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**RESEARCH PAPER**

**Understanding of Students in the Concepts of Geometry at  
Secondary Level District Lasbela, Baluchistan: An Evaluative  
Study**

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**ABSTRACT**

This study investigated the understanding of the students in the concepts of Geometry at secondary level. Geometry as one of the branches of the mathematics has an important in the study of mathematics. In this study 15 (Girls/Boys) schools were selected. Teachers (Male/Female) were 58 and students (Girls/Boys) were 600. The Following Tools used in research (i). Test of students through text book exercises (ii). Test of students through their conceptual understanding (iii). Check list for assessment the physical and learning environment of classroom and school (iv) questionnaire for teachers. These tools were divided in different parts. Researcher has discovered that the factors that are responsible for students' difficulties in learning geometry include: teachers' methods of instruction, lack of proof by students, lack of background knowledge, poor reasoning skill in geometry. Recommendations are formed on the basis of findings of this research study. School Management should give more time to geometry so concepts of Geometry may easy to understand. Lack of Concept building of geometry in early classes is also a big problem.

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**Introduction**

Everybody needs some knowledge of mathematics in one way or the other way. Nevertheless, it has failed that for an ordinary man, knowledge acquired during the primary and middle stage will suffice consequently over making it optional or compulsory at high/ higher secondary school. Students can use mathematical structures, operations, and processes to build a framework and tools for reasoning, supporting conclusions, and clearly articulating ideas. Students gain the ability to utilize mathematics to extend and apply their knowledge in other domains as they understand the relationship between mathematical concepts and everyday situations

and draw connections between mathematics and other topics (M. Goos, C. Vale & Still man, 2017). The activity that generates this new knowledge is known as research. All research is an advancement on existing frontiers of knowledge. It moves us beyond the limits of our current understanding. Both are breaking fresh grounds and improving existing knowledge and the proper functions of research. The research, on the other hand, adds to existing information in a systematic manner. This sense of order should be stressed. Research does not consist of arbitrary and haphazard groupings in pursuit of fresh information. The knowledge that accrues from research is verified and verifiable by anybody who may like to do so (Dalen, 1973).

National curriculum 2006 for mathematics consists of five standards. The competencies are intentionally kept broad as to allow flexibility to the teacher in accordance with their students. Standard-1 Numbers and operations Standard-2 Algebra, Standard-3 Measurements and geometry, Standard-4 Information Handling, Standards-5 Reasoning and logical thinking'. Following that, the benchmarks serve as a roadmap for achieving competencies at a specific developmental level in order to meet the standards. They provide indicators of what to expect from students as they complete each of the five developmental stages, grades I to II, III to V, VI to VIII, IX to X, and XI to XII (Curriculum, 2006).

District Education Department supervised by District education officer (DEO) with two-district officers of education (DOE) male and female. The Department is divided by six circles for management at district level. Each circle's head is called Deputy District Officer Education (DDOE) male and female. Learning coordinators and supervisors male and female are working under the DDOE's. A number of 620 schools are functioning at District Lasbela, above fifty-three thousand students (Girls and Boys) are enrolled in these institutions. There are 45 secondary schools, which are facilitating the students in education. There are 15 girls and 30boys' secondary school out of 45 running under the education department Lasbela. (Census Edu; Dep; 2018)

In this study, the researcher investigated the low understanding of students in concepts of geometry at secondary level District Lasbela Balochistan. The study topic is related with standard-3 of mathematics that is given in the curriculum 2006. In Baluchistan, there are two zones, summer and winter. The institutions are functioning in summer zone or winter zone, the only one board is facilitating them and it conducts the examination at secondary level Balochistan Intermediate and Secondary Education (BISE) Quetta. The summer zone has a time for teaching, which is only five months for grade nine, and seven months for grade ten but the winter zone has a time for teaching nine months for both grade. Lasbela district falls in summer zone, lack of teaching duration effects the performance of the teachers and students.

There is no official consolidated national data on Math's learning outcomes. At the provincial level, only Sindh and the Punjab conduct standardized annual

testing below the Class X (or Grad 10) level. Both those exercises were initiated through donor-funded programs, now they been fully integrated into the provincial architecture (Pakistan Alliance for Math's and Science, 2017).

The Sindh Government has in the last four years carried out annual Standardized Achievement Tests (SAT) to measure learning achievement among students enrolled in public sector schools across the province. Overall, Maths achievements are considerably weak in the province. Mean Scores for various content strands in Maths. Students score highest in information handling, followed by numbers and operations. They perform most poorly on questions related to geometry (Powering Pakistan for the 21st Century, 2017).

The part of geometry takes place at the end of the textbook. The teachers start teaching at the beginning of the textbook when they reach on at the part of geometry, the lack of duration block them to continue. Therefore, this study will aim to highlight some factors relating to low understanding the concepts of geometry in mathematics, which are directly related to the Board of Intermediate and Secondary Education (BISE) Quetta. A number of the findings however may also be useful to educationalists and researchers for further studies. It is acknowledged that order factors, for example, students habits and parental role, may also play a part in the findings presented in this study and it can therefore be seen that further research based on such factors will be required in future with this initial project being used as a foundation. This study will investigate the causes of unsatisfactory understanding of students in concepts of geometry at the secondary level of District Lasbela Balochistan. Based on these causes the researcher will recommend some suggestion for future measures.

### **Literature Review**

Before we start the teaching of a subject, it is important for us to know as to why we are going to teach it. The process of teaching can be positioned on right lines only with the help of clear-cut aims. Aimlessness in teaching would result in the wastage of time, energy and other resources. What should be the aims of teaching mathematics in our schools? The answer requires the knowledge of all the advantages that can be drawn from the teaching of mathematics. The aim is based on the educational values of the subject. Aims help in the realization of the values possessed by a subject. Education is crucial for achieving certain ends and goals. Various subjects of the school curriculum are different means to achieve these goals. The term aims of teaching mathematics stands for the goals, targets or broader purposes that may be fulfilled by the teaching of mathematics in the general scheme of education. Aims are like ideals their attainment needs a long term planning. Their realization is not an easy task. Therefore, they are divided into some definite, function and workable units named as objectives that are those short-term, immediate goals or purposes that may be achieved with in the specified classroom situation. They help in bringing about behavioral changes in the learners for the ultimate realization of

the aims of teaching mathematics. The aims are broken into specified objectives to provide definite learning experiences for bringing about desirable behavioral changes (Sidhu, 2002).

### **Objectives at the entire school stage**

The objectives at teaching mathematics for the entire school stage of secondary may be classified as under:

- i. Knowledge and understanding objectives: He understands the interrelationship of mathematical facts, formulae, principles and process and he understands the theoretical and abstract of mathematics.
- ii. Skill objectives: He develops skill in solving the same problem by various possible methods.
- iii. Application objectives: He learns the application of mathematics in his day-to-day, social, vocational, occupational and recreational life.
- iv. Attitude objectives: He gains confidence and competence in the learning mathematics.
- v. Appreciation and interest objectives: He enjoys mathematics of mathematical problems of every type.

### **Standards and Competencies of Mathematics 2006**

The continuous focus on the content of the mathematics standards is the most essential characteristic of this curriculum. The goal of accelerating the progress of students, through a standard-based program, has a significant impact on the entire curriculum. These standards necessitate the provision of more continued, substantive, more rigorous and more systematic instructions to students. In addition, the benchmarks in each of the content areas are highlighted for elaboration. They show what students should expect at the end of each of the five developmental stages: stage one (grades I to II), stage two (grades III to V), stage three (grades VI to VIII), stage four (grades IX to X), and stage five (grades IX to X) (grade XI to XII). Learning outcomes indicate what students should know and be able to do for each topic at the particular development level (National Curriculum, 2006).

Explained here are the standards and competencies that are highlighted in the document of curriculum 2006. There are five standards of mathematics and the competencies are more explain the standards.

**Standard-1: Number and operations**

**Standard-2: Algebra**

**Standard-3: Measurements and Geometry**

**Standard-4: Information Handling**

**Standard-5: Reasoning and logical thinking**

### **Material and Methods**

The collection and analysis was primarily determined in relation to the contextual settings and the perspectives of the learners. This paradigm allowed the researcher to analyse how grade 09 and grade 10 learners perform on selected geometric tasks and observe how they were progressing of geometric thinking, thus investigating the phenomena of the world and humans. It is with this understanding of my role as researcher that I undertook for this study to explore the grade 9 and grade 10 learners' understanding of basic geometry concepts by using tests and check list.

### **Research Design**

In this section I will first look at the definition of a research design and then explain how this research was designed.

Creswell (2009) defines research designs as plans, strategies and procedures for the research, comprising decisions from the underlying world views to the detailed methods of data collection and analysis. According to Luneta (2013), the research design is a road map of how the research will be conducted. The research design includes the method to be used, the data to be collected, where, how and from whom the information will be collected as well as the circumstances under which the information will be collected. The decision for using specific research design, as stipulated by Creswell (2009), is influenced by the world views and assumptions of the researcher, personal experiences of the researcher, audience of the study, nature of the research problem, research strategy and methods of data analysis and interpretation. Similarly Schulze (2003) views research design as the choice of research strategy and methods based on the researcher's opinion on how solutions to the research problems may be obtained.

The data of this research is contained within the understanding of the learner participants and the researcher engaged them through conceptual understanding test and text book concepts understanding test. The intention of this research was to gather data regarding the perspectives of research participants on their understanding of geometric concepts. The study was quantitative and qualitative one, aiming to understand the meaning which informs the human behavior and it was carried out in a naturalistic setting.

### **Strategies**

**Data collection procedure:** The researcher personally collected the data with the help of questionnaires of teachers, student testes and check list for assessment class room

learning/ physical environment with the help of the head teachers. These information Performa collected for those schools which were selected by randomly. All the teachers and students were promised that all the information will be kept secret.

**Data analysis procedure:** The questionnaires of the teachers, student testes and check list data collected and the data presented in form of tables after editing. Different statistical tests applied to make the interpretation of the data easier and data will be presented in graphics.

### Results and Discussion

- The teachers (65.5%) disagreed with regards to the providing geometrical equipment's to teachers for teaching of geometry, whereas, some of the teachers (34.5%) agreed.
- The teachers (100%) agreed with regards to students have already some knowledge about the basic concepts of geometry whereas none of the teachers (0%) disagreed.
- The teachers (44.8%) not assured with regards to students have a clear knowledge about point, line segment and ray whereas, some of the teachers (29.3%) agreed.
- The teachers (41.4%) disagreed with regards to students can draw the angles with the help of protractor and compass whereas, some of the teachers (31.0%) agreed.
- The teachers (51.7 %) not assured with regards to student's ability about logical reasoning whereas, some of the teachers (48.3%) disagreed.
- 100% teachers agreed with regards to facing difficulties to develop the knowledge of students in teaching of theorems whereas, none of the teachers (0%) disagreed.
- 100% teachers disagreed with regards to the students have fully knowledge about axiom and postulate whereas, none of the teachers (0%) agreed.
- (100%) teachers disagreed with regards to there are two methods of logical reasoning inductive and deductive students can easily use these logical methods to solve the problem whereas, none of the teachers (0%) agreed.
- 81.0% teachers disagreed with regards to Students know about the elements in proving a geometrical theorem whereas, some of the teachers (19.0%) undecided.

- 100% teachers disagreed with regards to the students use distance formula to show that the given three or four non collinear points whereas, none of the teachers (0%) agreed.
- 100% teachers disagreed with regards to the students apply distance and midpoint formula to solve /verify different standard results related to geometry
- 81.0% teachers agreed with regards to the students can easily use geometrical equipment's to draw the different shapes of geometry whereas, some of the teachers (19.0%) undecided.
- 84.5% teachers agreed with regards to the students can draw the different kinds of triangles, square and circles etc. whereas, some of the teachers (15.54%) undecided.
- 82.8% teachers agreed with regard to the geometry is more difficult than other concepts of mathematics whereas, some of the teachers (17.2%) disagreed.
- 81.0% teachers agreed with regards to the students can draw a geometrical shape and they can write the steps of the constructed shapes whereas, some of the teachers (19.0%) undecided.
- 77.6% teachers agreed with regards to the students can provide the informal proof of Pythagoras theorem whereas, some of the teachers (12.1%) undecided.
- 100% teachers agreed with regards to the students can face difficulty / hurdles to understand this concept (Pythagoras theorem) whereas; none of the teachers (0%) disagreed.
- 70.7 % teachers disagreed with regards to the teachers use the supporting material to develop the understanding of the students in that concept (Pythagoras theorem) whereas, some of the teachers (29.3%) agreed.

### **Students' Responses Findings**

#### **Students' Participation**

- Number of seats and percentage of children were seated on bench, desk and mats (chatai), proper seating arrangement encourage participation of students, the black board was amiable in good working order., relevant posters, charts and illustration were displayed properly.

### **Noise Pollution**

- Classroom was safe from noise pollution, classroom environment encourages group work of students, classrooms have enough space for students to move easily, there was no external noise which effects learning

### **Teacher's Attitude**

- Teacher's attitude was friendly and co-operative with students; teacher facilitated the students while working in group, student's participated in learning activities thoroughly, providing time for independent learning to students

### **School Events**

- School holds regular events where the achievements of students were publically recognized and applauded (result day, award/ certificates, trophies), hold regular events like Pakistan Day, Defense Day etc.

### **Positive behavior and learning environment**

- Students' facilitated each other in friendly environment, schools had an effective policy to promote positive behavior in school premises, school had a Code of behavior that was clear to every student

### **School Rules**

- School rules were communicated to students frequently and effectively, staff including non-teaching was fully aware and adopt the school rules, students knew the reason of rules, even effectively communicated to parents/ guardians.

### **Parents/ Guardians**

- Parents/ guardians were regularly informed about the positive behavior of students such as notes, homes, phone calls etc., even Parents/ guardians were regularly got informed of students' unacceptable negative behavior

### **Behavior Modification**

- Students had a clear idea of rewards that can be used for Positive behavior, they had a clear idea of the range of sanctions that can be used for unacceptable behavior, they were aware of the variety of strategies that can be used in that school to address behavior which inhibits teaching and learning, there was a consistent approach to managing behavioral issues in the school, the Code of Behavior is understood and had been adopted by staff



as well, there was a system placed to monitor and review the Code of Behavior regularly

### **Health and Safety Policy**

- There was an effective health and safety policy in the school

### **Seating Arrangement**

- students' were seated according to a seating plan, the chalkboard/whiteboard was easily seen by all

### **Teachers' preparedness**

- teacher recognized academic and behavioral achievements in class, no matter how small

### **Classroom Rules**

Classroom rules were set with consensus and understanding of the students, classroom rules were few in number, clearly worded and regularly used in class, classroom rules were framed positively and reinforced, classroom rules were clearly displayed in the classroom, teacher explicitly enforced the class rules and routines of positive behavior, teachers' had established clear routines for students entering and exiting the room, teachers' had established clear routines for clearing up and ending a class.

### **Reward**

- teacher had high expectations for students, rewards were small and readily achievable for students, classroom rewards were linked to the school's reward system, rewards were awarded fairly and consistently

### **Teaching material**

- teachers' had clearly established routines for gaining students' attention, teachers' had established clear routines for quiet and silent classroom, teachers' had established clear routines for distributing and collecting materials/equipment and changing activities
- in classrooms sanctions were clear to students and appropriate to the unacceptable behavior

### **Classroom Sanctions**

- sanction applied in consistent and fair manner in the classroom, classroom sanctions were related to behavior, sanctions' were easy to comprehend by parents/guardians

### **Awareness of School Rules**

- the rules were communicated to and adopted by all staff members

### **Monitoring**

- corridors and social areas were well supervised/monitored by staff, problem areas were identified and adequately monitored

### **Students' Conflict**

- System were in place for the effective resolution of student conflict
- break and lunchtime systems were acceptable and adopted by all staff
- there was adequate supervision at break and lunchtime
- school environment were pleasant, orderly and safe
- students were felt cared for and valued
- all students were encouraged and supported to achieve their full potential
- students were encouraged to take responsibility for their learning and behavior
- there were effective student welfare policies in this school (e.g. anti-bullying policy)
- there was an effective, relevant and inclusive SEN policy in the school
- behavior issues were addressed in accordance with equal opportunity legislation

### **Conclusion**

The skills that are deemed necessary for survival in the 21st century are critical thinking, creativity, communication, problem-solving, logical argument, perspective and collaboration , these skills are instilled through the learning of geometry. According to geometry is applicable and relevant to employment in

everyday life, other subjects in the curriculum such as science, arts, and technology. Geometry, according to research, has the power to inculcate in kids the necessary life skills; it provides a solid foundation for visualizing arithmetical, algebraic, and statistical concepts.

Geometry is an important part of mathematics curriculum both at primary and secondary level. Despite the importance of geometry in helping students understand the natural world around them, both teachers and students still struggle to grasp the principles in the structure of the solar system, a geological formation, rocks and crystals, plants and flowers, and even animals. Furthermore, it was revealed that the majority of pupils lack the ability to use figure attributes during geometric reasoning.

In Pakistan teachers can also get benefitted from such ideas which other country teachers are using to teach their children. Around the globe teachers are using activities to make things easy and comprehensive to children and also using realistic approach. Teaching geometry is not easy but with the help of appropriate teaching methods it can make easy to understand and student's friendly but the role will be played by teacher in doing so. School management and curriculum wing also can work in this regard but actual role model will be a teacher.

If teachers are almost certain that students are not able to understand geometry concepts and not able to use graph proper, having trouble in understanding the Pythagorean theorem, not able to use reasoning skills in geometry, visualization is a problem it actually showed that teachers are failed in fulfilling their duties in regard with teaching of geometry, teachers are failed in making them understand regarding concept of geometry.

It means some revolutionary steps of teachers training in geometry teaching is needed. Serious steps should be taken and try to grasp the root cause of this problem. Curriculum design team revisit geometry syllabus, adopt some models from around the globe and work on this issues seriously.

### **Recommendations**

Recommendations are formed on the basis of findings of this research study. This is the responsibility of school management that every class should have a big geometry set to make them understand the concept on black board. If school cannot afford many sets in school so they should have one or two sets in school so teacher can use them simultaneously in their classes.

- Time allocation for geometry is also not sufficient math is a subject which has many subjects in it such as Algebra, Arithmetic and Geometry so time allocation of geometry always insufficient because in school most of the math blocks covers Algebra than Arithmetic and in the end very insufficient time allocated to Geometry.

- Because of insufficient time allocation is also a hurdle in concept building of geometry and builds understanding at secondary level. School Management should give more time to geometry so concepts of Geometry may easy to understand.
- Lack of Concept building of geometry in early classes is also a big problem.
- Theorems are started from senior secondary classes in lower secondary classes there is no concept of theorem teaching in school. That's why it takes time in understanding but time allocation is a big constraint in school
- Teaching strategies play a vital role in concept building and understanding of any subject, math and geometry is always a problem for students to understand. In that case if teacher is not using appropriate strategies so it will be more difficult for student to understand geometrical concepts. Teachers should be more careful in adapting teaching strategies to teach geometrical concepts or theorems
- Lack of evidence, lack of perception knowledge, poor reasoning skills, poor understanding of geometric concepts, lack of visualization skills, inappropriate teaching method, unavailability of teaching materials, and gender differences are all common causes of students' difficulties in learning solid geometry.
- Teachers who teach math, Algebra and geometry should understand that these subjects need extra efforts in term of reasoning skills, visualization skills and apperception knowledge so these teachers should spend some time in understanding the concept, enhance their reasoning skills, improve student's visualization skills by doing these tasks properly with evidences and activities students will understand concepts easily.
- Curriculum wing should visit the Math, geometry syllabus and start using such things in early classes so students will have some knowledge about these graph paper usage in upper secondary
- The biggest issue is that in early classes geometry only concern with very simple angles not more than that that's why students face a big trouble in secondary when new and difficult theorems starts, because they have no idea of these theorems in early classes so they start getting scared with them and teachers are also not concerning with these problems of students which makes matters worse
- students encounter geometry problems involving triangles as the class of shapes, they will tend to apply the Pythagorean theorem as a relationship between properties to determine the size of a particular property, and

students' geometrical problem solving is influenced by several factors such as the process of abstraction, reasoning, and the influence of metacognitive knowledge. Teachers should consider all these problems when teaching them so problems may solve or may bring some solutions.

- Teachers' responses revealed that mostly schools have no geometry appliances to draw angles, circles and triangles on board. This is the responsibility of school management to provide geometry box having all appliances so teachers can draw on board for students
- Study results discovered that students are not good in geometrical theorems, mostly teachers agreed that students Pythagoras theorem is a big problem for students to understand and write its statement.
- It is advised to curriculum designers to give more exercises on such topics and also give proper guide lines to teachers so they easily teach them.
- Geometry is a difficult subjects and teachers making it more difficult so it is the responsibility of curriculum designer to give work sheets and different easy steps.
- A proper teacher's guide should provide regarding geometry concepts to teachers.
- School management should arrange Professional development course for teachers regarding geometry concepts and how to teach geometry with fun so they teach it with fun.
- Teachers should try to make geometry concepts and theorem easy and comprehensive so students take interest and can easily understand.

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