Chapter – 5

SUMMARY, CONCLUSIONS, IMPLICATIONS
AND SUGGESTIONS

5.1. Summary:

There was a time when the traditional approach of teaching was adopted by most of the teachers, where the learner used to be dependent only on the lecture delivered by the teacher. They were not exposed to enough practice of speaking on their own and hence the interaction among the students in the classroom was almost absent.

The dynamics of teaching is a crucial factor in how much students learn. Though students’ performance may not be a simple direct consequence of the teacher's teaching act, the latter has a lot to do with classroom learning. Teachers establish the pattern of general conduct during a lesson, while on their part students establish certain types of behaviour to coincide with this pattern. Consequently the students participate to varying degrees in different classes and react differently to different teachers. This combined instructional pattern and student’s participation lead to a specific classroom environment characterized by specific interaction patterns.
Teaching is an interactive process. Interaction means participation of teacher and students in the process of teaching. In this process, teacher influences the students, students also interact with the teacher. Interaction takes place among the students themselves. Also it means in the process of teaching, everybody interacts with every other person involved in the process. It also assumes that classroom interaction is a series of events and that teaching behaviour consists of acts or patterns of behaviours, embedded to the chain of classroom events.

Interaction patterns is mainly achieved by two means of resources: verbal and non-verbal means of expression. Teachers spend a lot of time talking, lecturing, asking questions, giving instructions, responding, reacting and structuring. These are verbal interaction. Interaction is organised around three activities: problematisation, construction and reflection. The teacher is the activation in the process of problematisation and tutor in the process of knowledge construction, taking pupils informal strategies as a starting point for the interactional development of mathematical concepts and insights. It is desirable that teachers give pupils the opportunity to verbalize and justify their solution and stimulate pupils to listen to teach others solutions to compare and criticise these and to ask for clarifications, they should be pushing discourse. In this negotiation of mathematical meaning, pupils construct common knowledge. Classroom interaction thus forms a critical resource for learning.
Interaction is important for all subjects but mathematics is very important. For pupils, interaction in mathematics acquires its meaning through schools content as well as the relationship. In present time teaching of mathematics have become dull because of students having less – interest and the teacher is not able to understand the desires, psychological conciliation and problems of students.

Every practice of mathematics teaching and learning is a locally emerging process with open ends. The course and the results of this process depend on the students and the teachers’ capacities to interpret and influence the interaction in their classroom. Interaction in everyday mathematics classes is a complex issue. Although interaction in the classroom is situated and its source is contingent upon the perception and realisation of those involved.

At the secondary school stage that mathematics come to the students as on academic discipline. In a sense, at the elementary stage, mathematics education is guided more by the logic of children's psychology of learning rather than the logic of mathematics but at the secondary stage the student begins to perceive the structure of mathematics. At this stage the student begins to feel comfortable and ease with the characteristics of mathematical communication: carefully defined terms and concepts, the use of symbols to represent them, precisely stated propositions using only terms defined earlier and proofs justifying propositions.

Interest and good performance in any particular subject depend on understanding of subjects. Understanding, good performance, interest
and selection as a stream of particular subjects depend on interaction between teacher and students. Understanding, good performance and interest in any subject depends on many factors as nature of subject, environment of classroom, teachers’ presentation in subject, matter of subject etc. Classroom interaction between students and teachers is an important factor, but there is no provision for the development of intellectual and thinking skills among students who are given less time for active participation and interaction and the teacher seems to have a very dominant role in the class.

**Need of the Present Study:**

Today's mathematics teachers and researchers engaged in the field of mathematics education complain that student studying in secondary classes often have a poor understanding of basic concepts in mathematics. Fremling and Durrani (1974) reported that students often made gross errors in simple topic. Ogborn (1986) reported his four warns about coming students in secondary schools, they do not know enough, they do not understand what they know, they do not understand what is mathematics and how it works and they are unable to learn effectively by themselves.

At secondary school stage interaction in mathematics classroom is very important. Good interaction in mathematics classroom can help in understanding mathematical concepts, in improving mathematical skills and in increasing mathematical knowledge. Teacher's classroom verbal behaviour affects student's achievement, Good & Brophy (2000). In fact student's opportunity to participate actively in the classroom contributes
to one of the most predictors of student achievement, Berliner & Biddle (1995). Teachers can analyze their classroom interaction in order to obtain information about the chain of events and especially their own acts of teachings behaviour. Teachers affiliate with students and central classroom processes is an important factor in explaining the effectiveness of classrooms for student learning (White 2007, Davis 2003, Pace & Hemmigs 2007). Classroom interaction is the heart of formal system of education. So identification of different commonly used mathematics classroom interaction patterns together with identification of their different characteristics a worth while research enterprise that will help their adaptation for improvement of mathematics.

In present study the researcher seeked to investigate the classroom interaction patterns in mathematics classrooms. With this study it was tried to know teachers’ teaching patterns and interaction between teachers and students. The present study was therefore designed to examine interaction patterns in some selected mathematics classrooms from urban and rural secondary schools taught by male and female teachers. For better understanding of teaching process it is essential to know the interaction situation present in the on going classroom. The study of classroom interaction may improve the quality of teaching simply because it would reduce the gap between intent and action.

**Research Questions:**

- What is the present situation of Cognitive Interaction Patterns in mathematics classroom at secondary level?
• Whether teachers and students in secondary education apply the same frame of interaction to their perception of how teachers relate to student?

• Is there any difference in Cognitive Interaction Patterns between male and female mathematics teachers of secondary schools?

• Is there any difference in Cognitive Interaction Patterns between mathematics teachers of urban and rural secondary schools?

**Statement of the Problem:**

The present research work is entitled as - "Cognitive Interaction Patterns in the Classroom of Mathematics Teachers of Secondary Schools."

**Objectives of the Study:**

Objectives of the present study are as follows:

1. To study the cognitive interaction patterns in the classroom of mathematics teachers of secondary schools.

1.1 To study the cognitive interaction patterns in the classroom of male mathematics teachers of urban secondary schools.

1.2 To study the cognitive interaction patterns in the classroom of female mathematics teachers of urban secondary schools.

1.3 To study the cognitive interaction patterns in the classroom of male mathematics teachers of rural secondary schools.

1.4 To study the cognitive interaction pattern in the classroom of female mathematics teacher of rural secondary schools.
2. To compare the cognitive patterns in the classroom of mathematics teachers of urban and rural secondary schools.

3. To compare the cognitive interaction patterns in the classroom of male and female mathematics teachers of secondary schools.

4. To compare the cognitive interaction patterns in the classroom of male mathematics teachers of urban and rural secondary schools.

5. To compare the cognitive interaction patterns in the classroom of female mathematics teachers of urban and rural secondary schools.

6. To compare the cognitive interaction patterns in the classroom of male and female mathematics teachers of urban secondary schools.

7. To compare the cognitive interaction patterns in the classroom of male and female mathematics teachers of rural secondary schools.

5.2 Findings of Objectives:

Finding related to Objective No. 1:-

The highest percentage of Cognitive Interaction Patterns was found for Presenting function which is 71.29% (TC = 69.54%, SC = 1.75%). It is followed by Reacting (14.29%), Responding (5.22%), Structuring (4.88%) and Questioning (4.31%) are used very low.

Percentage of Questioning was found 4.3% (TC=3.87%, SC = 0.43%) in which Asking narrow thinking type questions was found 3.28% (TC=3.0%, SC=0.28%) and Asking broad thinking type questions was found 1.02% (TC=0.87%, SC=0.15%).
Percentage of Responding was found 5.22% (TC=3.54%, SC=1.78%) in which Responding to narrow thinking type questions was found 2.19% (TC=1.63%, SC=0.56%) and Responding to broad thinking type questions was found 3.03% (TC=1.81%, SC=1.22%).

Percentage of Reacting was found 14.29% (TC=11.42%, SC=1.87%) in which Reacting to maintain the level of participation was found 6.91% (TC=5.57%, SC=1.34%), Reacting to extend the level of participation was found 5.38% (TC=4.40%, SC=0.98%) and Reacting to terminate the level of participation was found 2.0% (TC = 1.45% SC= 0.55%).

Percentage of Structuring was found 4.88% (TC=3.66%, SC=1.22%) in which Structuring through direction was found 1.08% (TC=0.88%, SC=0.20%) and Structuring through pause and silence was found 3.80% (TC=2.78%, SC = 1.02%).

**Findings related to Objective No. 1.1:-**

The highest percentage of Cognitive Interaction Patterns was found for Presenting function which is 68.17% (TC=65.39%, SC=2.78%). It is followed by Reacting (20.46%), Responding (6.12%), Structuring (2.78%) and Questioning (2.51%) are used very low.

Percentage of Questioning function was found 2.51% (TC=2.16 SC=0.35%) in which Asking narrow thinking type questions was found 1.87% (TC= 1.64%, SC=0.23%) and Asking broad thinking type questions was found 0.64% (TC=0.52%, SC=0.12%).

Percentage of Responding was found 6.12% (TC=3.84%, SC=2.28%) in which Responding to narrow thinking type questions was
found 2.02% (TC=1.38%, SC=0.64%) and Responding to broad thinking type questions was found 4.1% (TC=2.46%, SC=1.64%).

Percentage of Reacting was found 20.46% (TC=17.39%, SC=3.07%) in which Reacting to maintain the level of participation was found 7.62% (TC=6.39%, SC=1.23%), Reacting to extend the level of participation was found 10.04% (TC=8.84%, SC=1.2%) and Reacting to terminate the level of participation was found 2.8% (TC=2.16%, SC=0.64%).

Percentage of Structuring was found 2.76% (TC=2.07%, SC=0.69%) in which Structuring through direction was found 0.80% (TC=0.64%, SC=0.14%) and Structuring through pause and silence was found 1.98% (TC=1.43%, SC=0.53%).

Findings related to Objective No. 1.2:-

The highest percentage of Cognitive Interaction Patterns was found for Presenting function which is 69.12% (TC=67.48%, SC=1.64%). It is followed by Reacting (17.78%), Responding (6.37%), Structuring (3.83%) and Questioning (2.93%) are used very low.

Percentage of Questioning was found 2.93% (TC=2.75%, SC=0.18%) in which Asking narrow thinking type questions was found 2.49% (TC = 2.37%, SC=0.12%) and Asking broad thinking type question was found 0.44% (TC = 0.38%, SC=0.06%).

Percentage of Responding was found 6.37% (TC=4.27%, SC=2.1%) in which Responding to narrow thinking type questions was found 3.5% (TC=2.64%, SC=0.86%) and Responding to broad thinking type questions was found 2.87% (TC=1.63%, SC = 1.24%).
Percentage of Reacting was found 17.78% (TC=14.4%, SC=3.34%) in which Reacting to maintain the level of participation was found 9.28% (TC=7.64%, SC=1.64%), Reacting to extend the level of participation was found 6.23% (TC=5.37%, SC=0.86%) and Reacting to terminate the level of participation was found 2.27% (TC=1.43%, SC=0.84%).

Percentage of Structuring was found 3.83% (TC=2.78%, SC=1.05%) in which Structuring through direction was found 1.11% (TC=0.94%, SC=0.17%) and Structuring through pause and silence was found 2.72% (TC=1.84%, SC=0.88%).

**Findings related to Objective No. 1.3:-**

The highest percentage of Cognitive Interaction Patterns was found for Presenting function which is 73.07% (TC = 71.84%, SC=1.23%). It is followed by Reacting (10.41%), Questioning (6.13%), Structuring (5.70%) and Responding (4.67%) are used very low.

Percentage of Questioning was found 6.13% (TC=5.65%, SC=0.48%) in which Asking narrow thinking type questions was found 4.63% (TC=4.28%, SC=0.35%) and Asking broad thinking type questions was found 1.5% (TC = 1.37%, SC=0.13%).

Percentage of Responding was found 4.67% (TC=4.27%, SC=2.10%) in which Responding to narrow thinking type questions was found 1.74% (TC=1.33%, SC=0.41%) and Responding to broad thinking type questions was found 2.93% (TC=1.83%, SC = 1.1%).

Percentage of Reacting was found 10.41% (TC= 0.66% SC=2.75%) in which Reacting to maintain the level of participation was
found 5.7% (TC = 4.36%, SC=1.34%), Reacting to extend the level of participation was found 3.18% (TC=2.15, SC=1.03%) and Reacting to terminate the level of participation was found 1.53% (TC=1.15%, SC = 0.38%).

Percentage of Structuring was found 5.7% (TC=5.43%, SC=0.27%) in which Structuring through direction was found 0.96% (TC=0.83%, SC=0.13%) and Structuring through pause and silence was found 4.74% (TC=4.60%, SC =0.14%).

**Findings related to Objective No 1.4 :-**

The highest percentage of the Cognitive Interaction Patterns was found for Presenting function which is 75.04 % (TC=73.68%, SC=1.36%). It is followed by Reacting (8.15%), Structuring (7.41%), Questioning (5.79%) and Responding (3.65%) are used very low.

Percentage of Questioning function was found 5.79% (TC=5.05%, SC=0.74%) in which Asking narrow thinking type questions was found 4.2% (TC = 3.78%, SC = 0.42%) and Asking broad thinking type questions was found 1.59% (TC = 1.27%, SC = 0.32%).

Percentage of Responding was found 3.65% (TC = 2.45%, SC = 1.2%) in which Responding to narrow thinking type questions was found 1.43% (TC =1.11%, SC=0.32%) and Responding to broad thinking type questions was found 2.22% (TC = 1.34%, SC= 0.88%).

Percentage of Reacting was found 8.15% (TC=5.83%, SC= 2.32%) in which Reacting to extend the level of participation was found 4.83% (TC = 3.7%, SC=1.12%), Reacting to extend the level of participation was found 1.94% (TC= 1.08%, SC=0.86%) and Reacting
to terminate the level of participation was found 1.381%. (TC = 1.04%, SC = 0.34%).

Percentage of Structuring was found 7.41% (TC=5.76%, SC=1.65%) in which Structuring through direction was found 1.47% (TC=1.12%, SC=0.35%) and Structuring through pause and silence was found 5.91% (TC=4.64%, SC=1.30%).

**Findings related to Objective No 2:**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding, Reacting and Structuring functions were found 68.66%, 2.72%, 6.24%, 19.07% and 3.3% in mathematics classroom of urban secondary schools respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding, Reacting and Structuring functions were found 74.05%, 5.96%, 4.16%, 9.27% and 6.56% in mathematics classroom of rural secondary schools responsively. The percentage of Responding and Reacting in mathematics classroom of urban secondary schools are relatively higher than that in mathematics classroom of rural secondary schools. The percentage figure of Responding and Reacting in Mathematics classroom of urban secondary schools are 6.24% and 19.07% respectively and same in respect of mathematics classroom of rural secondary schools are 4.16% and 9.27% respectively. As against this percentage of Presenting, Questioning and Structuring in mathematics classroom of rural secondary schools are relatively higher than that in mathematics classroom of urban secondary schools. The percentage figure of Presenting, Questioning and Structuring in mathematics
classroom of rural secondary schools are 74.05%, 5.96% and 6.56% and same in mathematics classroom of urban secondary schools are 68.66%, 2.72% and 3.3% respectively.

**Findings related to Objective No. 3:-**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 70.61%, 4.31%, 5.4%, 15.46% and 4.22% in the classroom of male mathematics teachers respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 71.95%, 4.29%, 5.06%, 13.16% and 5.54% in the classroom of female mathematics teachers respectively.

The percentage of Reacting in the classroom of male mathematics teachers is relatively higher than in the classroom of female mathematics teachers. The percentage figures of Reacting are 15.46% and 13.16% in the classroom of male and female mathematics teachers respectively. As against this percentage of Presenting and structuring in the classroom of female mathematics teachers are relatively higher than in the classroom of male mathematics teachers. The percentage figure of Presenting and Structuring are 71.95% and 5.54% in the classroom of female mathematics teachers and same in the classroom of male mathematics teachers which are 70.61% and 4.22%.

In respect of Questioning and Structuring a similar situation appear to exist in both types of teachers’ classroom. In case of male mathematics teachers’ classroom percentage of Questioning and Structuring are 4.31% and 5.41% respectively while for female
mathematics teachers’ classroom percentage of Questioning and Structuring are 4.29% and 5.06% respectively.

**Findings related to Objective No. 4:-**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 68.17%, 2.51%, 6.12%, 20.46% and 2.78% in the classroom of male mathematics teachers of urban secondary schools respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 73.07%, 6.13%, 4.67%, 10.41%, and 5.70% in the classroom of female mathematics teachers respectively rural secondary schools respectively.

The percentage of Responding and Reacting in the classroom of male mathematics teachers of urban secondary schools are relatively higher than male mathematics teachers of rural secondary schools. The percentage figure of Responding and Reacting in the classroom of male mathematics teachers of urban secondary schools are 6.12% and 20.46% respectively and same for male mathematics teachers of rural secondary schools are 4.67% and 10.41% respectively. As against this percentage of Presenting, Questioning and Structuring in the classroom of male mathematics teachers of rural secondary schools are relatively higher than that of male mathematics teachers of urban secondary schools. The percentage figure of Presenting, Questioning and Structuring in the classroom of male mathematics teachers of rural secondary schools are 73.07%, 6.13% and 5.70% respectively and same for male mathematics
teacher or urban secondary schools are 68.17%, 2.51% and 2.78% respectively.

**Findings related to Objective No. 5:**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 69.12%, 2.93%, 6.37%, 17.78% and 3.83% in the classroom of female mathematics teachers of urban secondary schools respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 75.04%, 5.79%, 3.65%, 8.15%, and 7.41% in the classroom of female mathematics teachers of rural secondary schools respectively. The percentage of Responding and Reacting in the classroom of female mathematics teachers of urban secondary schools are relatively higher than of female mathematics teachers of rural secondary schools. The percentage figure of Responding and Reacting in the classroom of female mathematics teachers of urban secondary schools are 6.37% and 17.78% respectively and same for female mathematics teachers of rural secondary schools are 3.65% and 8.15% respectively. As against this percentage of Presenting, Questioning and Structuring in the classroom of female mathematics teachers of rural secondary schools are relatively higher than that of female mathematics teachers of urban secondary schools. The percentage figure of Presenting, Questioning and Structuring in the classroom of female mathematics teachers of rural secondary schools are 75.04%, 5.79% and 7.41% respectively and same
for female mathematics teachers of urban secondary schools are 69.12%, 2.93% and 3.83% respectively.

**Findings related to Objective No. 6:-**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 68.17%, 2.51%, 6.12%, 20.46% and 27.8% in the classroom of male mathematics teachers of urban secondary schools respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 69.12%, 2.93%, 6.37%, 17.78%, and 3.83% in the classroom of female mathematics teachers of urban secondary schools respectively.

The percentage of Reacting in the classroom of male mathematics teachers is relatively higher than that in classroom of female mathematics teachers. The percentage figure of Reacting in the classroom of male mathematics teachers of urban secondary schools is 20.46% and same in classroom of female mathematics teachers which is 17.78%. As to Questioning and Responding the magnitude of difference is of a very marginal nature. In case of classroom of male mathematics teachers Questioning and Responding are 2.51% and 6.12% respectively while for classroom of female mathematics teachers Questioning and Responding are 2.93% and 6.37% respectively. In respect of Presenting and Structuring also a similar situation appears to exist. In classroom of male mathematics teachers, percentage of Presenting and Structuring are 68.17% and 2.78% respectively while in classroom of female
mathematics teachers percentage of Presenting and Structuring are 69.12% and 3.83% respectively.

**Findings related to Objective No. 7:-**

Percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 73.03%, 6.13%, 4.67%, 10.41% and 5.7% in the classroom of male mathematics teachers of rural secondary schools respectively and percentage of Cognitive Interaction Patterns for Presenting, Questioning, Responding and Structuring functions were found 75.04%, 5.79%, 3.65%, 8.15%, and 7.41% in the classroom of female mathematics teachers of rural secondary schools respectively.

The percentage of Reacting in the classroom of male mathematics teachers is relatively higher than that in classroom of female mathematics teachers. The percentage figure of Reacting in the classroom of male mathematics teachers of rural secondary schools is 10.41% and same in the classroom of female mathematics teachers which is 8.15%. As against this percentage of Presenting and Structuring in the classroom of female mathematics teachers of rural secondary schools are relatively higher than that in classroom of male mathematics teachers of rural secondary schools. The percentage figure of Presenting, Questioning and Structuring in the classroom of female mathematics teachers of rural secondary schools are 75.04% and 7.41% respectively and same for male mathematics teachers of rural secondary schools are 73.03% and 5.70% respectively. In respect of Questioning and Responding a similar situation appears to exist. In classroom of male
mathematics teachers, percentage of Questioning and Responding are 6.13% and 4.67% respectively while in classroom of female mathematics teachers percentage of Questioning and Responding are 5.79% and 3.65% respectively.

5.3: Conclusions:

Based on the results it could be concluded that most dominant function of Cognitive Interaction Patterns was Presenting under teacher category and students play a very passive role in classroom. It meant that most of the teaching learning time was devoted to presenting information by the teacher.

Teaching is dominated by presenting information by teacher with more than half of classroom interaction time occupied by direct instruction. Consequently the time left to student engagement is limited and in some classroom restricted to low level mechanical response to teacher question. In all components of Cognitive Interaction Patterns percentage of teacher category (TC) are relatively higher than student category (SC). It means that the students’ participation were not sufficient in total teaching learning process. The students were not active enough in the classroom interaction. The classroom activities were still in teachers dominant. Teacher spent the most their teaching time in explaining, lecturing and demonstrating the materials to the students. The result also reflected that the teacher and students spent a little time in Questioning and Structuring. The teacher rarely classified
or developed ideas suggested by a student. The students rarely turn things around by asking questions.

The initiative behavior patterns in respect of all the categories of mathematics teachers show a very high tendency to initiate talks and indulge in lecturing behavior, which is the usual traditional practice in schools.

In case of overall mathematics classrooms, the highest percentage of cognitive interaction patterns was found for Presenting function. It is followed by Reacting, Responding, Structuring, and Questioning, which are used very low. This sequence was also found similar in the classroom of male mathematics teachers and female mathematics teachers of urban secondary schools.

Percentage of all functions of Cognitive Interaction Patterns in the classroom of mathematics teachers of urban and rural secondary schools were not found similar but percentage of all functions of Cognitive Interaction Patterns were found similar in mathematics classroom of male and female teachers. Highest percentage was found for Presenting function in mathematics classroom of male and female teachers but lowest percentage was found for Structuring and Questioning in mathematics classroom of male and female teachers respectively.

The highest percentage of Cognitive Interaction Patterns in the classroom of male mathematics teachers of rural secondary schools was also found for Presenting function. It is followed by Reacting, Questioning, Structuring, and Responding, which are used very low. In case of female mathematics teachers of rural secondary schools, highest
percentage of Cognitive Interaction Patterns was also found for Presenting function. It is followed by Reacting, Structuring, Questioning and Responding. Thus it may be stated that highest percentage of Cognitive Interaction Patterns was found for Presenting in both types of male and female mathematics teachers of rural secondary schools.

Percentage of all functions of Cognitive Interaction Patterns in the classroom of mathematics teachers of urban and rural secondary schools are not similar. The percentage of Responding and Reacting in mathematics classroom of urban secondary schools are relatively higher that in mathematics classroom of rural secondary schools. As against this percentage of Presenting, Questioning and Structuring in mathematics classroom of rural secondary schools are relatively higher than that in mathematics classroom of urban secondary schools. Highest percentage for Cognitive Interaction Patterns was found for Presenting function in both type urban and rural secondary schools. Lowest percentage of Cognitive Interaction Patterns was found for Questioning and Responding in urban secondary schools and rural secondary schools respectively.

Percentage of all functions of Cognitive Interaction Patterns were found similar in mathematics classroom of male and female teachers. It varies only between 1% to 2%. Highest percentage was found for Presenting function in mathematics classroom of male and female teachers but lowest percentage was found for Structuring and
Questioning in mathematics classroom of male and female teachers respectively.

Highest percentage of Cognitive Interaction Patterns under teacher category was also found for Presenting. It is followed by Reacting to maintain the level of participation, Reacting to extend the level of participation, Asking narrow thinking type questions, Structuring through pause and silence, Responding to broad thinking type questions, Responding to narrow thinking type questions, Reacting to terminate the level of participation, Structuring through direction, And asking broad thinking types questions are used very low.

Highest percentage of Cognitive Interaction Patterns under student category was found for Presenting. It is followed by Reacting to maintain the level of participation, Responding to broad thinking type questions, Structuring through pause and silence, Reacting to extend the level of participation, Responding to narrow thinking type questions, Reacting to terminate the level of participation, Asking narrow thinking type questions, Structuring through direction and Asking broad thinking type questions are used very low.

The foregoing generalization and conclusions in respect of mathematics teachers of secondary schools indicate an over – dominance of presenting patterns and a tendency towards use of didactic mathematics. It is evident that most of the teachers use behaviour
patterns, which may not encourage discovery learning or preoccupation with enquiry investigative concerns on the part of students of mathematics. It seems worthwhile to suggest that practical workshop training sessions, supplemented with oriented programmes in the newer modes and methods of teaching science should be organized on priority basis. Teachers should be given an opportunity to undergo intensive training in models leading to more and more of discovery learning patterns and divergent or creating behaviour on the part of mathematics students.

5.4: Educational Implications of the Study:

The Cognitive Interaction Patterns are sequential occurrence or proportional occurrence of classroom interaction elements. Thus through interaction patterns one can see the classroom where actual teaching learning take place. This knowledge of interaction patterns may help to develop the 'Theory of Teaching' which is the stage of infancy at present.

Teachers who wish to improve self-development, self-assessment in classroom interaction and especially college students who seek to became teachers can use this information to identify patterns of teaching and then proceed to develop and to control their teaching behavior in a continuing programme of self development. Student teachers, teacher educators and practitioners especially those engaged in supervision may use this result to develop strategies for inculcation of effective interaction patterns and elimination of ineffective interaction patterns.
The result also carry a direct message for all those who are actually interested and engaged in the task of bringing about quantitative change in the conditions of classroom teaching and learning. It would provide the basis for modifying behavior and organizing competency-based teaching programme in respect of the teaching mathematics.

It would provide the basis for modifying teaching behaviour and organizing competency based teaching programmes in respect of the teaching mathematics:

It would also function as mirror to the teachers of mathematics and induce them to changing their own behaviour.

It would help prospective teachers to develop and improve their teaching behaviours and skills so as to become effective classroom managers in the subject of mathematics.

The practice teaching programmes may also be recognized on the basis of the evidence adduced.

For potential researchers in this field, the study would offer a background for conducting better planned researches in respect of classroom observation and interactive processes.

5.5: Suggestion for Further Research:

While completing this piece of research, many new ideas spring to mind which might be the basis for identifying and formulating further schemes of studies. The classroom observations for effective teaching at
any level being a new approach, more endeavors are called for to conduct systematically planned researches in this area.

The following studies may contemplate in the light of findings reported here correlations studies may be planned for various categories of subject teachers with reference to response and initiation modes of behaviour.

1. The classroom verbal behaviour of teachers may be studied exclusively in terms of the class climate and extent of openness available in the structure of classroom organization.

2. Studies may be undertaken to go beyond the verbal interaction by taking into account the full range of classroom events.

3. This study was conducted on secondary schools it can be conducted on higher secondary school level.

4. Only Hindi medium secondary school students of UP Board considered as a population and sample in this study. English medium secondary schools and other boards may be considered for further study.

5. The extent of divergent and convergent thinking potentials in the behaviour of teachers may be analyzed in terms of variables of age, sex and experience.

6. A comparative study may be planned keeping in view the teaching subjects as variables in the areas of science, geography, history and language teaching. It would also be useful to study the
classroom interaction styles of teachers in different academic streams.

7. Classroom internationals styles of mathematics teachers may also be investigated through experimental studies.

8. Other instruments to measure classroom verbal and non verbal behaviours of pupils and teachers may be used to discover other factors for effect teaching that might be useful for practicing teacher.

5.6 Limitations of the Study

1. As the study is conducted only on U.P. board, Its result cannot be generalized to the other boards.

2. Findings of the study are subject to methodological limitations of descriptive research.

3. Findings if the study are subject to limitations of instruments used for qualitative study.