Underpinning Theories of Cooperative Learning Approach in Learning Mathematics

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ABSTRACT
This is a research based article which was carried out couple of years back. Firstly, I introduce the context of this paper. Then, I discuss some theoretical and philosophical foundations of cooperative learning in terms of ontological, epistemological, and axiological viewpoints. Then, finally, I shed light on the research based implications of cooperative learning in the schools and tertiary education followed by a brief conclusion of this article.

Keywords: *Cooperative learning, ontology, epistemology, axiology, theories, principles, outputs of study*

I. INTRODUCTION

My teaching/learning (T/L) experience of more than two decades and the reviewed literatures for my research showed that the students who receive additional education support usually lack the academic skills to be successful within the current school system. Due to the lack of such skills, students seem to be less motivated in the classroom (Maheady, 2001). In this context, application of cooperative learning technique may influence their academic outcomes with enhanced student motivation and participation within the classroom activities. While implementing cooperative learning in the classrooms, the students are divided into small groups and they are encouraged to work together for problem-solving and related mathematical tasks (Johnson, 2006 cited in Kshetree, 2009).The main purpose of cooperative learning is to develop a positive interdependence among the students of different abilities and characteristics by sharing the available resources and working together to achieve the common goals (ibid). Another goal of cooperative learning is to provide students with opportunities to build a team and experience the dynamics of supporting each other in the team (Maria, 2016). While doing this, students as team members take responsibility not only for themselves but for the co-learners for their learning and development

Cooperative learning is a pedagogical process in which the students work together to achieve learning goals within a group which may not be otherwise possible by working on an individual basis (Johnson, Johnson & Holubec, 1986). The beauty of cooperative learning is that it involves students actively in the learning process through empowerment, access, and equity of opportunities to construct their knowledge that makes sense to them. This process also allows students to acquire new knowledge and skills through the deconstruction of established meanings and reconstruct and expand it through shared learning experiences in a social setting.

There is uniformity among scholars in relation to what is cooperative learning and how it functions in an environment. In this context, Ritt (2006, cited in Kshetree, 2012) argues that cooperative learning is a pedagogical approach that employs varieties of teaching/learning (T/L) activities to enhance students' conceptual and procedural understanding of the subject matter by employing a structured approach with series of steps that require students to create, analyze and apply concepts various concepts in one hand and develop a group-dynamics on the other hand. Further, Kagan (1990) emphasizes ideas of Vygotsky, Piaget, and Kohlberg in developing the individual and the social setting for the dynamics of real-life learning. It combines both the individual accountability and team responsibility for acquiring both subject matter knowledge and social skills of students. Cooperative learning method allows students of various personal characteristics such as cognitive abilities, talents, and socio-cultural backgrounds to accomplish the common goal set by the team. The advocates of cooperative learning, Johnson and Johnson (2000), state that team learning promotes more positive attitudes of students towards the instructional experiences than in the individual competitive learning approaches. They claim that cooperative learning should result in positive effects on students' performance and processing and retaining information (ibid). This may further lead to students' critical thinking and meta-cognitive learning strategies. Hence, cooperative learning as a pedagogical approach has many merits over other approaches despite the limitations. This approach is not just a stand-alone method, but it has strong philosophical and theoretical foundations that I would like to discuss in the next sub-section.

II. THEORETICAL FOUNDATIONS OF COOPERATIVE LEARNING

The researcher had undergone to study the different aspects of cooperative T/L methods, which could be the ingredients for the research. There are increasingly recognizing different "forms of doing mathematics" or different "practices of a mathematical nature" or even better, "mathematical practices of a different form" or "mathematics of a different style." But, the researcher must recognize different theoretical frameworks or philosophical systems that support these practices and into which they fit.

Johnson and Johnson (2000) conducted a meta-analysis of the status of cooperative learning in various fields with reviews of 164 studies on cooperative and identified the different characteristics of this pedagogical approach. This review included the studies conducted since 1970 until 2015 of which 28 percent of them were conducted after 1990. Among those studies, about 30 percent of them did not apply random assignment of research participants to the experimental conditions. However, about 45 percent those studies randomly assigned the participants to the experimental or pedagogical conditions, and about 25 percent of them randomly assigned the test groups to the conditions of designed interventions. They further reported that 46 percent of those studies were conducted in the basic education settings, for example, elementary schools. There were about 20 percent of studies conducted in the middle and 10 percent were in high schools. Nonetheless, about 24 percent of those studies were conducted in the post-secondary and adult educational settings.

Many researchers and scholars agree that cooperative learning should be based on a sound theoretical and philosophical foundation. Stanne (2000) agrees that the design and implementation of cooperative learning should be based on a theory that is validated by research outcomes that are operationalized into procedures that other practitioner-educators can use in their context. Hence, cooperative learning as a pedagogical approach is strongly founded on varieties of educational, social, and other theories. According to Upadhyaya (2001), some of these theories come from anthropology and sociology. Others are even related to economics and political science. Among these theories, most of the studies on cooperative learning seem to align with psychology that focus on students' cognitive-developmental, and other behavioral and social learning theories.

Ontology of Cooperative Learning

Poluhoff's (1997) main message is that "With proper resources, all people can learn mathematics", and he strongly claimed, "With enough time and proper methodology, everyone in the class can learn mathematics" (cited in Kshetree, 2012). It gives a hidden curriculum message that mathematics is useful in understanding the world; it is not just pushing around numbers, writing them in different ways depending on what the teacher wants.

It is emphasized that one child simply modeling the other cannot explain subsequent individual progress and become more advanced. But, it has been repeatedly demonstrated that "Two wrongs can make a right" (Glachan & Light, 1981 cited in Kshetree, 2009). It indicates that the knowledge is gained by the action of the learner. It needs coaching rather than teaching, to see and act on own behalf; nobody can see for others, no one can see in teaching which had stroked and pushed ahead to find the source of knowledge. It means students should participate in their own mind in group works.

An equitable learning environment engages students as active participants in mathematics instruction. The students cannot learn mathematics effectively by passively listening disengaged from the learning process. Teachers must provide opportunities for students to construct their own understanding of mathematical concepts (NCTM, 1989). Multiple learning situations must be providing that build on students' prior knowledge and cultural backgrounds. The investigator thought the way out of directly involving in and linking pre-existed knowledge to recent learning in cooperative learning.

So, the ontology of cooperative learning attained that the students cannot receive knowledge as gift passively; despite, they create it by action, as Piaget (1928) claimed. He further added that mathematics' meaning is in the head, so it needs mental action. Piaget (1928) gave the new turning in mathematics learning by challenging to traditional ontology, empiricism and rationalism by bringing in practice the "Action" as the main source of knowledge. Similarly, (Johnson, 2006 cited in Kshetree, 2012) challenged the philosophy of knowledge is a

universal truth and replaced it by working hypothesis. These were those strong platforms, which made the investigator more determined to study in cooperative learning.

Different scholars focused on different aspects of learning. For example, Lave (1991) conceived of learning in terms of participation, whereas Dewey (1964) emphasized pragmatist learning through personal experience. Vygotsky (1978) focused on individual development and learning based on communication in a social setting through peers or group interaction. Such setting provides the learners an opportunity to observe others who are more knowledgeable, imitate their actions, and subsequently develop their higher level of mental functions through processing the information. In mathematics learning, the T/L of mathematics is comprehended at a higher level through mutual interaction by influencing the actions of both the teacher and students at different levels.

According to D'Ambrisio (1976 cited in Kshetree, 2011), ethnography is the source of knowledge even for learning ways. It looked into a mirror and saw nothing-often a change in the culture provides access for students who would otherwise not be full participants in our mathematics classrooms. When students experience mathematics in a classroom as not relating to them or their culture, they may feel invisible and unconnected with the content. Thus, it is believed that the ethnic-source of knowledge can be helpful for learning through social interaction and let them reflect their experience; sharing ideas in task-centric way for solving problems; linking experience, communication, knowledge which able to be rolled; self-discipline, self-motivation, self-esteem, self-management; experiment and the actions in groups which transforms the knowledge from action to mental thoughts and operation which brings students out from egocentrism called decentration (Piaget, 1928).

The theoretical concept of cooperative learning believes in gradual shifting teachers' instructions and clues to small groups. Regarding theoretical bases for cooperative learning, Kshetree (2011) noted that Piaget (1928) and Dienes (1971) have provided a psychological base as learning through mental actions and reflection, Dewey (1964) laid the foundation of the philosophical base as developing working hypothesis and viability (relative, personal and subjective). Similarly, the anthropological base as learning through scaffolding for cooperative learning has been provided by Lave (1991). According to him, learning is meaningful through observation, sharing and teaching peers. He added that Bruner (1990) stressed on social process of learning approach as learning is meaningful when they engage freely in the social process, dialogue and discussion in-group. Moreover, it has exploited the learning ideas of mathematics developed by Piaget, Bruner, and Dienes. According to J. Piaget, there are three learning stages–formal operational, concrete operation and pre-operational. Similarly, Bruner's (1990) learning strategies-symbolic, iconic and inactive, and Dienes' learning levels-formalization, symbolization, representation, generalization, and free play have been framed up as the theoretical concept of cooperative learning.

The main thesis, according to cooperative learning theorists, of this pedagogical approach is that "it is above all through interacting with others, coordinating his/her approaches to reality with those of others that the individual tends towards new approaches" (Doise, 1990, p.46, cited in Kshetree, 2009). Besides, it has tried to grasp the ingredients of knowledge of mathematics like; sharing the ideas from idealism, measuring the world from realism, using viability from experimentalism and choosing and getting autonomy from existentialism for cooperative learning. On the basis of these features, the cooperative learning has been framed up which needs working together, learning together, sharing the observations, finding and describing relationship/patterns, explaining procedures, getting feedbacks, going in conclusion, elaborating and transforming the facts in real life situation (Kshetree, 2012).

Epistemology of Cooperative Learning

This philosophy of learning, which promotes discourse and reflects both Piaget's (1928) cognitive development theory and Vygotsky's (1978) social learning theory. The expectation within this T/L context is that individuals should develop better mathematical thinking by discussing mathematical ideas with peers, giving explanations, responding to questions and challenges, listening to peers, making sense of others' explanations, and asking for clarification of ideas. The use of such conceptually orientated explanations, involving alternative solution strategies, assists in building robust knowledge structures, thus strengthening students' mathematical achievements. In the construction of knowledge, cognitive conflict and resolution are seen as the mechanism for transforming thought (Piaget, 1928; Vygotsky, 1978) those students who participate in the activities and social dialogues of collective discourse are seen to develop higher mental functions more effectively.

The cooperative group has been considered as the unit of classroom learning and evaluating the shifting focus on the emergent properties of the group interaction in a social setting. These emergent properties are not fixed states to be expected in a linear approach but keep shifting and re-modeling the dynamics in between the individuals and groups. These dynamisms can be described with three different theoretical positions: socio-constructivist, socio-cultural and shared (or distributed) cognition approaches. So, the cooperative learning through small-group work experiences helps students explore mathematical concepts in an interactive problem-solving setting. Research carried out by Kshetree (2009) reveals that group interaction or cooperative learning even promotes female and minority student's self-esteem, motivation and achievement. Group interaction also promotes the development of mental operations or processes in students, since students tend to internalize the talk heard in the group (Vygotsky, 1978). Slavin (1995) claimed that when students participate in cooperative learning, their attitudes toward their classmates, particularly those from different ethnic backgrounds, improve student learning to respect other students' points of view and differences.

Thus, by taking turn and listening more to other students can give a reason with respect and positive response to different views. The use of T/L materials helps them to discuss and relate the problems with practical ways by using their brain creatively. They may find the mathematics patterns and learn them from concrete to abstract by calling in action and reflection. They also talk and describe; listen and ask questions to teachers and other group members. While doing this, the students can maintain the discipline of cooperative learning for its tangible result (Palincsar & Brown, 1984 cited in Kshetree, 2009). Also, the students actively contribute to group exploration, and the individuals construct knowledge. Initially, the newly constructed knowledge of the individuals is often diverse, nonstandard and incomplete. Further interaction with the group, however, modifies individual's knowledge structure. Diverse knowledge is homogenized through the group process, especially when group discovery occurs.

Johnson and Johnson (1996) have shown that as groups practice cooperative learning skills, they develop through four stages: forming, functioning, formulating, and fermenting. The 'forming' skills are basic skills required for groups to function and include moving and talking quietly, using eye contact and group members' names, and encouraging all group members to participate. 'Functioning' skills are those skills, which allow greater self-management within the group. Individual members maintain their given roles, all group members are included and encouraged, and the interactions are both courteous and positive. Students use 'formulating' skills to apply and analyze ideas and to ask for and listen to elaborations, justifications, and summaries from other group members. 'Fermenting' skills enable students to integrate ideas to form a concept or general principle. Students with these skills are able to question, critique and evaluate peers' ideas, and develop and integrate the ideas of others into a new concept or application. At this level students are also able to handle controversy in a positive and constructive manner.

In this way, students go through four strategies of 4F (forming, functioning, formulating, and fermenting) that assist in developing group skills and systematize the learning in groups. Further, these strategies frame up the stepwise learning as wait and give individuals time to think for themselves; be specific with feedback and encouragement; give help when asked in the form of a specific strategy, idea or question rather than an answer; and support agreement or disagreement with evidence. Regarding the group works, according to Bruner (1990), the 5E keeps specific meaning in learning as; engage all in the group, explore the idea, explain and elaborate the learning, and evaluate in the group which assists in developing the skills of forming, functioning, formulating and fermenting in order. In conclusion, the cooperative learning is a meaningful approach when there is positive interdependence of the group members with critical thinking and group or peer-wise face-to-face interaction that aligns individual accountability with personal responsibility of the group members for reaching the goals set up by each group (Maria, 2016).

Axiology of Cooperative Learning

The cooperative learning method is founded on the theories of social interdependence, cognitive development, and behavioral learning (Moschkovich, 1999 cited in Kshetree, 2009). As a virtue of cooperative learning approach, his research found four changes in students' behavior: (i) students became more engaged in problem-solving, (ii) students moved from a competitive to a cooperative stance, (iii) students discovered several correct ways of finding a solution and (iv) students code-switched to ensure everyone in the group understood. In addition, two changes in teacher behavior related to cooperative learning were: (i) the regular classroom teacher moved desks from rows to groups and (ii) the teacher became more aware of the students' mathematical abilities. Thus, mathematics educators are shifting away from traditional classrooms to reform-oriented mathematics classrooms that focus on students actively engaged in mathematical discourse in cooperative

settings. As claimed by (Johnson, Johnson, & Holubec, 1986), some researches provide exceptionally strong evidence that cooperative learning may result in a greater team and individual effort to achieve a more positive relationship among the learners with greater psychological health than the general competitive or individualistic setting of learning in the classroom.

Researchers have accepted that the 'social interdependence theory' emphasizes learner cooperation to accomplish a common learning goal. For example, psychologist Kurt Koffka proposed dynamic groups as wholes with interdependence among the members as a variable that contributes to learning at different levels (cited in Lave, 1991). He further stated that interdependence with common goals may provide with the essential elements of a group to function as a team. Such interdependence may create cooperative or collaborative groups which can be viewed as the dynamic wholes. However, according to the cognitive development theory, group cooperation should precede the cognitive growth of each group members. Such growth may spring when individuals in the groups work to attain the common goals. Therefore, both Piaget and Vygotsky focused cooperative learning with cognitively more knowledgeable peers resulting in an effective cognitive development the group members (Johnson & Johnson, 2000). The cooperation among the group members of different abilities not only benefit the member of lower cognitive ability, but it enhances the learning of group member with a higher cognitive level while going through interaction and alternative modes of thinking, reasoning, and problem-solving to support other members.

Similarly, the assumption of behavioral learning theory is that students will work hard on tasks that provide a reward and that students will fail to work on tasks that provide no reward or punishment. Cooperative learning is one strategy that rewards individuals for participation in the group's effort. Further, the interaction among students around appropriate tasks under cooperative learning increases students' mastery of critical concepts. When students interact with other students, they have to explain and discuss each other's perspectives, which lead to greater understanding of the material to be learned. The struggle to resolve potential conflicts during cooperative activity results in the development of higher levels of understanding (Slavin, 1995).

The elaboration theory suggests that one of the most effective means of learning is to explain the material to someone else. Cooperative learning activities enhance elaborative thinking and more frequent giving and receiving of explanations, which has the potential to increase depth of understanding, the quality of reasoning, and the accuracy of long term retention (Johnson, Johnson & Holubec, 1986). It implies that the use of cooperative learning methods should lead to improve student-learning and retention from both the developmental and cognitive theoretical bases.

In this way, the academic benefits due to cooperative learning include higher attainments in reading comprehension and mathematics and enhanced conceptual understanding and achievement in science. Social benefits include more on-task behaviors and helping interactions with group members, higher self-esteem, more friends, more involvement in classroom activities, and improved attitudes toward learning (Gillies, 2002).

Further, in regard to autonomy of T/L in cooperative learning approach, the classroom democracy includes the abolishing all distinctions of colors, caste, creed, and gender and it guarantees equality of opportunities to all (Saxena, 2001). In short, justice, fair play, freedom, equality, and fraternity are the watchwords of democracy. Further, he has given democratic principles in pairs as freedom of expression and publicity, resourcefulness and self-administration, individual and the collective's development. So, it was intuitional to appraise democratic norms and values in cooperative learning-approach because it is white space for connecting teachers with students (guidance platform), self-expression (spot), debating and dialoguing (discussion forum), searching archived knowledge (technology) and learning in a structured manner (tutorials).

As Toulmin (1958) claimed if the mathematics addressed in the classroom is trivial or frustrating, then the vision of mathematical understanding for all will not materialize mathematics and it must be challenging to students, without being discouraging, in order to stimulate engagement (cited in Kshetree, 2012). If the mathematics is trivial or not meaningful to the students, then it may be boring. If it is boring, then the classroom environment will rapidly disintegrate (ibid). Thus, in order to create an environment in which cooperative learning could take place whereas students feel safe, but also challenged at the same time. The groups should be small so that every member can contribute to the task.

The required techniques of cooperative learning to make this possible and effective, all learners should actively participate in the tasks. The teacher also becomes a learner at the same times as the students. The learners may teach each-other and the teacher may learn from their interaction and group dynamics. While working in teams,

respect should be given to every member of the team and the class as a whole. The projects and questions in the tasks should be interesting and challenging to the students. The student diversity is one of the key aspects that should be celebrated by all the members and the whole class. The contributions of each group member are valued high. The learners get the opportunity to develop skills for conflicts resolving when they arise. The group members draw upon their past experiences to build new knowledge (Zakaria & Iksan, 2007 cited in Kshetree, 2009).

In my understanding, in cooperative learning, multi-minds work together in a friendly environment in small groups on a structured activity. They should individually accountable for their work, and the work of the group as a whole should also be assessed. The cooperative groups work together in peers or small groups in face-to-face and all members learn to work on given tasks as a team. In small groups, the learners can share their strengths in different areas and they develop weaker skills by helping each other. While working in a group, they also develop their interpersonal skills together with cognitive and meta-cognitive skills. When the cooperative groups or peers are guided by clear objectives, the learners engage themselves in numerous activities that may improve their understanding of subject matter and the social values of working together. When students experience mathematics in a classroom as not relating to them or their culture, they may feel invisible and unconnected with the content. So, it needs to visualize mathematics with own true participation.

III. IMPLICATIONS OF COOPERATIVE LEARNING APPROACH

Mathematics is a body of the knowledge - the area of science, with its own symbolism, terminology, contents, theorems, and technologies. Students must know lots of mathematical concepts, theories, and relations at a time. They must know the mathematical language but more of them pass their time in listening and reading in terms of writing, thinking, analyzing, and using the mathematical language. As a result, students miss the logical power and they cannot develop the creative power to think. In this situation, theoretical knowledge with rote learning can be found. In this way, mathematics has become a challenging adventure to grasp its concept. By realizing this fact, many more researches have been carried out in the pedagogical sector to make the learning mathematics joyful and meaningful. Out of them, the contribution of cooperative learning has been found to be significant as discussed below.

(i) Systematized group works

While drawing out the teachers' practicum knowledge Doise (1990, cited in Kshetree, 2009) found that through cooperative interactions, students learn mathematics from and with each other as they engage in the following seven systematized group works such as: a) Compare experiences; b) Share ideas; c) Articulate mathematics and their thinking; d) Pose questions); e) Be motivated and gain confidence; f) Gain autonomy; and g) Test understanding (test out thoughts and ideas, compare their work, compare the answers, compare the steps and they promote each other's learning and understanding). The study opined up the ideas about how to filter, promote and consolidate the students' learning behaviors so that cooperative learning could be own business. It helped to determine the working modality of students in small groups. The ideas that I grasped from this literature were about how to organize peer groups' learning business and create the conducive environment for the cooperative learning system.

(ii) Enhanced Self and Team Responsibilities

As Palmer et al. (2003) claimed, "Cooperative learning" is an umbrella term for a variety of educational methodologies involving a joint intellectual effort by students, or students and teachers together. The cooperative learning environment is enriched in team responsibility along with the individual's role in spite of solely individual competitive as claimed by Johnson and Johnson (2000). It was found to be enriched in democratic behaviors (cooperation, freedom, self-administrative, individual development, self-expression, debating and dialoguing, searching archived knowledge and learning in a structured manner, access to learning, partnership, the relationship between students and among colleagues, etc.) as Saxena (2001) claimed.

(iii) Positive Interdependence

According to Jacobs, Wang, Li, and Xie (2008, cited in Kshetree, 2009), positive interdependence plays a crucial role in peer groups where students have a harmonious feeling which is resulted into good support to each other. They are aware of hurting behaviors. It is the "All for one, one for all", "sink or swim together" feeling

that leads they work for common goals. The group is not finished until everyone in the group has achieved the specified goal. Thus, all the peers of the group reach to the level together. There are nine ways to promote positive interdependence (Johnson and Johnson, 2000) such as specified goals, required environmental, designated roles, resources, identified external challenge, rewards or celebration, fantasy, dignified identity and well defined tasks. So, the group members should care upon these matters while working in peer groups.

The study of Glachan and Light (1982, cited in Effandi, 2003) showed the thing that is at stake in cooperative learning is not the imitation from each other but positive interdependence among the members to find answers to the questions with the same level of cognitive development. At the same time when students enter the situation with different viewpoints and perspectives can also be benefitted from the potential conflictual interactions through which they learn to value the differences. These studies also demonstrated that under certain conditions, the group or peer interactions may produce a superior performance of the students.

(iv) Enhanced Students' Motivation

In a study, Gillies (2002) highlighted the effectiveness of cooperative learning on students' performance one year after they were trained to work in cooperative groups. The findings of the study concluded that students in cooperative learning were found to be more motivated, cooperative, assistive and seek help from their peers in the instructional tasks in comparison to those who were not exposed to the cooperative environment. The results also emphasized students' development and use such those skills in learning and supporting each other.

Similarly, in another study, Jenkins, Antil, Wayne and Vadasy (2003, cited in Effandi, 2003) investigated teacher perceptions towards cooperative learning. The findings of the study further showed that cooperative learning improved students' self-esteem with enhanced on-task behavior and academic success and productivity. Additionally, the findings further revealed that cooperative learning provided students an effective alternative means to learn from each other and support in each-others' developing through equal opportunities for all students with higher level of motivation, commitment, and responsibility.

(v) Effective Participation

As Mandl & Renkl (1992, cited in Kshetree, 2011) claimed in his study that teacher expositions are constructed using a variety of teaching strategies including transforming global to local and domain/task-specific explanation; scaffolding; demonstration and teacher or practitioner modeling; questioning and the use of alternatives to questioning. It has been suggested that 10 to 20 minutes is the average attention span; after that, the mind tends to wander. Good expositions are clearly structured. A piece of advice commonly given to peer speakers is: say what you're going to say, say it, say what you've said. In a structured exposition, a teacher or practitioner will indicate the purpose and content. The subject knowledge has an important influence on the quality of teacher expositions. Research indicates that if we know what we are talking about, we are more likely to be able to explain clearly and cope with others' misunderstanding by offering further elaboration. The main ingredient of this literature was to identify the role of learners and their participation while implementing cooperative learning approach in the classroom.

Blaye and Light (1990, cited in Kshetree, 2011) found in their study that it implies such as illustration, example, analogy, and metaphor – helps to understand and develop students by offering alternative ways to view and respond to the information being expounded. Here, the discussion method is an important component of peer teaching/learning because it can: encourage students to ask questions; give them opportunities to explain, clarify and justify their thinking; offer opportunities to assess understanding; strike a balance between teacher or practitioner contribution and students' participation. It has given the ideas about the pedagogical matters of cooperative learning with appropriate illustrations and examples.

(vi) Facte-to-face interaction

Wertsch (1991) found that the teachers' practical knowledge indicated the following five behaviors of the teacher which would facilitate face-to-face interactions that promote learning. They were as: a) Listens and observes (teacher listening conversation and observing process); b) Questions and prompts (questions to facilitate and check for understanding; c) Supports students' thinking; d) Models questioning (teacher using a questioning approach during whole-class instruction that students then mirror i.e. students repeat the same questions in groups); and e) Promotes good peer relations (healthy dialogue through shared questions, seating

plan, voluntary grouping, and peer observations). It helped to ensure students' participation and make the group works effective while conducting the cooperative learning approach among the groups (cited in Kshetree, 2009.

(vii) Structured investigation

According to the study of Riggio et al. (1991), the teachers' practical knowledge indicated that by engaging students in the four learning activities (forming, functioning, formulating and fermenting), they would have opportunities to have systematic investigation in group works (cited in Kshetree, 2009). These four activities are related to the inquiry of the problem-solving process in a given context, inquiry of a new concept from the problem context, going through the practice, and investigations of interrelated concepts or variables through structured tasks or projects.

(viii) Strengthened relationships

Croom (1997), in his research of cooperative learning, found that to support mathematical understanding in the classroom, it needs teachers to be the mediator for encompassing language, communication, relationship, mathematical content, mathematical connections, decision making and equity.

Treniacosta and Kenney (1997) in Diversity in Learning coded that "Mathematical Power for All" cannot be fully realized if the classroom environment limits any child's access to challenging mathematics instruction. If students are to persist in their efforts to make sense of mathematics, if students are to do the work that is an inevitable aspect of under concepts and problem-solving strategies, then each student must feel that his or her response is valued. Its main ingredient was that no one student is exempt from participation; no student is allowed to limit another's efforts to participate, and build team relationship. So, each student is expected to contribute to the problem-solving process (cited in Kshetree, 2009).

The research has found that peer interaction and relation can have a powerful influence on academic motivation and achievement. The research has also suggested that socialization experiences that occur during peer tutoring can benefit both the tutor and tutee by motivating students to learn and increasing their social standing and relationship among peers (ibid). From these kinds of literature study, the research has made enriched in the ways and importance of relation and peer works for meaningful learning.

(ix) Increased Students' achievement

Effandi (2003) studied how cooperative learning affects student achievement and problem-solving skills. The experimental section of the study used cooperative learning approach while the control section applied the usual traditional lecture method. The results of that study also showed that the cooperative group instruction was found to be significantly better than the traditional lecture method in terms of achievement and problem-solving skills. This study also found that students in the cooperative groups had more favorable attitudes towards the group work. The study concluded that the cooperative method was more preferable approach than the traditional instructional technique.

In another study, Azizah (1997) conducted a study on 966 pupils by using Students' Team Achievement Division and they found that the cooperative learning can inculcate values such as independent, love and cleanliness. Another similar study in a Jigsaw model involved 1180 students from 18 schools, concluded that the values of self-dependent, rational, love and hardworking are prominently inculcated. From these studies, it was found that cooperative learning can enhance joyful learning, scientific and social skills promote inquiry learning and the increase in achievements. These things were considered to observe in the study.

Perrault (1983) found that cooperative learning resulted in significantly higher achievement in industrial arts students, especially, at the knowledge and comprehension domains of Bloom's taxonomy, when compared to students taught by competitive methods. In the study, mathematics was taught to both elementary and secondary students using a cooperative learning strategy which found significant gains between the pretest and posttest scores. The researchers concluded that cooperative learning was an effective method of teaching mathematics (cited in Kshetree, 2011).

A study examining the effects of cooperative learning on mathematics achievement of a group of seventh-grade students found that students involved in the cooperative learning performed significantly better than students

who were not exposed to the cooperative learning. In a study comparing the effects of cooperative learning to individualistic learning in a classroom, Johnson and Johnson (2000) found that cooperative learning experiences resulted in higher academic achievement.

IV. CONCLUSION

The reviewed literatures are evidenced that CL approach is figured out as an umbrella of all other methods. CL is a body of concepts and T/L techniques for supporting students to enhance the learning achievements. As mentioned in ontology and epistemology of CL, it has been based on wide range of theories and working principles such as socio-cultural theory, social psychology, Piagetian developmental psychology, humanist psychology, behaviorism, cognitive psychology etc. It has itself many methods where each and every one was found helpful to make the learning creative, stimulating, student-centered, joyful, socialized, team building and meaningful based on learning theory of constructivism.

The main characteristics of CL are social interdependence, cognitive development, learning and changing behaviors, motivational and developmental perspectives for meaningful learning. It has also emphasized the development of positive attitude, promoting peer group tasks, and group work autonomy. It promotes students' activities such as comparing experiences, sharing ideas, articulating mathematics, posing questions, being motivated and gaining confidence, and testing understanding. The cooperative learning environment is enriched in team responsibility along with the individual's role without unhealthy competition. In my research study, the T/L system with CL approach produced intellectual synergy of many minds coming to bear on a problem by mutual engagement in a common endeavor.

In CL approach, students get opportunity of talking turn by turn, listening more, reasoning, respecting and being responsible, using T/L materials, discussing to relate the problem in empirical ways, finding the mathematics patterns, reflection, talking and describing in small groups of like-minded friends. As CL approach is conducted through social activity and teamwork, it requires the true and direct participation of the students on their own behalf with learning alternatives and opportunities. In peer groups, they can be challenged by slightly higher level of questions; as a result, students extended their zone of proximal development as well. CL approach allows students to talk friendly in peer groups and the higher order cognitive talk taken place which promotes higher level of understanding, conceptualizing, and application.

It can be concluded that CL is an umbrella for a variety of educational methodologies that involves joint intellectual endeavor of students and teachers as claimed by Johnson and Johnson (2000). Stanne (2000) claimed that CL approach is considered as a highly productive sector in the area of educational methods for emerging theories, knowledge, practice and researches. Furthermore, the deteriorating situation of T/L mathematics can be improved significantly if teachers develop and use teaching episodes through CL approach. The teachers should also be trained accordingly; if so, the pitfall situation of learning mathematics can be addressed. Thus, it showed with recommendation that the higher level of students' achievements in mathematics can be ensured through mastery of individual as well as team in cooperative learning approach.

V. ACKNOWLEDGEMENT

I am very much obliged to Master of Philosophy program, Faculty of Education, Tribhuvan University for providing me such an opportunity to undertake this research study. I am grateful with coordinator of the program Prof. Dr. Vidhyanath Koirala for his overall cooperation and support for the study. I express my sincere thanks to my supervisor Prof. Dr. Hari Prasad Upadhyay for his outstanding guidance, suggestions and scholarly touch in every corner of this study. My appreciation goes to those sample schools' teachers and students who provided me excellent working environment for this study. Similarly, I am thankful with my all senior professors and colleagues of Department of Mathematics Education for their kind cooperation and genuine feedbacks provided while carrying out this study.

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