashcards, etc. can be kept in the mathematics laboratory. It can be used to explain different mathematical concepts, drawings, pictures, numbers, numerals graphs, charts, etc. Charts and paper can be used for different purposes. It can be used for paper folding, drawing, designing, making charts and graphs, and other different topics of percentages, fractions, averages, and statistical data also can be presented. Similarly, pins & threads, chart papers, glazed papers, sketch pens, and other stationery are also kept in the mathematics lab.

Pictures and Photographs

The pictures and photographs of various mathematicians, their prominent work, and historic events are important and displayed in the mathematics lab. It may be much more useful if the contributions of these mathematicians are also indicated on such charts which help to inspire the learner.

Models

Several mathematical models such as triangles, squares, cylinders, pyramids, solids blocks, and different Geometric shapes or solid shapes real or models, etc. can be kept in the mathematics laboratory. These models help the learner understand abstract mathematical concepts and principles.

Materials concerning Mathematics and other Subjects

The equipment or materials that are used in other subjects and also related to mathematics illustrating the application of mathematics like a Barometer, Hydrometer, Weight Machine, Pendulum, Geo-board, Rubber Band, Bulletin Board, Whiteboard, Measuring Tape, Workbooks, Textbooks, Teacher's books, Curriculum, Teaching Manuals, Flannel Boards, etc. are also kept in mathematics laboratory.

Proportional Dividers, Slide Rules, and Calculating Machines

The most useful instruments in the study of geometrical shapes and figures are also kept in a mathematics laboratory. Such instruments can use to magnify or reduce figures, graphs, maps, etc. Slide rules are quite useful in mathematical calculations. Training in mathematical calculations can be provided by using simple calculating machines.

Survey Instruments

The work associated with the survey is also related to the field of mathematics. The instruments used in a survey like an angled mirror, plane table, level meter, hypsometer and clinometers, and transit also are kept in a mathematics laboratory.

Overhead Projector and Projective Aids

Different projective aids and projecting devices such as magic lanterns, epidiascope, transparencies, film-strip projectors, etc. should also be kept in the mathematics laboratory. The overhead projector is an important electronic teaching aid that projects an image from transparency. The picture and the information of transparencies are reflected on a screen.

Computer and other Electronic Devices and Software

Computer and mathematics software are the best things for teaching mathematics in the 21st century that can be used quite efficiently. Computer software, audio-visual instructional materials such as projector, electronics board, radio, television set, tape recorder, videotape, etc. These applications not only solve mathematical problems easily but also help to learn the subject deeper as well as better. There are various mathematics softwares online and offline related to mathematics teaching and learning. Among them, most of the software is useful to learn mathematics in a much easier way. Such as Math for Child, Math Practice, Talking Math, Mathematica, Mathalicious, Matlab, Geogebra, etc.

Setting Mathematics Laboratory

The setting of a mathematics laboratory depends on the size, design, and general layout of the laboratory room. The schools may change the design and general layout to suit their requirements. The setting of the laboratory also depends upon the available equipment, materials, and furniture. The setting of the laboratory is not a permanent matter but it can be changed according to the needs and desire to meet its requirements. However, the laboratory room should be spacious, lighted, and well-ventilated the safeguard the materials and manage the equipment and materials properly for the ease carry out different activities like group work and other presentations (Rathod & Amin, 2020). The arrangement of the materials should be managed properly so that everyone can easily find and use the materials and equipment. The quantity, quality, and size of the furniture should be appropriate according to the size of the laboratory room and the number of students in the classes of the concerned school. Some furniture is also required to keep the essential equipment, raw materials, and other necessary things as well as to carry out the teaching-learning activities effectively. The way setting mathematics laboratory to manage remarkable and setting with a catalog, we can follow the list of activities.

- Identify the materials by labeling them with name tags required in the laboratory
- Put the electronic and non-electronic equipment or materials in different places. viz. geometric objects should not be placed with audio-visual materials
- Put the concrete materials on one side and other semi-concrete materials on another side
- Put the bulletin board close at the entrance door for the effective display of the information
- Make arrangements for the benches and tables to allow for free movement in the laboratory
- Keep the relevant pictures and charts on picture handrails and boards with non-overlapping

- Keep the whiteboard fixed position so that every student can freely see it
- Make properly partitioned or safe enclosures for keeping portable and dedicated materials
- Keep electronic display materials such as projector, television, computer, etc. to see easily by each student properly
- Make proper electrification for lighting as well as comfortable and safe use while operating electronic materials
- Display small materials on tables in a certain order and organized manner
- Set the laboratory room with well-ventilation as well as air circulation
- Keep handy materials in a cabinet or separate shelve that can be easily destroyed
- Arrange the materials safely in their respective places like tables, shelves, boards, etc. in such a way that they can be easily accessed when needed and returned appropriately after the use
- Keep the local, low-cost, and no-cost materials aside from the laboratory
- Keep heavy materials in the lower part of the rack or on the floor level of the laboratory room.

Administration and Maintenance of Mathematics Laboratory

The effectiveness of the mathematics laboratory depends on administration, management, and proper maintenance. The mathematics laboratory should be managed to care for, maintain and execute by trained personnel (laboratory assistants) with adequate knowledge about handling the laboratory and with great eagerness to work with students. He/she is also expected to have special skills and interests to carry out practical work in the subject. When the concerned mathematics teacher accompanies the class to the laboratory then the teacher and the laboratory assistant could jointly conduct the desired activities (Rathod & Amin, 2020). The teacher or the laboratory assistant needs to develop familiarity and adeptness with their students. As stated by Rigby et al., (2018) mathematics laboratory requires skilled facilitation to engage the students in activity and to elicit their ideas. They further state that the students can pursue more complex and persistent problems of practice, develop more coherent instructional practices within and across grade levels, and tackle emerging questions about student learning.

Laboratory assistants with appropriate qualifications and preferred knowledge in the subject can be an extra benefit for the mathematics knowledge transformation. The time allocation for the laboratory depends upon the subject matter (contents) and the level of the students. It is generally about 15% - 20% of the total available time for mathematics class and can be used in the learning activities in the laboratory (Anaduaka & Sunday, 2021). The total available time for mathematics class can be divided cautiously considering the theory classes and practical work.

The attractive and well-managed setup of the laboratory also motivates the learner and helps to create constructive, explorative, and logical skills and understand the basic concepts of mathematics (Rathod & Amin, 2020). The provision for visiting and working with the students in the laboratory individually or in a group should be allowed within school hours. The management and maintenance of the laboratory are equally important. Thus it is necessary to record the all equipment and materials available in the laboratory. The record of the visitors as well as students and teachers should also manage and a suggestion book should be kept for the visitors for the betterment of the laboratory. The equipment and materials should be up-to-date and also added and upgraded too if it is necessary. The laboratory assistant should be prepared

and submitted the technical report to the mathematics teacher and school administration regularly.

Impact of Mathematics Laboratory

Mathematics laboratory provides a learning opportunity not only for the teacher but also provides from peers. It helps the teacher to deliver the class by working together with their students in a creative way. To support learning from the classroom experience, the work in a mathematics laboratory is organized around a learning cycle with four phases: learning together, co-planning a lesson, enacting the lesson, and debriefing together (McDonald et al., 2013). In this learning cycle, the students learn in a group, plan the lesson together, act and perform an instructional activity that provides the practical means for focusing student and teacher learning together, and at last, they also debrief together (Rathod & Amin, 2020). Throughout these classroom presentations, teachers experiment together with new teaching practices and learn together about students' mathematical thinking. As stated by Fernandez (2002), teachers spend time together in classrooms. However, in a mathematics laboratory, teachers work together to experiment with instruction during both planning and classroom enactment by collectively discussing instructional decisions at the moment (Gibbons et al., 2017). Thus mathematics laboratory helps the teacher to modify their role as the facilitator that might play in supporting them to collectively learn in and from practice. Hence the mathematics laboratory may have an impact on the teacher's role, teaching strategy, students' assessment technique, and classroom instruction. Some impacts of mathematics laboratory are as follows:

- It shifts the teacher as a learner in the classroom, which enables the teacher to see their learners in new ways
- Its focus on instructional activities that support teacher and makes them feel more prepared for implementation in their classroom and to develop a sense of alignment with their colleagues
- Mathematics laboratories may influence the students and teacher on activity-based learning rather than the traditional teacher-centered method
- It makes the teacher a supportive role play or a facilitator and makes the students a major part of the learning process
- Learning may be easier and more permanent due to activity-based learning and more time consuming
- The teaching activity plans are collectively created and possessed by the participating teachers
- It helps to create a positive attitude toward learning mathematics in both students and teacher
- It helps the students to develop to work in a group, collaborate, and socialization
- It helps to develop problems solving skills and encourages the students to promote creativity
- It helps the students to motivate for learning and develop cooperation and coordination skills among them.

Conclusion

Education is imparted for achieving certain ends and goals. Various subjects of the school curriculum have different means to achieve these goals. Each subject has certain goals that are

attached and have an expectation to be achieved through teaching and learning of that subject. Thus mathematics education also has certain goals that are also expected to acquire through mathematics teaching and learning. To achieve such goals, like all efforts to achieve equitable learning experiences for students, the mathematics laboratory can be a useful resource if teachers and students are empowered to experience school as a space where their ideas are heard (Yeasmin, 2018). Considering these above all aspects of mathematics laboratory, it can be best utilized as a means of achieving the goals of mathematics education at the school level curriculum. Also, it helps to enhance the activity-based teaching-learning process in mathematics and it can be an essential learning space for the students as well as the teachers.

This study focuses on the initiation of using mathematics laboratories in teaching mathematics at school level education. It revealed that a mathematics laboratory could be an appropriate platform for creating positive attitudes towards mathematics learning as well as promoting active participation in learning mathematics. The study also suggests that only the traditional teacher-centered method of teaching does not facilitate mathematics learning effectively. Thus the use of a mathematics laboratory provides the students to relate their knowledge with real life through active participation. This also impacts on teacher's role, classroom instruction, and student assessment techniques. Hence, this paper strongly recommends to all school-level mathematics teachers and headmasters facilitate the establishment of the mathematics laboratory in their schools and the proper utilization of it in mathematics teaching.

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