

MEKELLE UNIVERSITY



COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES



DEPARTMENT OF CHEMISTRY

ATHESIS

On

EFFECT OF COOPERATIVE LEARNING ON STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY ON THE TOPICS OF CHEMICAL EQUILIBRIUM AND PHASE EQUILIBRIUM: THE CASE OF KELLEM PREPARATORY SCHOOL, KELLEMWOLLEGA ZONE, OROMIA REGIONAL STATE, ETHIOPIA

Submitted to the Department of Chemistry in partial Fulfillment of the Requirements for the Degree of Master of Science in Chemistry.

BY

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APPROVAL SHEET

MEKELLE UNIVERSITY



COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE



DEPARTMENT OF CHEMISTRY

“Effects of cooperative learning on students ‘academic achievement in chemistry on the topics of chemical equilibrium and phase equilibrium: the case of Kellem preparatory school, Kellem Wollega zone, Oromia regional state, Ethiopia”

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DECLARATION

I, the undersigned, declare that this thesis entitled “effects of cooperative learning on students’ academic achievement in chemistry on the topics of chemical equilibrium and phase equilibrium :the case of Kellem preparatory school ,Kellem Wollega zone, Oromia regional state, Ethiopia” is my original work and has not been presented for any other award ,and that all sources of materials used in this thesis are duly acknowledged .This thesis was carried out under the supervision of my principal advisor Dr. Goitom G/Yohannes and Co-advisor Dr. Gebrekidan Mebrahtu , Department of chemistry college of natural and computational sciences, Mekelle university in the academic year of 2025 . .

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ABBREVIATIONS

CG	Control group
CG1	Control group respond on pre-test
CG2	Control group post-test
CGPT1	Control group pre-test scores
CGPT2	Control group post-test score
CGTSD	Control group test score difference
EG	Experimental group
EG1	Experimental group respond pre-test
EG2	Experimental group post-test
EGPT1	Experimental group pre-test scores
EGPT2	Experimental group post-test score
EGTSD	Experimental group test score difference
PKT	Prior knowledge test
MOE	Ministry of education

ABSTRACT

The study investigate effects of cooperative learning on students' academic achievement in chemistry on the topics of chemical equilibrium and phase equilibrium: The case of Kellem preparatory school, Kellem Wollega zone, Oromia regional state, Ethiopia. The study sampled 120 students from two sections one taken as experimental group and the other as control group which are purposively selected from six sections of Kellem Preparatory School grade 11 natural science because of relatively low score in chemistry. The data obtained from 60 students (M=29 and F=31) participated in cooperative learning instruction methods and 60 students (M=30 and F=30) participated in instruction based on regular learning methods, 2 School administrators and 2 Chemistry teachers. The research was used experimental methods, questionnaire and interview for data collection. Data analysis was done descriptively using mean, frequencies, percentages and t-test. A pre-test was administered before the study to identify students' prior knowledge. Sample students score an average academically achievements 60.12% of control group (M=30.06% and F=30.06%) and 60.4% of experimental group (M=29.20% and F=31.20%) before the treatment. A post-test was administered after cooperative learning instruction methods in order to examine the difference in achievements. In the comparison of the post –test of the two groups, the experimental groups were an average of 81.44 % (M=39.36% and F=42.08%) of academic achievements and 62.52% of control group (M=31.26% and F=31.26%) academic achievements in selected topic. The result of study show that cooperative learning instructional methods was better than the regular method of instructional methods in increasing students' academic achievements and promote face to face interaction, creating positive dependence and insuring the active participation of all students in activities.

Key words: Cooperative learning method, Traditional teaching method, Academic achievement

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Chemistry is one of the important science subject taught at upper secondary school level. It is one of the cores Science that students required to pass at high scores to qualify for admission into higher educational level. In spite of this central and important position chemistry among other science and related discipline academic achievements in chemistry at preparatory school is poor .Many factor have been suggested as contributing to this poor achievement of students in chemistry in particular .Some of this factor include: inadequate laboratory equipment, poor teaching methods (Ayogu,2001),mathematical nature of chemistry among others. For the concept in chemistry to be taught effectively to chemistry in upper secondary schools, cooperative (collaborative) learning has been considered relevant and fruitful(Lyman andHarvey,2002).Cooperative learning is model in which students help each other's learning on academic topics by forming small group, self-confidence of individual growth, their skill for communication develop, power of solving problem and critical thinking rises and they actively attend the education period (Eilk, 2005, Lin ,2006).Cooperative learning is teaching-learning strategy in which students work together in small team and use a number of activities to achieve state objective and improve their understanding of the subject matter(San,*et.al.*,2015) Many studies have been conducted in different setting of education, using different kinds of cooperative learning techniques. Such techniques are learning together (LT), jigsaw grouping, teams-games-tournaments (TGT), and group investigation (GI), student teams' achievement division (STAD), and team accelerated instruction (TAI). A series of research studies has found a appreciate relationship between the higher cognitive and affective outcomes and cooperative learning approaches (Johnson and Johnson, 2005: Tran and Lewis, 2012a; Tran and Lewis, 2012b).A study carried out by Anthony (2009) revealed that secondary and upper secondary school students have difficulties in learning certain chemical concepts such as solubility, electrolysis, oxidation reduction reaction, chemical equilibrium and balancing chemical equation To achieve mastering of chemical equilibrium and other concepts in chemistry, several instructional strategies are device over the years. The earliest and the least effective teaching method is traditional method.

Concerning this method, In comparison with cooperative learning techniques, lecture based teaching has been reported to be less effective to the demands of high rates of cognitive and affective outcomes (slavine, 2011). In order to improve students' cognitive outcomes, an alternative to lecture-based teaching could be cooperative learning (Tran and Lewis, 2012a and b). This approach has been reported to improve students' achievement, and their knowledge retention (Johnson and Johnson 2009).

Therefore, Chemistry concept cannot be taught in abstract, students need to conduct themselves in-group and exchange in form of cooperative learning method on any given concept for them to understand better. The concept of cooperative learning is still quite popular with scholars (Slavin, 1990). It is also common held approach in theory, research and education application (Graham, 2005; Maloof and White 2005 and Johnson and Johnson 1999). Recently there has been significant increase in use of cooperative learning which is more efficient than other learning method (Slavin *et.al.*, 1995). Achievement of the student have been found to be enhanced by the use of cooperative learning (Johnson, 1989; Slavin, 1990). The education policy of federal government of Ethiopia highly recommends teaching at all level of students by active learning. But most of the teachers are not appreciate on the advantage of active learning especially cooperative learning. Zehie (2009), who carried out research on the attitude of Ethiopian teachers toward their profession, state that good quality education requires quality of teachers and active learning methods. It will believed that the manner in which the teachers are teaching students become aware of their own learning to think critically and to derive their own pattern of thought meaning from content present through interaction as the result of cooperative learning. The commonly used teaching learning approach in Ethiopia most school use traditional method of teaching like teacher centered approach (lecturing). Even though the student in different institution and school due to different condition the failure rate of students increase from time to time in different area of Ethiopia including our regional state in Kellem Wollega with mostly regard to preparatory school in Chemistry. This may be due to the way of teaching and learning strategy .To decrease student's failure rate, the Ethiopia educational policy design the strategy of active learning with mostly in cooperative learning strategy. To achieve the objective, teachers are expected to implement active learning and student centered approach in classroom (MOE 2010). It is based on these that this research set out to find the effects of cooperative learning method in teaching chemistry lesson would enhance students' academic achievement increase and reduces failure rates in chemistry.

The study will concern on the impact of cooperative learning on students 'academic achievement. The academic achievement in chemistry in Kellem preparatory School is very low compared with other subjects. In addition, the attitude of the student toward learning chemistry is decreasing from time to time and from year to year. Many of the students do not like to learn chemistry. This is because chemistry needs more critical thinking, skill of mathematics, skill of practical work of laboratory and more understanding.

1.2. Statement of the Problems

The purpose of the study was to investigate the effects of cooperative learning instructional strategy on students' academic achievement in Chemistry lesson with reference to grade 11 students in KellemWollega zone. From the researcher experience and observation the students' academic achievements in chemistry are poor relative to other subjects and there is need to explore effective teaching strategies that can be used to improve academic achievements in chemistry.

The problem is the relationship between the academic achievement and teaching methodology style to avoid the problem cooperative learning has been considered relevant and fruitful (Lyman and Harvey, 2002). Therefore the researcher conducted the research whether cooperative learning improves students score.

One of the issues which are always being discussed in the field of education in Ethiopia context is the poor quality of education, may be due to poor curriculum, poor resources and poor quality of teacher. But the reality at the moment is mainly poor teaching methodology which would be the gap that needs to be filled in order to improve the need quality of education. By providing the every existing the curriculum, extensive material, and well qualified teachers, only could not be solved the problem of learning, unless methodology of teaching is appropriate for students.

The teaching methodology is the most influential that can play important role in determining students' academic achievement in Chemistry. But the researcher in this study will try to show it is teaching methods that can have impact on student academic achievements in Chemistry lesson rather than others like curriculum and resources

The academic achievement in chemistry in Kellem preparatory school is very low compare with other subject. This is due to many factors. These are carelessness, lack of experience,

low motivation, and quality of curriculum, time spent on self-study and time spent on additional work.

According to the researcher experience among all other factors, teaching methodology was the main and core problem in chemistry lesson. Many chemistry contents lesson like the atomic nature of substance, atomic structure, chemical bonding and structure, chemical kinetics, chemical and phase equilibrium, solution, acid and base reaction, thermodynamic, and electrochemistry needs critical thinking, skill of mathematical calculation, skill of laboratory work and more practical exercise. Therefore, the teachers should understand about the difficulty of students experience when teaching chemistry .In order to develop effective learning methods teachers and students should overview about active learning with cooperative learning method according to the current situation of Ethiopia for students' learning style. Cooperative learning approach is student centered method of teaching. According to the researcher experience most chemistry teachers in Ethiopia secondary and preparatory schools usually prefer teaching with traditional techniques. They tend to concentrate on solving the problem through algorithmic approaches, rather than concept learning. They may consider that practicing example in this way is the best preparing for the University entrance examination. Additionally the preparatory chemistry curriculum prescribes a lot of material to covered teachers derive the lesson in the form of lecture to covered the annual lesson. This was another perceived as a real barrier to students more understanding. This study found out that, is cooperative learning approach can improve academic achievement of students in Chemistry lesson in the Preparatory Schools of Kellem Wollega?

Research hypotheses

To systematically examine the problem under consideration the following research hypotheses were formulated.

H₀:-Cooperative learning has no significant positive effect on students' academic achievement in Chemistry lesson in the preparatory Schools of Kellem Wollega Zone.

H₁:-Cooperative learning has significant positive effect on students' academic achievement in Chemistry lesson in the preparatory Schools of Kellem Wollega Zone.

1.3. Objective of Study

1.3.1 General objective

The general objective of this study is to investigate the effect of cooperative learning on students' academic achievement of chemistry lesson: the case of Preparatory Schools of Kellem wollega Zone.

1.3.2. Specific objectives

- To evaluate the performance of both experimental and control group by giving a pre-test before intervention.
- To evaluate the performance of both experimental and control group by giving a post-test after intervention.

1.4. Significances of the Study

This study mainly focused on active learning methodology of cooperative learning to improve learning ability in teaching learning process and the finding of this study was expected to have great significance for the teachers to overcome the difficulty of individual difference, weakness and strength among student. So the teachers would get a clear explanation how important of cooperative learning is in ensuring students to achieve better than other teaching method and next teachers can structure the content of teaching hoping that it would help students in building academic high in performances.

This research can also encourage students on the road to identify problems that are created by their learning style and students modify their participation and motivation about themselves for success full quality of education in Chemistry in general and their qualification in particular. More over it can help students develop interpersonal relationship between their partners and apply the principle to other external bodies outside of the classroom.

The research also would help Chemistry teacher especially who teaches grade 11 to make informed decision on appropriate and effective teaching strategies that can be used to improve the students' achievement and motivation of learners.

Furthermore, the finding of this research can serve policy makers to prepare a teacher's code of conduct that would enable them to produce and equip with current effective method of classroom teaching. It also serves as reference for other researcher who wants to conduct research on same area of study. It is wise and appropriate to put focuses of putting efforts in improving performance of students on cooperative learning.

1.5. Delimitation of the Study

This study is focus on effect of cooperative learning on student's academic achievement in Chemistry lesson, of Kellem Preparatory School in Kellem Wollega Zone, Oromia Regional state with special reference to grade 11.

The main reason why research has been focused on Kellem Preparatory School is that the attitude of students toward learning Chemistry and students achievements in chemistry is low when compared with other subject in a view of researcher. This is because Chemistry needs critical thinking, problem solving and skill of laboratory works other than of any subject. More over most students who join higher institution has low chemistry achievements and low interest to learn chemistry with the researcher experience for many years in observing the cultural, economical, political, parental involvements in students learning, difficulty area of students in their study in Kellem Wollega Zone.

Consequently, to improve these situations, the cooperative teaching methods can have some things to do with students academic achievements in chemistry. Here are the delimitations:

1. The subject of the research is Kellem Preparatory School of Kellem Wollega Zone with experimental chosen because the near location ,easy way to do experiments on and help ,observe, teach ,organize, training and doing experiment research on the school. The research has forced to delimit the area of experiment in one Preparatory School with special reference to grade 11 in Kellem Wollega Zone. This is because the data collection process is easier and valid and reliable enough information data would be obtained in save cost and time.
2. The information of research is collected through the sample respondent toward the instruments which is in the form of pre-test, post-test, questionnaire and interview. Therefore, the information is very much depends on how the respondents understand the question, how the respondents give attention to the study and how truly they answer the questions.
3. Another delimitation of this paper is that only two independent variables (control and experimental group) are to be measured to obtain academic achievement in Chemistry the dependent variable, questionnaire and interview for the implementation of cooperative learning.
4. The study has been limited to teachers prepared pre-test, teachers prepared post-test, questionnaire and interview as instruments of data collection because the researcher

believes that by administering these instruments the impact of cooperative learning on students' academic achievement and the implementation of cooperative learning in chemistry lesson information can fully be found.

1.6 Limitation of the Study

The lack of material availability in research area and internet access and local research availability may affect the quality of research.

Few students were not give attention for the experiments in both groups in providing the researcher tangible information on academic achievements and school directors, teachers and students again do not give consideration when conducting the questionnaire and interview and lack of confidentiality even when they provide what they expected.

Although the pretest mean scores of both the experimental and control group show that both groups were academically matched at the beginning of the study, however, individual differences in academic ability cannot be totally ruled out and could have influenced the post-test scores.

1.7 Organization of the study

This study consists of five chapters. Chapter one deals with the problem and its approach whereby, its map out of the background of the problem, statement of the problem, significance of the study, delimitation, limitation of the study and definition of terms. Chapter two treats review of related literature that includes essence of cooperative learning, application of cooperative learning in upper secondary school, benefit of cooperative learning to upper secondary school chemistry students, delimitation of cooperative leaning in instructional method, limitation of cooperative learning, pillars of cooperative learning, theoretical frame work of cooperative learning study. Chapter three describes the methodology, sample and sampling technique, tools of data collection, procedure of data collection and ethical consideration of the study. Chapter four consists of results, discussion, and data analysis and interpretation. The last chapter consists of conclusion and recommendation of the study.

1.8. Definition of Common Terms

For the purpose of this study, the following terms have been defined:

Cooperative Instructional Strategy

Cooperative learning is teaching- learning strategy in which students' works together in small

team and use a number of activities to achieve state objective and improve their understanding of the subject matter (San, *et. al.*, 2015)

Achievement Test

An achievement test aims to assess what knowledge and skills students have learned from a particular course or set of materials. An achievement test is usually directly anchored in course objective (McMillan and Schumacher, 2010).

Traditional teaching

The traditional teaching learning process is setting where the majority of interactions are teacher-centered (Vandat and Ramon, 2012).

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Essence of Cooperative Learning

Cooperative learning can be defined as learning approach in which students help one another on a academic subject in small mixed groups formed both in class and in non- class environment, which helps individual gain more self-confidence and develop their communication skill and problem solving and critical thinking abilities and through which all of the students actively participate in the learning teaching process (Bolling, 1994; Bowen , 2000, Eilks, 2005;Lin , 2006;Gardener and Korth, 1996).

The main aim of forming cooperative group is to motivate the students to take on their learning responsibilities by making good use of social relation between students and their significant effects and to run learning process in a way that is much more complex than is the case in any of other class room model. (Sharan *et al.*, 1980)

Cooperative learning has recently started to gain attention as an alternative to education strategy applied in university and high school. The reason for this attention is that during the group work though the strategies and problem solving method used, students can learn a lot from each other by comparing own perspective with those others and collaborating in providing definition and making decision (Bearison et al , 1986 ; Maloof and white , 2005; Refer son and Jeffery , 2004). Studies that examine cooperative learning methods show that these methods used in both theoretical and practical laboratory setting, can help students improve their academic and social skill by ensuring their active participation in learning process (carpenter, 2003; Johnson and Johnson, 1999; Lord, 2001)

2.2. Application of Cooperative Learning in Upper Secondary School

“It could well be that faculty members of the twenty-first century college or university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments” (Duderstadt,1999). The role of the college professor is changing. While large lecture halls and bell curves have generally characterized higher education, according to Fink (2004) the past twenty years have seen an increase in active learning and cooperative learning based pedagogies in colleges across the country. Fink reports that when asked, most college professors state they have tried structured group

learning in at least one of their classes, at least once throughout the semester (Fink, 2004). As the Constructivist educational paradigm continues to take hold, it is likely that the higher education will continue to make progress in alignment with this movement.

There is also a general confusion as to what the term ‘cooperative learning’ means. Very often, this phrase is a blanket term, applied to any sort of group work or interaction between classmates that results in a product. Educators often operate under the false assumption that putting adults in groups automatically assumes that they are being ‘cooperative’ and that they are ‘learning.’ Neither of these assertions is necessarily true (Johnson and Johnson, 1994).

According to the Cooperative Learning Center at the University of Minnesota, Cooperative learning is a relationship among a group of students that requires five elements: position Interdependence, individual accountability, interpersonal skills, face-to-face Promotive, interaction processing out (Johnson and Johnson, 1994).

From the ‘five pillars’ of cooperative learning which Johnson,(1991) use as their basis for utilizing such practices in the college classroom. Based on Paulsen and Faust’s assertion that there is reluctance among professors to embrace cooperative learning structures, this five pillars approach seeks to provide a complete model for implementing pedagogical change. Examining Dr. Vermette’s actual implementation of this structure will help to bridge the gap between educational theory and actual college teaching.

Being that David and Roger Johnson have been at the forefront of cooperative learning theory for four decades, the five pillars model was chosen for this paper due to its solid foundation in educational research. Johnson, Johnson and Smith (1998) have reported that between 1924 and 1997, over 168 studies have supported the notion that cooperative learning is effective for students over 18 years old. This ‘five pillars’ model for cooperative learning has been well studied and Johnson and Johnson have been at the forefront of much of this research. For the purposes of objectivity however, only cooperative learning research not conducted by Johnson, Johnson and Smith will be considered in the research portion of this piece.

2.3. Benefits of Cooperative Learning to Upper Secondary School Chemistry Students

Cooperative learning is among the most well researched of all teaching strategies. Forty years of research has shown that when compared to other methods of instruction, cooperative learning is one of the most effective ways for students to maximize their own learning and the academic accomplishments of their classmates,(Johnson and Johnson, 1994; Slavine, 1996),

highly structured cooperative learning allows students to develop their own understanding of key concepts all the while encouraging and assisting others.

2.3 .1. Academic benefits

Concentrating on academic achievement at the post-secondary level provides the unique the opportunity to examine the effects of cooperative learning on a population of students who are largely self-motivated and self-directed learners. These students have learned to work and succeed in variety of instructional setting throughout their schooling careers.

Thus, the hundreds of studies showing increased academic achievement using cooperative learning in the preparatory classroom suggest that cooperative learning promotes significant cognitive results even for the most esteemed of student populations. One recent study of nearly 500 undergraduate engineering students from six diverse institutions indicated that cooperative learning produced “statistically significant and substantially greater gains in student learning than those associated with more traditional instructional methods.” Even with differences in pre-course characteristics and learning advantages, levels of understanding and retention still increased in the cooperative learning settings (Terenzini 2001). For decades there have been hundreds of studies, which ultimately have come to the same basic conclusion, post-secondary students learn more, are better able to remember and then transfer their knowledge when taught with the cooperative learning model than other instructional methods (Cooper *et al.*, 1990, Goodsell *et al.*, 1992).

Research has shown that students learn by doing, thinking critically about concepts and then applying their knowledge to diverse situations. In a cooperative learning setting, students must not only articulate their standing to their teammates but also have the luxury of immediate feedback from their peers (slavin, 1996).

2.3.2. Socio-emotional benefits

In 1991, the US Department of Labor conducted a nationwide survey to investigate what skills employers most seek in their new employees. The purpose of this survey was to get the business world’s “take” on what schools could do to better prepare American worker for highly skilled, highly profitable jobs. While technical skills and general intelligence proved important, the skills most often cited were “communication skills, interpersonal skills and initiative” (Dowd and Liedtka, 1994).

In the document from the US state department entitled "What Work Requires of Schools," among the top attributes US employers most desired were:-Sociability- demonstrates understanding, friendliness, adaptability, empathy ,Self-Management- assesses self accurately, sets personal goals, monitors progress, and exhibits self-control, ability to participates as member of a team- contributes to group effort, Ability to exercises leadership- communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies; ability to work with diversity- works well with men and women from diverse backgrounds.

As evident from these demands, knowing content academic is not enough to make today's college graduate competitive in the workplace. No longer can students just have sound academic standing, but they must be taught and have the opportunity to practice the social and personal competencies necessary to survive in the workplace. Research indicates that compared to other forms to instruction cooperative learning helps students become better communicators and listeners, cooperative members of a team and effective leaders (Goodwin, 1999).

2.3.3. Socio- cultural benefits

Much of information about different cultural and ethnical heritage cannot be attained through reading books .Only through knowing, working with ,and personal interaction with member of diverse groups can students really learn to value diversity ,utilizing it for creative problem solving ,and developing an ability to work effectively with diverse peers.

“Understanding the perspective of others from different ethnical and cultural back grounds requires more than information .If requires the personal sharing of view of points and mutual processing of situation . In addition in order to identify with and internalize the values inherent in the society as a whole, Students must work cooperatively with others, build personal and committed relation Ships with peers who are committed to a super ordinate identity as the members of the same society. There is considerable evidence that cooperative experience , compared with competitive and individualistic ones promote more positive , committed ,and caring relation Ships regardless of different in ethnic ,cultural, language ,social class ,ability ,or other differences”(Johnson and Johnson ,2008).

The technology makes its' possible to address learning environment that features integrate and thematic curriculum collaborative learning and emphasizing language acquisition and literacy skill to meet the challenge of cultural and linguistic diversity (Garcia,1994).Some of

the difference cultural diverse learner Experian's are common to all learner and some are specific to cultural diverse group and individuals. Peer pressure example that occur in all group, including students of dominant culture. The socio –cultural approach in his study briefly describes the relationship between “cooperative” and “culture”. Cooperative learning provide structure learning experience that can prepare students for the realities and diversity work place ,work with people with different skill ,cultures, approach from different places ,and develop practical skill in: decision making problem solving ,values clarification ,critical thinking, negotiation and team work as our culture support.

2.3.4. Instructional Benefits

One of the main benefits of cooperative instructional strategy is that it can foster an environment that embraces the great diversity of learners. This viewpoint is found shared by Lord (2001) who claims that cooperative instructional strategy allows learners to share their differences in a positive way and can add value to the team by bringing their different backgrounds to the group.

Van Wyk (2007) emphasized the importance of cooperative instructional strategy and points out that it offers a different paradigm for teaching and learning, because learners discover and construct knowledge. Furthermore, cooperative instructional strategy gives learners the opportunity to develop new talents and skills, and optimizes teaching-learning interactions amongst learners and between learners and teachers.

Another benefit of cooperative instructional strategy lies in the fact that it promotes positive relationships among learners.

Such positive relationships according to Johnson and Johnson (2005) result in an increase in motivation persistence in working toward the shared goals satisfaction, commitment to group goals, productivity and personal responsibility for achievement.

2.4. Drawback of cooperative instructional strategy

One of the main criticisms leveled by opponents of cooperative instructional strategy is that it is too informal to bring about a deep understanding of the subject matter. Others argue that it is too time consuming and disruptive due to the informality of the process (Lord, 2001).

Grouping learners on the basis of academic ability for purposes of cooperative learning could give rise to clash of interest between fast and slow learners. Fast learners might feel that they are being held back by their slower team mates (Woolfolk, 2010). This sentiment is also shared by Sharan (2010) who argued that teachers implementing cooperative instructional strategy could be met with resistance and hostility from learners who believe that they are

being held back by their group members who work slower or by learners who are less confident and feel that they are being ignored or demeaned by their group members.

Some learners may learn to loaf because the group progresses with or without their contributions, others become even more convinced that they are unable to understand without the support of the group, rather than challenging and correcting misconceptions, learners support and reinforce-misunderstanding.

2.5. Pillars of Cooperative Learning

Johnson, *et al.*, (1991) define cooperative learning as “the instructional use of small groups so that students work together to maximize their own and each other’s learning.” Based on their research, they have proposed five essential elements that are necessary to construct effective cooperative learning experiences: positive interdependence, promote face-to-face interaction, individual accountability, social skills, and group processing.

2.5.1. Positive interdependence

Positive Interdependence is the belief that the individual is dependent on the contributions, inclusion, and success of the others in the group in order to be successful. Those with a strong sense of positive interdependence believe that there is value in learning from the ideas and contributions of others and that “group members sink or swim together” (Johnson, 1991). Infusing positive interdependence into group activities ensures that team members have a common goal and that there is an unwavering commitment to the success of group members. As they describe, “if there is no positive interdependence, there is no cooperation”

2.5.2. Promote face to face interaction

As Johnson, (1991) describe, promote face-to-face interaction is a foundational component to cooperative learning. The result of positive interdependence, promote face-to-face interaction occurs when students are given time in class to discuss, ask questions and support each other in the completion of their task. Students must understand that it is not only the final product that matters in cooperative learning but also the ongoing dialogue process that is a critical part of their success. Promote interaction is an essential part of establishing cooperative learning because face-to-face interaction provides the critical verbal and non-verbal feedback needed for group success (Johnson, 1991).

2.5.3. Individual accountability

The students who are understandably concerned about grades must feel that they are individually accountable for their performance in groups in order for cooperative learning to be successful. An obvious issue of concern for students in cooperative learning setting is

‘social loafing’ whereby one student does all of the work while the rest of the group gets a free ride (Johnson, 1991). This complaint however is more an indication of ill-defined and unstructured group work, not ‘five pillars’ based cooperative learning (Tannen et al., 2003).

2.5.4. Social skills

Much to the dismay of educators, placing students in close proximity to each other with a task to accomplish does not ensure cooperative learning will take place (Johnson and Johnson, 1994). Often it is not a matter lack of interest or defiance, but rather students do not have the social skills necessary to work effectively with others. So much emphasis in American schools is placed on individualism and competition that students need help developing the teambuilding and group maintenance skills necessary for cooperative learning to work. Just as teachers build academic skills to ensure cognitive gain, for cooperative learning to be successful, teachers need to use the same dynamic and intentional teaching of social skills. This means the teacher must develop expectations for each specific social skill, provide opportunities for students to practice them and then provide feedback regarding their implementation. According to Johnson, (1991) of all the competencies needed for cooperative learning to be effective, post-secondary students should have instruction in leadership, decision-making, trust-building, communication, and conflict-management skills.

2.5.5. Group processing

Providing students the opportunity to reflect upon the quality of their group work will ultimately determine the success of cooperative learning teams (Johnson, 1991). Providing time for individual and group reflection will increase the quality of cooperative learning teams by strengthening intrapersonal and interpersonal tensions. Allowing students to provide constructive feedback to their peers fosters met cognitive awareness while strengthening group synergy and allowing for continuous improvement (Johnson, *et al.*, 1991).

Cooperative Learning theorists Johnson, *et al.*,(1991) more specifically stated that reflection is central to all cooperative learning. Regardless of subject matter, the age of the students or academic ability, if utilized correctly under Johnson, *et al.*, (1991) five pillars, cooperative learning will only enhance student performance and success.

The learning activities and classroom structures set forth by Dr. Paul Vermette in his Multicultural course epitomized Johnson, Johnson and Smith’s notion of successful cooperative learning at the college level. Through this course, not only did his students learn about cooperative learning and multicultural education, but also they took an active role as

they participated in it and flourished under his guidance. Through examination of key learning experiences that occurred in Dr. Vermette's class, one can thereby apply these same notions into other college classroom settings, acquiring the similar affective benefits and cognitive gains for all students.

2.6. Cooperative Learning in Science

In Science education, students are observed to gain manipulative skill and knowledge abilities like experiment, observing and concluding critical thinking, implementation, analysis, scientific interpretation, the way scientist work, kind of scientific methods, relation between science and technology, curiosity interest, taking risk, cooperation and objectivity.(Yidiz *et al.*, 2006).

Cooperative learning is model in which students help each other's learning on academic topics by forming small group, self-confidence of individual growth, their skill for communication develop, power of solving problem and critical thinking rises and they actively attend the education period (Eilk, 2005, Lin, 2006)

It is stated that if cooperative learning is used in both theoretical and laboratory application, it enables students to actively take part in teaching processes and paves the way for advanced academic and social skills. (Carpenter, 2003)

Cooperative learning has recently started to gain attention as alternative to educational strategies in applied science in university and high school. There reason for this is attention is that during the group work, through the strategies and problem solving method used, students can earn a lot from each other by comparing their own perspective with those of other and by collaborating in providing definition & making decision.(Maloof and white, 2005).

2.6.1. Cooperative Learning in Chemistry

A classical implementation of cooperative learning in chemistry is that of Hanson & Wolf skill, who used a "process work shop" format in general chemistry class at SUNY-stony book. Student worked in team of three or four on activity that involve guided discovery, critical thinking question that help provide the guidance, solving context-rich and sometimes open ended and in completely defined problem and meta cognitive reflecting. Following each workshop, Students completed an individual quiz on the workshop content, thus promote individual accountability.

The study conducted in Mekelle university, Ethiopia, also reveals that cooperative learning is the best method to all educational level [grade 5 and above]. (Niguse w/Mariam Reda and Tsegay Hagos, 2015)

The performance outcomes measured include knowledge acquisition, retention, accuracy, creativity in problem solving and higher-level reasoning. Other studies show that cooperative learning is superior for Promote meta cognitive though, persistence in work a goal, transfer of learning from one setting to another, time on task and intrusive motivation for example, students who score in the 50th percentile when learning competitively would score in 6th percentile when taught cooperatively (Johnson, Johnson 2006 Springer, 2006). Similarly positive effects of group interaction have been found especially for chemistry course. Traditional team work lack of individual responsibility, which leads to in equality in term of work and commitment invested. It is possible to find students doing most of the work while contribute very little or do nothing. They “lack of equal participation” (Kagon, 1994).

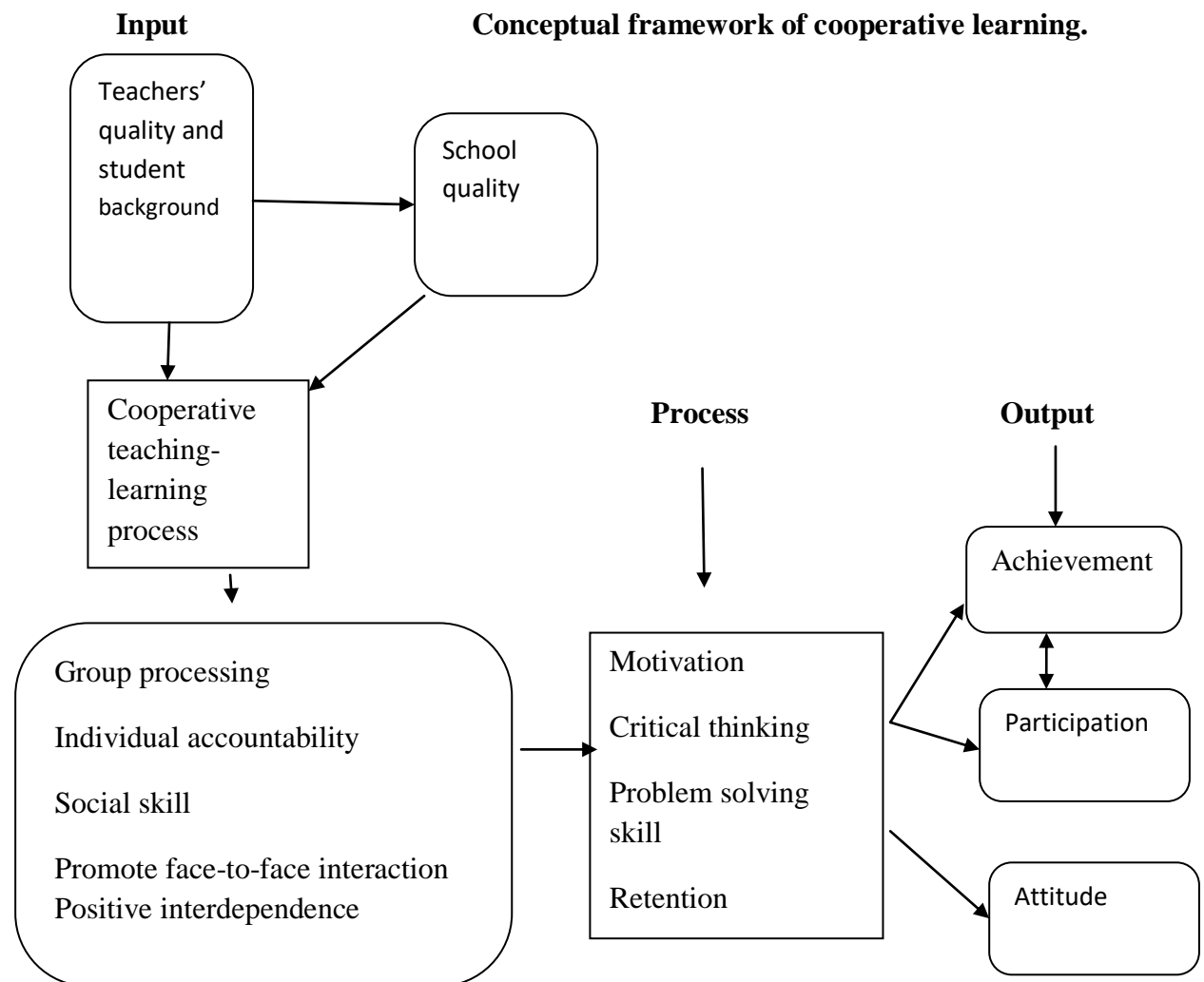
2.7 Theory of Cooperative Learning

Cooperative learning help students clarify concepts and ideas through discussion and debate. Because the level of discussion with in a group is significantly greater than in instructor lead discussion, students receive immediate feedback, thus advancing the level of discussion. There are two major theoretical perspective associated with cooperative learning: Motivational and cognitive (Swortzel, 1997).

Motivation theory: Students perceive that their success or failure is depend up on their ability to work together as group, Students are likely to encourage each other to do whatever helps the group succeed. They are also more to help each other with the tasks. Therefore, cooperative learning increase students’ motivation to do academic works (Johnson and Johnson, 1986)

Cognitive theory: Cooperative learning helps students acquire critical thinking and skills. Because Cooperative learning creates a situation in which students must explain and discuss various perspectives, a greater understanding of the material is obtained. Elaborative thinking is promoted because students give and receive explanations more often (Johnson and Johnson, 1986).

Based on pillars of cooperative learning and theory of cooperative learning of two kind that is motivational theory and cognitive theory and benefits of cooperative learning the following conceptual frame work would structuralized



Adopted from model of shalveson et al...1989

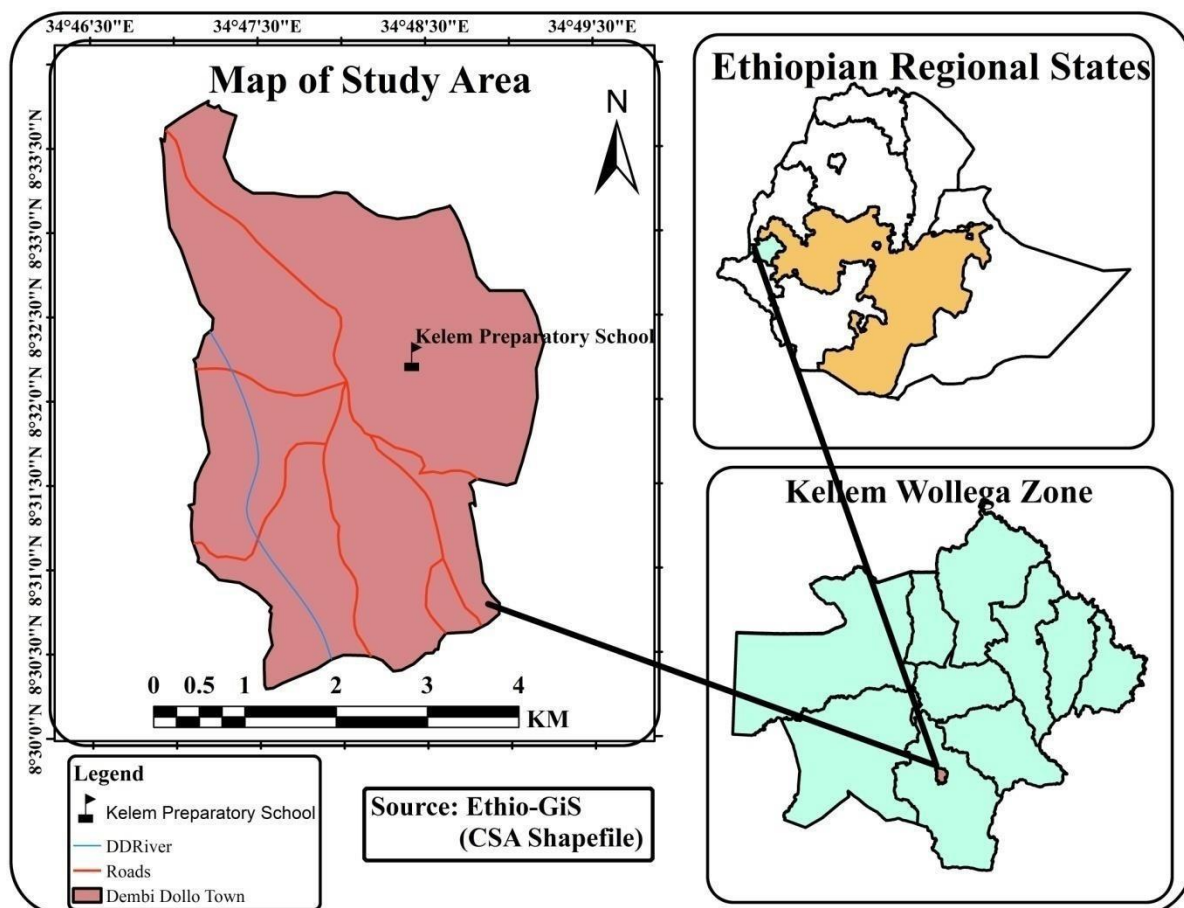
CHAPTER THREE

3. RESEARCH METHOD

3.1. Study Area

This study investigated the effects of cooperative learning on students' academic achievement in Chemistry lesson in Kellem Preparatory School with reference to grade 11. The selection of school for this study was based on the knowledge of the researcher about the school. The school involved in this study located in Dembi Dollo town of Kellem Wollega zone. Dembi Dollo is 652 km from Addis Ababa. Its climate is sub-tropical and the population of this town is 75000.

Map of the study area



3.2 Research Method

The research method that the researcher used to perform and assess any information regarding effects of cooperative learning for this study is quasi-experimental method. Quasi-experimental method study cause and effect in between dependent and independent variable.

Two groups of students from two sections of grade 11 natural science would be one as control group (CG) and another as experimental group (EG). Students of grade 11 natural science section 'A' were served as control group, Students of grade 11 natural science section 'D' were served as experimental group. One group which contains about 60 students would be used as CG and the other which also contains about 60 students was used as EG. All the 60 students in the experimental group were further divided into 12 groups, each containing 5 members and assigned for each member a task for the group and given the leading question for each group. The overall method of the research involves the pre-test, intervention, post-test and comparison of the two groups. This method was selected because it may help test the cause and effect relationship between the independent variable and the dependent variables. Instrumentation was not considered a threat to internal validity for this study because both the control and experimental groups were administered with the same teacher prepared pre-test and post-test and revised by chemistry teachers. Also the researcher alone taught both the experimental group and control group. There is no problem in this study, since differences among teachers cannot systematically influence post-test results.

Generally, this research method was used to collect both quantitative and qualitative data in population. The quantitative data were collected through experiment from control and experimental groups and whereas qualitative data were collected through questionnaire and interview. It is an efficient way of collecting information from a large number of respondents through employing this method with the representative of population. In this study there are two variables.

1 Independent variable:

Cooperative learning strategy (experimental)

Convention lecture method (control)

2. Dependent variable: Students' academic achievements in chemistry.

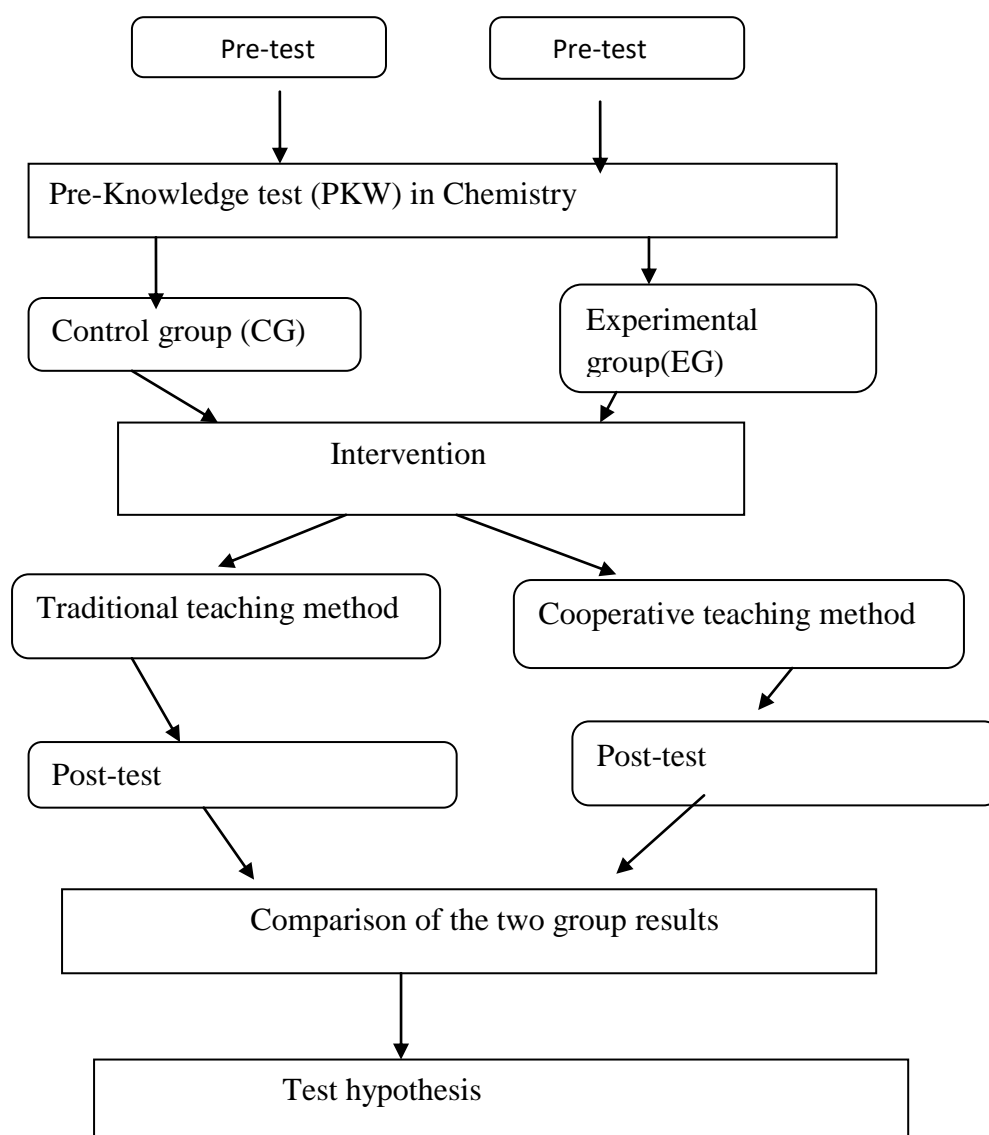


Fig.1 Research design

Research method design

This frame work shows the procedure of experiment on the proposed samples. First two sections were selected randomly one as control group and the other as experimental group,

and the pre-test was given for both groups. Then the intervention was proceeding. The post-test was given at last and compare the scores of both groups. Based on comparison the hypothesis was proved and the effect of cooperative learning on students' academic achievement in Chemistry lesson identified.

3.3 .Sources of Data

The sources of data for this study were students of Kellem preparatory school grade 11 natural science six sections (A, B, C, D, E, F) a total of 367, 2 school administrators and 2 chemistry teachers are the source of data. From teachers, students and School directors the data obtained was about the implementations of Cooperative learning instructional method in preparatory schools .In addition from students the researcher obtained information about effect of cooperative learning on students' academic achievement in Chemistry lesson. Therefore, grade 11 students of natural science, chemistry teachers and School administrators of Kellem Preparatory School were the source of population.

3.4 Samples and Sampling Techniques

In this study, the researcher used purposive sampling to select the school in terms of location, learners, teaching and learning facilities. From Kellem preparatory school of grade 11 natural science six sections a total of 367 students, two sections, section A and D are selected by purposive sampling. The following were steps that used by researcher. First, two sections comprises 60 students each (a total of 120 students) identified by random sampling, section A as a control group and section D as experimental group. Second, the identified groups (sections) were administered pre-test.Third, the intervention continued for seven weeks and then after, they have given a post-test.The pre-test for the researcher was used for two purposes. The first one was to know prior knowledge of selected students. The second purpose was to find where the difficulty of the topic of grade 11 chemistry lessons from six chapters.

3.5 Tools of Data Collection

In this study, teacher prepared test pre-test and post-test Chemistry test was used to measure the achievement of students' in the experimental and control group before and after the study. The test was designed by the researcher and moderated by two Chemistry teachers for its content validity. The teacher prepared test was based on the content taught during the study, and consisted of only multiple-choice questions. The total marks allocated for the test was 25 and time duration was one and half-hour. In addition to the test, the researcher also use a questionnaire for both experimental group and control group before and after treatment period to obtain their views on the effectiveness of cooperative learning. It also helps the researcher to collect information regarding to implementation of cooperative learning in

Kellem Preparatory School.

Research data for both groups were gathered by using pre-test for determination of prior knowledge of students before the implementation of related method and post-test for measure of academic achievement of students after intervention for both group and questionnaire to identify implementation of cooperative learning in Preparatory School level.

The pre-test and post-test was measured with descriptive statistics and t-test. The second set was questionnaire and interview about the implementation of cooperative learning were analyzed qualitatively.

Teachers' prepared pre-test: The test include 25 items with 4 alternatives which focus on students' knowledge of Chemistry. This test covers all knowledge concepts of three units (chemical bonding, rates of chemical reaction and chemical and phase equilibrium).

All questions were presented in multiple-choice forms. Each item had four alternatives for correct answer. It was used to assess students' chemistry knowledge before treatments and measure students' academic achievements in Chemistry. The maximum score of knowledge components of achievement was 22 out of 25. The content validity and reliability of this test was checked and revised by two MSc chemistry teachers of grade 11 of Kellem preparatory school.

Teachers' prepared Post-test: The test includes 25 items with 4 alternatives which focus on students' knowledge of Chemistry. This test covers all knowledge concepts of one unit (chemical and phase equilibrium). It differs from pre-test in that, the pre-test is the pre-knowledge test which based on general chemistry knowledge given before intervention. All questions were presented in multiple-choice forms. Each item had four alternatives for correct answer. It was used to assess students' chemistry knowledge after treatments and measure students' academic achievements in Chemistry. The maximum score of knowledge components of achievement was 24 out of 25. The content validity and reliability of this test was checked and revised by two MSc chemistry teachers of grade 11 of Kellem preparatory school.

Questionnaire and Interview question: Another technique of data collection was a questionnaire which was conducted with students, interview for teachers and school administrators of Kellem preparatory school. The contents of the questionnaire and interview

questions were mainly focused on the implementation of cooperative learning in Kellem preparatory school of Kellem Wollega Zone.

3.6 Procedure of Data Collection

In this study, Students in the experimental group were taught using cooperative instructional strategy while students in the control group were taught using conventional teaching method. At the end of the treatment which lasted for seven weeks, students in both the experimental and control group were tested (post-test) again using self prepared test so as to determine the effects of the teaching strategies that were used in the study. Both the pre-test and post-test was administered under similar conditions in both the experimental and control group.

The first step was to get permission and recommendation letter from department of Chemistry and permission from administration of the school because this research involves students, teachers and School directors which is under administration of school directors. After permission was be given by the administrators the researcher dealt with subject by himself.

The second step was to collect the data, the first procedure was registering the student's name of both groups in which one act as experimental group and another as control group and administers the pre- test and put in table their result. Again after the action was implemented the post –test was administered. The students' result of both groups was put in the table with corresponding to their previous result .Then the two tests score result was inserted in table and organize in statically and interpreted in terms of data obtained.

3.7 Action strategies and intervention

For all process of experiments in intervention the researcher perform by himself. The intervention done by researcher with opposite shift from regular class. Tutorial class for two (2) hours in a week for two days, for control group on Monday and Tuesday, for experimental group on Thursday and Friday for two months. To control extraneous variables both groups were taught by the researcher, material availability is good, enough text book and library.

In the study pre-test was applied in order to determine whether there is a difference in terms of prior knowledge in chemistry lesson between the experimental groups and control groups. The experimental group implementation based on cooperative learning method and the control group applied on traditional leaning method and perorate the students in their achievements to select in experiment. After pre-test was given, experimental and control groups started to apply

Teaching through cooperative learning method

In the experimental group, Students were divided into 12 groups of five members purposively depending on their pre-test result by mixing relatively high achievers, medium achievers and low achievers.

Students in the experimental groups were given orientation about cooperative learning and its importance. In addition, they were taught appropriate social skills needed for them to work effectively as a team. The taught skills included how to communicate effectively, how to help and support each other, and how to resolve conflicts constructively. The treatment during this study focused chemistry lesson with topics Chemical equilibrium and Phase equilibrium.

The students that were chosen as experimental group in which use the experimental application based on cooperative learning method were carried out were separated in to 12 groups of which composed of five students for each .The groups were requested to get a name and choose ahead of the group among themselves. Later on, each group was handed in group forms. In these forms were determined, name of the group, the number of members, the lesson was done each weeks, the study subject that was allocated for each group members and the responsibility that were to be fulfilled before coming up for the presentation and discussion that week .Every other week, the member of each group were handed in the topic concerning to his/her duties related to the shared sub topics with necessary information for the whole groups. Then, the group members were requested to present the given assignments that each of them was responsible to prepare and discuss on them .While by making inter group interaction to be high, the researcher had the reports presented effectively. After the group members completed the reports presentation the researcher give advice for a group and requested them to make a presentation with the group members. The other groups were allowed to ask question to the presenting group and in this way the deficiencies that were detected were assessed. Along this process as well, the researcher walked through the groups observing their work and provided help where needed.

For each group members assign a responsibility like leaders, recorders, questioner, reflector and time keeper. Training were given for all groups for two days a guide how they work, how the students share their idea, how they solve the problem and what are they going to do when each members go their home. For each group leading questions and work sheets were given. The following actions were taken for the purpose of intervention:

- The students were grouped randomly

- Every student member was assigned responsibility to minimize individual dominance and increase individual responsibility
- Different exercises and work sheets were prepared by the course instructors by the facilitation of researchers and given for students' group
- Time table for student was scheduled in discussing with students and the schedule was supervised and coordinated by the researchers
- Different reference material for the courses were collected by the researchers and given for the group
- Assigning a group presenter for group presentation to increase their self esteem, helping students to go to library to read reference materials related to their course
- Monitoring and evaluating daily activities of the group

The process was continuing for seven weeks. For the two weeks the action was not well; because the students dislike the group work as before they know. The students resist this cooperative learning. But later by make it smooth and adopting the work with new technological connection like internet and library use, the interest of student and attitude of students to lean by cooperative learning was increased from time to time. Later, the students were very interested in this learning strategy. At the last the post test was given to all groups in the same section.

Teaching through traditional method

The control group consisted of 60 Students who were taught using the traditional teaching method which is teacher- centered approach. In this method, the researcher presented information on the topic to the whole class while students listened and wrote notes at the end of the lesson. Learning activities were done by learners individually. The topics taught in the experimental and control group were the same. The treatment in both the experimental and control group lasted for a period of seven weeks. At the last the post test was given to the sample students

Pre-test

In the study a multi-choice pre- test was created from questions made up of 25 item main subject of chemistry lesson including pervious topic like chemical bonding, theory of chemical bonding, and rate of chemical reaction and general knowledge of chemistry. With pre-test, it was aimed to understand on what level prior knowledge of students were for the subject. In order to control the effect of extraneous variables on which the academic

achievements depends directly or indirectly researcher creating barriers by employing the test at the same time for both groups of students. In the pre-test, each right answer was equivalent to 1 point; every wrong or blank left was equivalent to 0 point and checked out of 25%.

Post-test.

Post- test: It was consist of 25 multiple –choice questions with 4 option on the topic of chemical equilibrium and phase equilibrium of chemistry of grade 11 after implementation was prepared. It was aimed on determining the more academic achievements of students in chemistry lesson. All the multiple choice questions were related to the topic that was taught with cooperative learning and traditional teaching method in both groups. In order to control the effect of extraneous variables on which the academic achievements depends directly or indirectly researcher creating barriers by employing the test at the same time for both groups of students. In the post-test, each right answer was equivalent to 1 point; every wrong or blank left was equivalent to 0 point and checked out of 25%.

3.8 Methods of Data Analysis

The data, which was gathered by using data gathering tool, was analyzed quantitatively and qualitatively based on pre- test and post-test result, questionnaire and interview. After collecting the necessary data, the data was analyzed by employing various statistical method and tools.

Descriptive statistics used to describe the data in term of mean, standard deviation. The paired t-test was used to determine whether the difference between the two mean scores of the two groups were significant. The paired t-test was done to compare the mean scores of experimental group and control group sample student scores and used to determine the probability of rejecting the null hypothesis.

Data that was obtained in interview was summarized and general suggestions were given. Generally on the data obtained from pre- test and post –test achievement result was discussed, summarized, given conclusion and recommendation was be given with relating the review of related literature.

3.9 Ethical Consideration

As part of ethical consideration the researcher was requested permission and the participant also too from the school administrator and the school administrator volunteer asked. This was done and permission from School administrator was received. As part the part of the

informed consent, anonymity and confidentiality's of participants were guaranteed through the research process.

Before collection of data from sample Preparatory School of the School administrators, teachers and students the objective of the study were communicated for them clearly and consent from them. The research makes available data from 120 students, 2 preparatory chemistry teachers and 2 preparatory school administrators, which aim at effect of cooperative learning on students' academic achievement in Chemistry lessons the case of Kellem preparatory School in Kellem Wollega Zone to analysis as primary data.

CHAPTER FOUR

4 RESULTS AND DISCUSSION

4.1 Introduction

This study investigated the effect of cooperative instructional strategy on students' academic achievement in chemistry in Kellem preparatory school of Kellem Wollega Zone with the reference to grade 11. The data collected for this research and evaluation of data that comes from data collection instruments, which used during research, were discussed, summarized and interpreted in an order.

In order to test the hypothesis the students score in achievement tests in chemistry of post test were for both the control group and the experimental group. In order to differentiate the effect of cooperative learning on students' academic achievements in chemistry, the researcher divides them in to 12 groups, and intervention was done for seven weeks .On each day of the week there were discussions and presentations. Descriptive statistical analysis was used for comparing the mean of both group and the t-test was used to determine the level of significance.

The data collected for this research by data collection instruments were analyzed and presented using frequency tables, Percentage and Statistical methods.

Table 4.1. Back ground information of the respondents

Subjects of study		Sex		
		M	F	Total
Students	EG	29	31	60
	CG	30	30	60
Teachers		2	-	2
School administration		2	-	2
Total		63	61	124

4.2 The Pre-test and Post-test Results

This study basically investigated the effect of cooperative instructional strategy on students' academic achievements in chemistry in Kellem preparatory school of Kellem Wollega zone with the reference to grade 11. It was designed as an experiment in which the teaching strategy was the independent or the manipulated variable and the student academic

achievement test is the dependent or measured variable. Participants in the study consisted of 120 grade 11 students from two sections that were randomly selected. The participants were divided into experimental and control group, with each group consisting of 60 students. At the beginning of the study, both the experimental and control group were pre-tested with self prepared pre-test. This was done to establish whether significant difference in academic ability existed between the groups before the start of the study. The study or treatment period lasted for seven weeks totally 2 months including a week of preparation and orientation time, during which the experimental group was taught using cooperative instructional method and the control group taught using traditional teaching method. The researcher prepares different materials, enough text book and library for both groups. For control group the intervention was done by teacher-centered method. In case of experimental group the intervention was done by student-centered method. The topics covered in both groups were the same and focused on chemical equilibrium and phase equilibrium In order to determine the impact the different teaching strategies had on the students' academic achievements, both the experimental and control group were tested (Post-test) using self prepared test .

4.2. 1 Results of the Administration of Pre-Test

This was used to show the students achievement result before intervention from 25 multiple choice item question which answer correctly. The results were treated in terms of Mean (M), and T-test. There for Students pre-test result who answer correctly from question 1-25 were compared between control groups and experimental groups.

All the 25 multiples question were scored individually and their results were, experimental group correct mean score of 15.1out of 25with standard deviations of 2.73.Similarly the control group correct mean score of 15.03out of 25with standard deviation of 2.47.The score of experimental group students ranged from 10to 24 and that of the control group students ranged from 10 to 21. From this one can understand that the two groups have similar back ground on the selected topic.

Mean scores between the two groups were done by paired samples t-test. From the result of the analysis, it was found out that there was no statistically significance difference between the mean score of the two groups at 0.05 levels of significances (table 4.2)

Table 4.2.Descriptive and t-test statistics for the pre-test

Group	N	Sum	Mean score	SD	t _{cal}	t _{cr}	p-value	α-value
CG	60	902	15.033	2.4702	0.091	1.672	0.93	0.05
EG	60	906	15.100	2.7335				

Furthermore the statistical comparison for the percentage mean scores of the pre-test of the experimental group and control groups of the mean as shown on table 4.2 describes that there was no significance difference between the two groups ($t=0.091$ at $p>0.05$). This confirms the fact that the two groups were essentially similar in their academic back ground and prior knowledge.

4.2 .2 Results, discussion and interpretation on pre-tests

The forth coming discussion deals with response to individual pre-test questions. Thus each section below would begin with the question as it was asked on the test and proceeds by highlighting the main focus of the question, followed by analysis and interpretation and comparison of responses. Analysis and interpretation was base on the response of the two groups.

Choose the best answer from the following alternatives

1.For reaction $A(g) + 2B(g) \rightleftharpoons 2C(g) + \text{heat}$,formation of C is favored if : A. temperature increased B .pressure decreased C .amount of A increased D. catalyst is added

This question relates with product formation of chemical equilibrium in simplest form in the given conditions. The students asked to answer this question with previous knowledge of grade 10.

From the analysis of the response of students, it was found that 76% of the sample students responded choice (c) which was correct. 8% students responded choice (b), 7% of the students responded choice (d), 5% of the students were responded on choice (a).

The mean scores between the two groups were done independently by descriptive statistics. From the results of analysis, it was found that there was no statistically significant difference between the mean score of the two groups (table4.3).

Table 4.3 Descriptive statistics for pre-test #-1

Question	Group	N	Mean	SD
1	CG	60	0.60	0.498
	EG	60	0.63	0.490

2. For reaction at equilibrium, which one of the following is true? A. $Q_p = K_p$ B. $Q_p > K_p$
C. $Q_p < K_p$ D. $Q_p = 0$

This question used to show the relation between K_p and Q_p in chemical equilibrium. The students asked to answer with the knowledge of chemical equilibrium. Analysis of the responses of this question indicates that only 54% of the sample students responded (d), which was the most popular and incorrect answer. 30% of the sample students responded (a) which was correct answer. 10% of the sample students' responses choice (c), and 5% of sample students answer the choice (b). The means scores between the two groups were done independently by descriptive statistical Samples one –tailed t-test. From the results of analysis, it was found that there was no statistically significant difference between the mean score of the two groups (table4.4).

Table 4.4 Descriptive statistics for pre-test #-2

Question	Group	N	Mean	SD
2	CG	60	0.63	0.504
	CG	60	0.63	0.504

3. For reaction $H^+(aq) + OH^-(aq) \rightleftharpoons H_2O(l)$ $K_f = 1.4 \times 10^{11}$ and $K_r = 2.5 \times 10^{-5}$ at 25° then which one of the following is the value of K_c for this process? A 5.6×10^{15} B. 1.8×10^{-16} C. 1.4×10^{11} D. 3.5×10^6

This question deals with K_c calculation based on the given information. The students asked to calculate K_c on the given information. As can be seen from few students' response the correct answer in both group. This was due to the abstractness of chemistry and the concept of chemistry was not easily understandable. This result also described by previous studies (Antony, 2009) which says some chemistry topics like chemical equilibrium concept is difficult.

From the analysis of the response of students, it was found that 77% of the sample students responded choice (a) which was correct. 2% students responded choice (d), 18% of the students responded choice (c), none of the students were responded on choice (b).

The mean scores between the two groups were done independently with descriptive statistics. From the results of analysis, it was found that there was no statistically significant difference between the mean score of the two groups (table4.5).

Table 4.5 .Descriptive statistics for pre-test #3

Question	Group	N	Mean	SD
3	CG	60	0.43	0.504
	EG	60	0.47	0.507

4. The unit for K_c for the reaction $H_3A(aq) \rightleftharpoons 3H^+(aq) + A^{3-}(aq)$ is A.mol/L
 B.mol³/L³ C.mol²/L² D.L³/mol³

This question informs to remember about chemical equilibrium and its formula units.

From the analysis of responses of students, it was found that 1(2%) of the sample students responded choice (a), 19(32%) of the students responded choice (c), 26(43%) of the students responded choice (b) which was correct answer.

The mean scores between the two groups were done independently with descriptive statistics. From the results of analysis, it was found that there was no statistically significant difference between the mean score of the two groups (table4.6)

Table 4.6 .Descriptive statistics for pre-test #4

Question	Group	N	Mean	SD
4	CG	60	0.43	0.504
	EG	60	0.43	0.504

5. At certain temperature $K_c = 7.5$ for the reaction $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$. If 2.0 mol of NO_2 is placed in a 2.0 L container of NO_2 and N_2O_4 at equilibrium? A. $[\text{NO}_2] = 0.23\text{M}$, $[\text{N}_2\text{O}_4] = 0.39\text{M}$. B. $[\text{NO}_2] = 0.40\text{M}$, $[\text{N}_2\text{O}_4] = 0.20\text{M}$. C. $[\text{NO}_2] = 2.00\text{M}$, $[\text{N}_2\text{O}_4] = 1.00\text{M}$. D. $[\text{NO}_2] = 0.15\text{M}$, $[\text{N}_2\text{O}_4] = 0.29\text{M}$. E. $[\text{NO}_2] = 0.39\text{M}$, $[\text{N}_2\text{O}_4] = 0.23\text{M}$

This question used to calculate the given problem with the given information. Then the students were asked to calculate the problem.

Analysis of the responses of this question indicates that only 54% of the sample students responded (d), which was the most popular and incorrect answer. 30% of the sample students responded (a) which was correct answer. 10% of the sample students' responses choice (c), and 5% of sample students answer the choice (b).

The mean scores between the two groups were done independently with descriptive statistics. From the results of analysis, it was found that there was no statistically significant difference between the mean score of the two groups (table 4.7).

Table 4.7 .Descriptive statistics for pre-test #5

Question	Group	N	Mean	SD
5	CG	60	0.17	0.430
	EG	60	0.17	0.346

All 25 questions were interacted in the same manner and summarized in Appendix Table 7

4.2.3 Results and discussion of on post-test

Choose the best answer from the following alternative

1 For reaction $\text{A}(\text{g}) + 2\text{B}(\text{g}) \rightleftharpoons 2\text{C}(\text{g}) + \text{heat}$, formation of C is favored if ; A .temperature is increased .B. pressure decreased . C. amount of A increased. D catalyst is added.

This question deals with factories affecting chemical equilibrium .Students should need to predict those factories

The questions were easily answered by memorizing those factories, which do not need critical thinking, skill of calculation and high concept memory.

Analysis of this question indicate that 77%of experimental group and 33%of the control group students responded(c),the correct answer for this question.10%of the experimental group and 37%of control group respond choice (a),7%of experimental group and 23%of the control group answer choice (b),7%of both group answer the choice (d).Mean of pre-test for experimental group is 0.63 and that of post-test for the same group is 0.90 which is the result of cooperative learning.

Again, the mean scores of the two groups were compared using descriptive statistics. From the result of analysis, it was found that there was statistically significant between the mean score of the two groups (table 4.8).

Table 4.8 .Descriptive statistics for post-test #-1

Question	Group	N	Mean	SD
1	CG	60	0.63	0.490
	EG	60	0.90	0.305

2 .For reaction at equilibrium, which of the following is true? A. $Q_P = K_P$ B. $Q_P > K_P$ C. $Q_P < K_P$ D. $Q_P = 0$

This question deals with the relationship between Q_P and K_P ; need some derivation of formula relation. When the percentage of the two groups were compared the experimental group was greater than control group. Because in the above expression in simple discussion the chemical equilibrium become zero. But with much reasoning the answer should be a. This study also described by previous study of (Slavine, 1998).

Response analysis of this question show that 87%of the experimental group and 77% of the control group replied the correct answer which is choice (a).7%of experimental group and

10% of the control group answer choice (b), 0% of experimental group and 7% of the control group answer (c), 0% of experimental group and 3% of control group answer choice (d).

Mean scores between the two groups were done independently using descriptive statistics. From the result of analysis, it was found that there was statistically significant between the mean score of the two groups (table 4.9).

Table 4.9 .Descriptive statistics for post-test #-2

Question	Group	N	Mean	SD
2	CG	60	0.70	0.466
	EG	60	0.90	0.305

3. For reaction $H^+(aq) + OH^-(aq) \rightleftharpoons H_2O(l)$ $K_f = 1.4 \times 10^{11}$ and $K_r = 2.5 \times 10^{-5}$ at 25° then which one of the following is the value of K_c for this process? A 5.6×10^{15} B 1.8×10^{-16} C 1.4×10^{11} D 3.5×10^6

This question deals with K_c calculation based on the given information. The students asked to calculate K_c on the given information. The result of the two groups can show the experimental group was better achiever than control group. This result also realized by previous study of (Bearson et al, 1986; Maloof and White, 2005) solving problem method can be enhanced by cooperative learning methods.

Analyses of this question indicate that, 80% of experimental group and 43% of control group replied the correct answer choice (a). 10% of experimental group and 43% of control group responded choice (b), 7% of experimental group and 10% of control group responded choice (c), 7% of experimental group and 20% of control group answered (d). Mean of pre-test for experimental group is 0.47 and that of post-test for the same group is 0.80 which is the result of cooperative learning.

Again, mean scores between the two groups were done independently using descriptive statistics. From the result of analysis, it was found that there was statistically significant between the mean score of the two groups (table 4.10).

Table 4.10 .Descriptive test statistics for post-test #-3

Question	Group	N	Mean	SD
3	CG	60	0.53	0.507
	EG	60	0.80	0.407

4 The unit for K_c for the reaction $H_3A(aq) \rightleftharpoons 3H^+(aq) + A^{3-}(aq)$ is A.mol/L
 B.mol³/L³ C.mol²/L² D.L³/mol³

This question used to derive the unite of some chemical equilibrium in reaction. The students asked to derive the formula units.

The response analysis show that around 87%of the experimental groups and 63% of the control group replied correctly which was alternative (b), 13%of the experimental group and27%of the control group were replied the incorrect answer.

Mean scores between the two groups were done independently using descriptive statistics. From the result of analysis, it was found that there was statistically significant between the mean score of the two groups (table 4.11).

Table 4.11 Descriptive statics for post-test #4

Question	Group	N	Mean	SD
4	CG	60	0.63	0.490
	EG	60	0.87	0.346

5. At certain temperature $K_c = 7.5$ for the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$.If 2.0 mol of NO_2 is placed in a 2.0 L container of NO_2 and N_2O_4 at equilibrium? A. $[NO_2] = 0.23M$, $[N_2O_4] = 0.39M$. B. $[NO_2] = 0.40M$, $[N_2O_4] = 0.20M$. C. $[NO_2] = 2.00M$, $[N_2O_4] = 1.00M$. D. $[No_2] = 0.15M$, $[N2O4] = 0.29M$ E. $[NO_2] = 0.39M$, $[N_2O_4] = 0.23M$

This question used to calculate the given problem with the given information. Then the students were asked to calculate the problem. The skill of calculation was developed by

cooperative learning instructional methods. This result also described with previous of studies (Maloof and White, 2005).

From the analysis the response of the students, it was found that only 30% of the control group and 50% of the experimental group replied the correct answer (a), 27% of the control group and 13% of the experimental group respond to choice (c). However the percentage of the experimental group and the percentage of control group which respond to the correct answer was highly varied.

Mean scores between the two groups were done independently using descriptive statistics. From the result of analysis, it was found that there was statistically significant between the mean score of the two groups (table 4.12).

Table 4.12 .Descriptive statistics for post-test #-5

Question	Group	N	Mean	SD
5	CG	60	0.47	0.507
	EG	60	0.77	0.430

All 25 questions were interacted in the same manner and summarized in Appendix Table 8

4.3 Students questionnaire and teachers Interview on Implementation of Cooperative Learning Strategy

The questionnaire and interview was designed to explore the effect and implementation of cooperative learning. It further sought to capture the phenomenological views of students, teachers and school administrators on the effectiveness of cooperative learning as a teaching strategy. In order to achieve the afore-mentioned objectives, a qualitative, open-ended methodology was selected as it allowed for maximum opportunity for the sample respondents to express their views.

The purpose of questionnaire and interview for this study was to collect information regarding to implementation of cooperative learning in preparatory Schools and view of students, teachers and school administrators.

For this research the questionnaire were employed to 10 students from both group selected by purposive sampling top 5 from each group, and the questionnaire was two times before implementation and after implementation. For the teachers only at the lastly the interview was employed

A questionnaire for students

1. How would you observe about cooperative learning in your school? Is it implemented in your school? If it was implemented in the class, what are the advantage and disadvantage?

In response to the first question on implementation of cooperative learning in both schools, all the students responses that the structure is present in class, only for doing the assignment in groups, but the instructional method is not excised in class as teaching methods. From this it is difficult to express the advantage and disadvantage.

2. When cooperative learning instructional method was used what are the challenges among the group member?

For the second question the responses of the students was on the challenges of cooperative learning implementation in school, few students responses were the teachers and students were low interest in this strategy, because this instructional method is not compatible in our country and it is time consuming method, majority of students response were even though the advantage of cooperative is known the strategy and art of the method is not clear for all. The practical problem among the students themselves were cooperative learning is time taking, individuals dominance, workload over higher achieving students, facilitates dependence syndrome, individual responsibility was less mentioned.

3. In the group working (cooperative learning style) are the students take the responsibility equally?

For the third question of formal group the students' responsibility on group works responses were, all the students responses were even the group formed in the class assigned for assignment works the participation of students were very low, only the bright students do the assignments.

4. What do you gain before cooperative learning implemented in the lesson and after the use of cooperative leaning in the chemical equilibrium and your achievement test?(only for experimental group).

5. Generally, what about your interest before the use of cooperative learning and after learning by cooperative method?(only for experimental group).

Question four and five was only for students of experimental group. It is concerned with use interest of cooperative learning before and after intervention. Almost all students responses were before intervention scores of the students were low, chemistry is difficult discipline,

many of chemistry materials like chemical equilibrium is difficult, interest of students to learn in cooperative method is low, working with group is not well because work is load over the brighter students, individual responsibility was less, seems to time taking action were among the students mentioned. After intervention all the above mentioned was completely changed.

Interview for teachers and school administer

1. From educational police of Ethiopia cooperative leaning is the best way of instructional among other active learning. What do you think about the implementation and use of this method in your school?

2. If it was implemented in class instruction what change do you observe about students achievements?

The first two questions were concerning with the implementation of cooperative learning strategy in preparatory schools. Majority of the respondent believe that cooperative learning instructional method is a crucial for students' leaning. But the practical application in the school level is low due to different factories.

3. If it is simple design what is the main challenges to do this?

Among these factories: motivation and interest of students, the strategy of class room facility, the awareness of students and teachers about cooperative learning in education, lack of clear guidance of cooperative leaning, resistance of students in group works, the text book preparation with related period distribution, lack of skill of organizing and controlling the groups were some of the respondents mentioned. But few respondents believe that this instructional method is not relevant to situation of our country. The third, fourth and five, questions were related with the challenge of cooperative learning implementation in preparatory schools. These challenges are improved by monitoring and evaluating daily activities of the group.

4. What about the interest and skill of teachers to implement this instructional methods?

5. From your observation is cooperative learning is valuable for increasing academic achievement of students?

According to the respondent believes there are many challenges to implement this valuable methodology. Among those problems that mentioned were: voluntarily participation of students in group, attitude and interest of students and teachers in cooperative learning, lack of skill to organize and control in group works, individual responsibility in group member of students, work load over higher achiever students were some of the mentioned.

For this research the questionnaire were employed to 10 students from both groups and the questionnaire was two times before implementation and after implementation. Before implementation majority of the students did not like cooperative learning strategy .After the implementation majority of the students support cooperative learning if it was properly used in practice not as theoretically. For the teachers only at the lastly the interview was employed. From the teacher the response give was even though the use of cooperative was clear the implication was exhaustive and the students do not interact with this method.

From the data collected through questionnaire and interview, there are challenges among the group members when learning through cooperative learning. Among the challenges indicated by the participants: cooperative learning is time taking, individual dominance, workload over higher achieving students, facilitates dependence syndrome, individual responsibility was less.

Summary of the major find from questionnaire and interviews

Before implementation majority of the students did not like cooperative learning strategy .After the implementation majority of the students support cooperative learning if it was properly used in practice not as theoretically. Work load over higher achieving students, cooperative learning is time taking, individual responsibility was less, improving the academic achievements of students, by assigning responsibility for each member, by giving them different exercises and work sheets, by make them use different reference materials cooperative learning is crucial for students learning.

4.4. Evaluation of Cooperative Learning on Students Academic Achievement in Chemistry

When researcher begin this research with the assumption was cooperative learning would be the solution to the problem regards to students motivations, class room participation and achievement. In different literature we found that cooperative learning was an effective strategy when used properly in class room. Cooperative learning can allow students to work

together in a safe and positive learning environment while taking responsibility for their learning and acknowledging the differences in each other.

During the implementation the researcher also found that cooperative learning was effective in which students understood their responsibilities as individuals and as group members, students learned how to talk with each other in supportive and constructive way. They also learn communication skills. As can be discussed with the group leaders after the intervention majority of students' (81.44% or 49 students) motivation, attendance, Participation and presentation skills were improved. This results described by previous studies of (Carpenter,2003; Lord,2001).Challenges were minimized in cooperative learning after individual responsibility was given for every student in the group and time schedule was prepared by the facilitators for the purpose of cooperative learning.

Another improvement, made after the implementation of the experiment was improvement of students 'academic achievement. Pre-test score of experimental group is 60.4%, after intervention their post- test result was 81.44%. This is partly due to students' interest in group work, individuals' responsibility in the participation of cooperative learning and students' motivation for achievement.

To evaluate the change the data collected with the help of pre-test and post-test which were measured as the percent mean scores and the percent mean gains of the sample students and the effect of cooperative learning instruction method on students' academic achievements were interpreted and analyzed.

Table 4.13 the pre- test percentage mean result of sample students in grade 11

Description	Experimental group	Control group
Total	906	902
Mean	15.1	15.03
Percentage mean	60.4	60.12

As shown on the table 4. 13 the pre-test present mean result of students in Experimental group was 15.1and that of control group was15.03out of 25.There fore, from this result it is

possible to conclude that insignificant differences observed between the mean value of the student scores in the experimental group and control group.

Table 4.14 .One tail paired samples t-test result of the pre-test of the respondents.

Group	N	Sum	Mean score	SD	t _{cal}	t _{cr}	p-value	value
CG	60	902	15.033	2.4702	0.091	1.672	0.93	0.05
EG	60	906	15.100	2.7335				

Furthermore the statistical comparison for the percentage mean scores of the pre-test of the experimental group and control groups of the mean as shown on table 4.13 and table 4.14 describes that there was no significance difference between the two groups ($t=0.091$ at $p>0.05$). This confirms the fact that the two groups were essentially similar in their academic back ground. The students in both groups, however scored the percentage mean of 60.12 of control group and 60.4 of experimental group signify that the students had little retention of knowledge on both groups. In the comparison of the post –test of the two groups, the experiment groups students, those treated by cooperative learning instructional method scored an average above 81.44% of academic achievements, where as the control group students, those treated by traditional instructional methods were scored on average 62.52% of academic achievements on a given topic of chemical equilibrium

Table4.15 The mean gains and present mean gains academic scores of experimental and control groups of the respondents

Description	Experimental group		Control group	
	25%	100%	25%	100%
Mean of pre-test	15.1	60.4	15.03	60.12
Mean of post-test	20.36	81.44	15.63	62.52
Mean gain	5.26	21.04	0.6	2.4

As can be seen from table 4.15 above illustrate that the mean gain of the students in academic score of the two group, noted that the percentage mean gain by control group was 2.4% and

that of experimental group was 21.04%.Consequently, the mean gains were suggestive of the fact that there were significant difference between experimental group and control group. The result show that cooperative learning instruction method contributes in increasing academic achievements of students. This study also realized by previous studies (Johnson, 1986; Slavine, 1990).

Table4.16. Gain of one –tailed paired samples t-test of the respondent

Pair	Pair difference		df	t_{cal}	t_{cr}	p-value	α -value
	Mean	SD					
EG-CG	4.733	3.13	58	8.19	1.672	0.00	0.05

Likewise, a statistical comparison of the paired sample in table 4.16 students in experimental group better performed than the students in control group ($t=8.19$ at $p<0.05$). This obviously implies that the students have acquired significant gained in selected chemistry topics(chemical equilibrium and phase equilibrium) after they have covered the units of chemical and phase equilibrium for about seven weeks for the purpose of this study.

Intended for above reason, the difference between the percentage mean gains of the experimental group and control group proved that students in the experimental group performed better than the control group because of the impact of cooperative learning instruction method after seven weeks. This finding support the second hypothesis which state that there is a significance association between cooperative learning and students' academic achievement in chemistry lessons of Kellem preparatory school in KellemWollega zone. The result of this study is consistent with the finding of previous research (Yamarik, 2007) which indicates that cooperative learning results in higher academic achievements.

Generally; this study is mostly to assess the effect of cooperative learning on students' academic achievements' in chemistry lesson. Therefore to study this systematically the research hypothesis was formulated.

The formulated hypothesizes were:

H₀:-Cooperative learning has no significant positive effect on students' academic achievements in Chemistry lesson in Kellem preparatory School.

In order to test this hypothesis, student scores in achievements test in chemistry post test were correlated for both control group and experimental group. The t-test was used to determine the level of significance.

Table4.17 Scores of experimental and control group post-test

Variable	N	Mean	SD	t_{cal}	t_{cr}	Remark
EG	60	20.37	2.33	8.29	1.672	Significant
CG	60	15.63	2.12			

From the table 4.17 it could be seen that the calculated t-value 8.29 is greater than the critical value of t at 0.05 levels confident which is 1.672 and there for the null hypothesis is rejected. This means that a significance different was found between the group taught with cooperative learning instructional method and the group taught with the usual traditional method of teaching.

There for hypothesis H_0 is rejected and hypothesis H_1 is accepted. In this case there were a rejection of H_0 and accepting of H_1 means that the observed difference in students scores were due to actual difference in methodology of teaching by proofing that Cooperative learning has significant positive impact on students' academic achievements in Chemistry lesson in Kellem preparatory School .

The positive impact of cooperative leaning bring a behavioral change on students with the outcome of increasing in academic achievements, motivation, participation and attitude change to learn chemistry lesson in Kellem preparatory School .

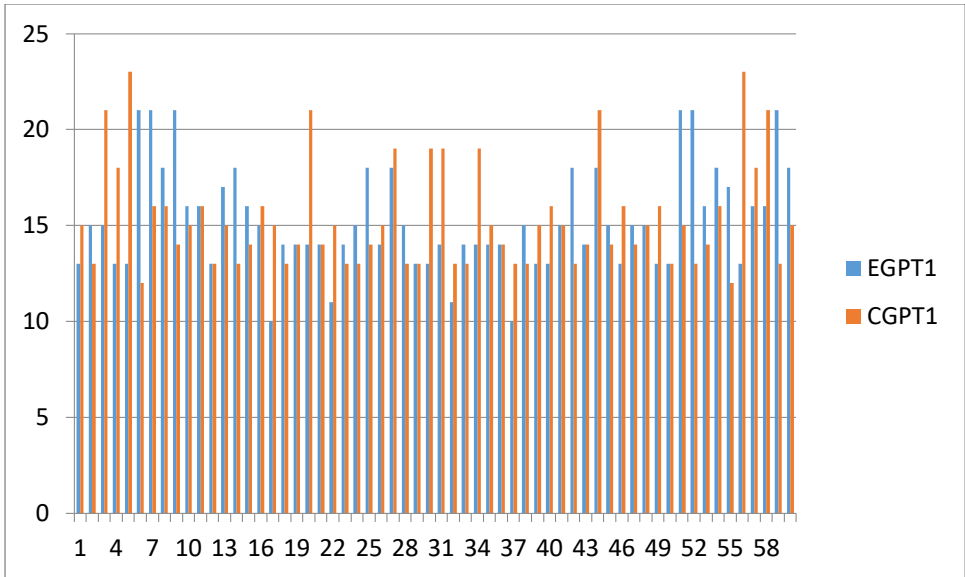


FIGURE 1.The distribution of students score on pre-test of experimental and control group.

EGPT1=Experimental group pre-test scores

CGPT1=Control group pre-test scores

As one can see from the above figure 1, few numbers of students scores higher than the rest. Majority of the students had similar pre-test scores. This scores distribution figure shows that students’ prior knowledge were almost similar. Majority of the students were scored between 10—17 out of 25%.

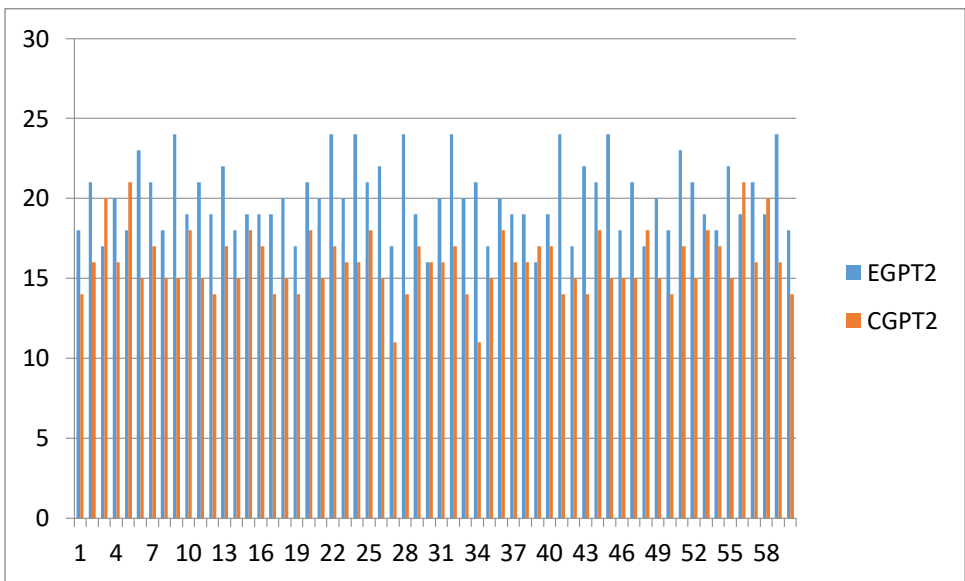


FIGURE .2.The distribution of students score on post- test of the experimental and control groups

EGPT2=Experimental group post-test score

CGPT2= Control group post-test score

Figure 2. show that the experimental group students, those instructed by cooperative teaching method scores higher than the control group, those instructed by traditional teaching method.

Majority (52 in number) of the experimental students score between 15—24 out of 25%, and very few (8 in number) students' scores less than of 15. Most of the students of control group were scores in between 10---15 out of 25% (40 in number) and very few number of students (20 in number) were scored greater than 15. Relatively the experimental group which was instructed with cooperative learning method students' scores the post-test than the control group which was instructed by traditional method. This is observed from my one way analysis of variance having one independent variable shown on the table 4.17 in which the calculated t-value 8.29 is greater than the critical value of t at 0.05 level of confident which is 1.672. An ANOVA (analysis of variance) with only two groups is equivalent to a t-test.

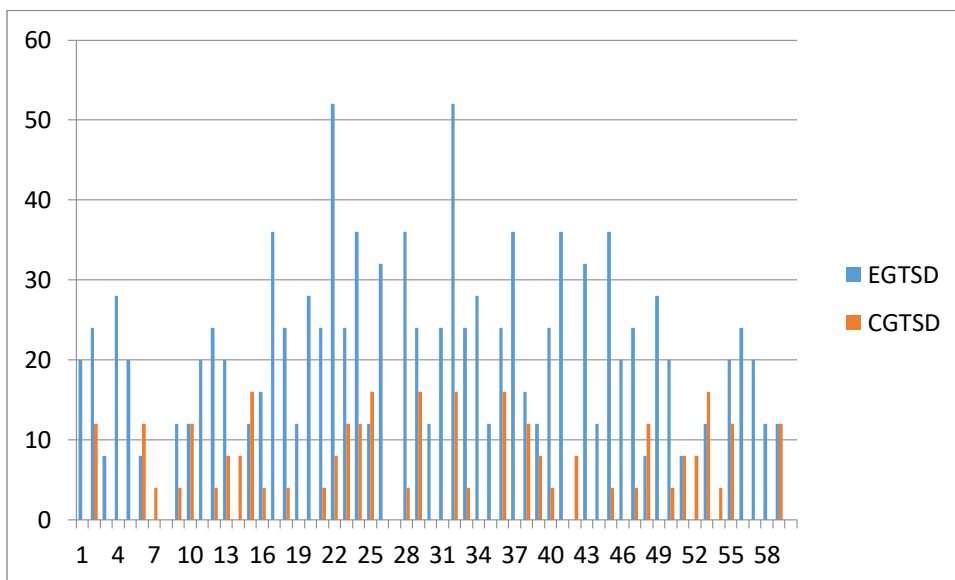


FIGURE.3 The frequency distribution of students score gained after intervention

EGTSD=Experimental group test score difference

CGTSD=Control group test score difference

As show on figure 3 the score gained by individual students of experimental group which was instructed by cooperative learning method gained much more than the students which were instructed in traditional teaching method. As one can see the score gained by experiment group was greater than 10% for each student, but the control group gained very few score when compared with experimental group?

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5. 1.Conclusion

This study examines the effect of cooperative learning method on the Students academic achievements' in chemistry lesson. From finding of the study we can conclude that cooperative learning has significant positive effect on students' academic achievements in chemistry lesson in kellem preparatory school of kellem wollega zone compared to regular cooperative teaching method. This conclusion is in line with the previous study of (Tras and 6Lewis, 2012 a and b) which says in order to learning improve cognitive out comes an alternative to lecture based teaching could be cooperative learning..

It is also evident from the finding that whenever students are a part of cooperative learning activities or assignments whether within the classroom or outside there is an improvement in their level of class participation and academic performance. The findings suggest that student believe that cooperative learning facilitates good working relationships, and enhances socialization and creativity. This conclusion is in line with the conclusion of (Eilk, 2005; Lin, 2006; Bolling, 1994) which state cooperative learning style increase participation and performance.

Furthermore, the students in cooperative learning group develop their skills than students in the group in which the traditional learning method are used. Based on these findings, it can be argued that the cooperative learning method makes a positive contribution to students' academic achievement by giving responsibility to the students in learning process by encouraging face to face communication, creating positive dependence and ensuring the active participation of all students in activities. These finding realizes those of previous studies on the effect of the cooperative learning method (Bearison et al, 1986; Maloof and White, 2005; Referson and Jeferey, 2004) studies that examine cooperative learning method used in both theoretical and practical which help students improve academic and social skills by ensuring their active participation in learning process (Carpenter, 2003; Johnson and Johnson, 1999; Lord, 2001).

From questionnaire and interview it possible to conclude that there was highly challenge in implementing cooperative teaching in preparatory schools. But the questionnaire and

interview results indicate again that students who were taught through cooperative learning achieved higher scores. This then implies that cooperative learning was more effective in enhancing students' achievement. Positive interdependence is an aspect of cooperative learning that is very important since it benefits both the weak and the bright students.

The results of this study also indicate that cooperative learning methods result in higher achievement than the traditional teaching methods according to the finding. A probable reason is that, when students explain and receive explanations from each other in group, they retain the new concepts much longer in their memory. They better understand what they have learned and there-fore improve their performance. This conclusion is in line with the previous study of (Tras and Lewis,2012 a and b) which says in order to improve cognitive out comes an alternative to lecture based teaching could be cooperative learning .The cooperative approach has the element of accountability and interdependence embedded in a structure that is not found in the traditional classroom. The positive impacts produced by the results reveal that cooperative learning can increase students' achievement. Cooperative learning also enhances understanding and self-confidence. These results would imply that incorporating cooperative learning in the classroom would enhance the learning.

The students in the study perceived that cooperative learning was beneficial to them. In short, they were willing to help and to cooperate with each other and to promote each other's learning. These attitudes help to build group identity and create an environment conducive to learning. However, it should be noted that some students preferred not to work in group, meaning that cooperative learning not for everyone. Therefore, Teachers should be aware of students' preferences in learning.

Generally, from the mean gain of students in academic score of the two groups; 31.14% by experimental group and 12.42%of control group and statistical comparison of paired sample test, students in experimental group better perform than the students in control group($t=8.29$ at $p<0.05$).

Therefore, the null hypothesis, H_0 , which says cooperative learning, has no significant positive effect on students 'academic achievement in chemistry lesson is rejected and the alternative hypothesis, H_1 , which says cooperative learning has significant positive effect on students' academic achievement in chemistry lesson is accepted. Because there is a statistically significant in mean achievement scores in chemistry between preparatory school

students who are taught through cooperative learning and those who are taught through the regular teaching method. This conclusion is in the line of conclusion of (Johnson, 1989; Slavin, 1990) which says that cooperative leaning method increase the academic achievements' of students.

5.2. Recommendation

Based on the findings of the study and post intervention outcomes, the following recommendations were made: Since cooperative learning has been proved to have numerous benefits such as improvement in academic achievement and enhanced class participation more emphasis should be placed by chemistry teachers of grade 11 on promoting this alternative technique.

- Cooperative learning strategy should be adopted by grade 11 Schools of Chemistry teachers as effective leaning strategy to improve students in academic achievement in chemistry and reduce failure rate.
- The teachers and students should get more time in the class room of the government Schools so that they can discuss the learning material in depth and their by develop different skill such as interaction skills by using cooperative learning strategies for Chemistry subject area of grade 11.
- The results of this research indicate that cooperative learning approach could be effective instructional methods for attaining higher students' achievement in chemistry. The School administrators and supervisor should give training for teachers in service and adjust experience exchange between teachers how to use cooperative learning instruction method in the class room of grade 11 in chemistry lesson.
- Cooperative learning is highly recommended as an alternative instructional pedagogy in the current wave of educational reform. To promote the implementation of cooperative learning effectively, both teachers and students would need to undergo a training course in this kind of learning.

Although the present findings support the positive impact of cooperative learning for increasing students' Academic achievement in chemistry, the sample of this study is restricted to only 120 participants. Therefore, future studies should apply cooperative learning with more participants to generate more evidence on the impact of cooperative learning. The present study was on impact of cooperative learning on students' academic

achievements; the next study also should emphasis's on implementation of cooperative leaning in preparatory schools and challenges of cooperative learning at preparatory schools

CHAPTER SIX

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CHAPTER SEVEN

7 APPENDECISE

7.1. Appendix I

Appendix Table 1 Percentage distribution responses of students for each question of the pre-test and post-test.

Question No	Pre-test EG	Pre-test CG	Question No	Post-test EG	Post-test CG
1	32	46	1	46	34
2	38	30	2	56	34
3	44	44	3	44	26
4	48	50	4	48	30
5	40	44	5	48	36
6	36	44	6	42	20
7	38	28	7	54	42
8	48	46	8	44	28
9	40	36	9	48	24
10	54	52	10	48	26
11	40	36	11	50	26
12	30	38	12	40	22
13	38	40	13	40	44
14	32	18	14	42	36
15	42	32	15	52	38
16	38	28	16	38	8
17	38	28	17	54	36
18	40	40	18	34	24
19	44	30	19	24	4
20	44	38	20	14	8
21	38	24	21	40	24
22	38	22	22	40	18
23	48	46	23	36	18
24	26	38	24	24	14
25	46	48	25	44	22
Sum	1000	926	Sum	1050	642
Average	40	37.04	Average	42	25.68

Appendix Table 2. Percentage distribution of the two group based on their result.

Question	Experimental group		Control group	
	PT1	PT2	PT1	PT2
	PR1%	PR2	PR1%	PR2%
1	53	77	77	57
2	63	93	50	57
3	73	73	73	43
4	80	80	83	50
5	67	80	73	60
6	60	70	73	33
7	63	90	47	70
8	80	73	77	47
9	67	80	60	40
10	90	80	87	43
11	67	83	60	47
12	50	67	63	37
13	63	67	67	73
14	53	70	30	60
15	70	87	53	63
16	63	63	47	13
17	63	90	47	60
18	67	57	67	40
19	73	40	50	7
20	73	23	63	13
21	63	67	40	40
22	63	67	37	30
23	80	60	77	30
24	43	40	63	23
25	77	73	80	37
Average	66.56	70	61.76	42.92

AppendixTable3.descriptiveand t-teststatisticsforeach questionofpre-test

Group	Average	SD	df	t _{cal}	t _{cr}	P-value	α-value
EG	20	3.1	48	1.77	2.04	0.088	0.05
CG	18.52	4.6					

AppendixTable 4.Descriptiveand t-teststatisticsresult ofstudent’sforpre-testoutof 25

N	Group	Mean	SD	df	t _{cal}	t _{cr}	P-value	α.value
60	EG	15.1	2.72.4	58	1.74	2.01	0.093	0.05
60	CG	15.03						

AppendixTable5 Descriptive and t-testforeachquestion ofpost-test.

Group	Average	SD	df	t _{cal}	t _{cr}	P-value	α-value
EG	21	4.9	48	11.3	2.01	0.00	0.05
CG	12.84	5.3					

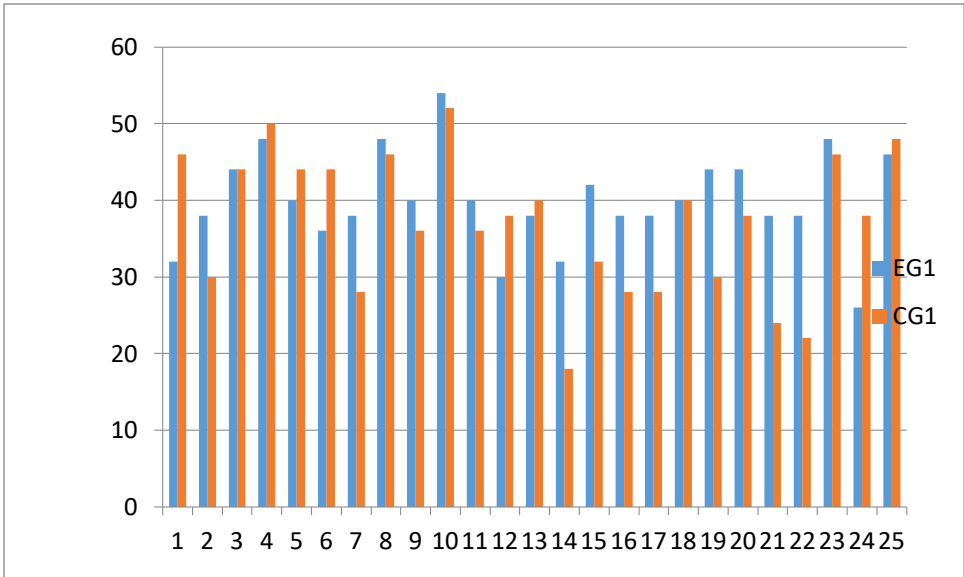
AppendixTable6 Descriptiveand t-testresultof studentsforpost-testoutof 25.

N	Group	Mean	SD	dt	t _{cal}	t _{cr}	P-value	α-value
60	EG	20.36	3.13	58	11.47	2.01	0.00	0.05
60	CG	5.26	3.13					

Appendix Table 7 Summary of Percentage, Mean and Standard deviation of the pre –test of experimental and control group.

Question	CG	%	Mean	SD	EG	%	Mean	SD
1	46	77	0.77	0.430	32	53	0.53	0.507
2	30	50	0.5	0.507	38	63	0.63	0.490
3	44	73	0.73	0.450	44	73	0.73	0.450
4	50	83	0.83	0.379	48	80	0.8	0.407
5	44	73	0.73	0.450	40	67	0.67	0.479
6	44	73	0.73	0.450	36	60	0.6	0.498
7	28	47	0.47	0.507	38	63	0.63	0/490
8	46	77	0.77	0.430	48	80	0.8	0.407
9	36	60	0.6	0.498	40	67	0.67	0.479
10	52	87	0.87	0.346	54	90	0.9	0.305
11	36	60	0.6	0.498	40	67	0.67	0.479
12	38	63	0.63	0.490	30	50	0.5	0.509
13	40	67	0.67	0.479	38	63	0.63	0.490
14	18	30	0.3	0.466	32	53	0.53	0.507
15	32	53	0.53	0.507	42	70	0.7	0.466
16	28	47	0.47	0.507	38	63	0.63	0.490
17	28	47	0.47	0.507	38	63	0.63	0.490
18	40	67	0.67	0.479	40	67	0.67	0.479
19	30	50	0.5	0.509	44	73	0.73	0.450
20	38	63	0.63	0.490	44	73	0.73	0.450
21	24	40	0.4	0.498	38	63	0.63	0.490
22	22	37	0.37	0.490	38	63	0.63	0.490
23	46	77	0.77	0.430	48	80	0.8	0.407
24	38	63	0.63	0.490	26	43	0.43	0.504
25	48	80	0.8	0.407	46	77	0.77	0.430

From the summery of table.7, even though for each question there were small statistical significant different between the two groups, the overall mean difference were not observed for both groups.



APPENDIX FIGURE.1 .The frequency distribution of students responds on pre-test before intervention

EG1=Experimental group respond pre-test

CG1= Control group respond on pre-test

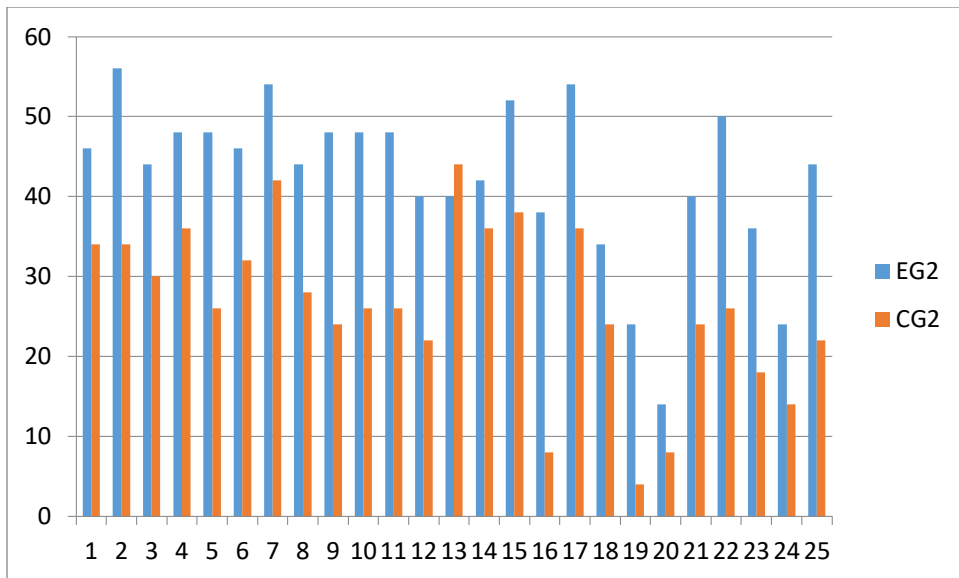
As one can see from the above figure 1,small number of students correctly responds on question number 2,6,11,12,14,19,21,22,24, those question needs conceptual knowledge to answer the question .Then the students did not answer by simple memorization. Some of the questions were formula relation, some were calculation, and some were unit derivation.

Maximum students' response were observed on question number 3, 4, 8, 10, 15, 18, 23, 25, was due to simple memory question. Even though there were individual difference in students in majority questions both groups were answer correctly.

Appendix Table -8 Summary of Percentage, Mean and standard deviation of the students respond on post –test of experimental and control groups.

Question	CG	%	Mean	SD	EG	%	Mean	SD
1	34	57	0.57	0.430	46	77	0.77	0.430
2	34	57	0.57	0.430	56	93	0.93	0.254
3	30	50	0.5	0.504	44	73	0.73	0.450
4	36	60	0.6	0.509	48	80	0.8	0.470
5	26	43	0.43	0.504	48	80	0.8	0.470
6	32	63	0.63	0.490	46	90	0.9	0.305
7	42	70	0.70	0.466	54	90	0.9	0.305
8	28	47	0.47	0.507	44	73	0.73	0.450
9	24	40	0.4	0.498	48	80	0.8	0.407
10	26	43	0.43	0.504	48	80	0.8	0.407
11	26	43	0.43	0.504	48	80	0.8	0.407
12	22	37	0.37	0.490	40	67	0.67	0.479
13	44	73	0.73	0.450	40	67	0.67	0.479
14	36	60	0.6	0.450	42	70	0.7	0.479
15	38	63	0.63	0.490	52	87	0.87	0.466
16	8	13	0.13	0.346	38	63	0.63	0.490
17	36	60	0.6	0.498	54	90	0.9	0.305
18	24	40	0.4	0.498	34	57	0.57	0.504
19	4	7	0.07	0.254	24	40	0.4	0.498
20	8	13	0.13	0.346	14	23	0.23	0.430
21	24	40	0.4	0.498	40	67	0.67	0.479
22	26	47	0.47	0.507	50	77	0.77	0.430
23	18	30	0.3	0.466	36	60	0.6	0.498
24	14	23	0.23	0.430	24	40	0.4	0.498
25	22	37	0.37	0.498	44	73	0.73	0.450

From summary of table 8, it was easily possible to understand there was difference in the mean of the two groups. Again from figure 2 it was easily observed that there were different between the responses of the two groups.



APPENDIX FIGURE .2.The frequency distributions of students respond on post test after intervention

EG2= Experimental group post-test.

CG2=Control group post-test

Figure.2. show that the experimental group students, those instructed by cooperative learning methods perform better than the control group students, those instructed by traditional method. Variations of students were observed on the two groups after treatment on the previous prior knowledge. To some extent the control group students answer correctly on some easily memorized question on selected topics. Relatively in the experimental group students perform the achievements test.

7.2 Appendix II

Pre-test

Choose the best answer from the following alternatives

1. Which one transmits electricity in solid state? A. water B. Copper C. Sodium chloride D. Sulphur
2. All the following have the same molecular shape except one .A. CHCl_3 B. CH_4 C. NH_3 D. PH_4^+
3. The smallest formula for compound containing Mn^{+4} and O^{-2} .A. MnO B. Mn_4O_2 C. MnO_2 D. Mn_2O_4
4. Identify the molecule that doesn't have double or triple bond. A. CO_2 B. Cl_2 C. CO D. N_2
5. Which of the molecules is non-polar? A. CS_2 B. SO_2 C. CHCl_3 D. SF_4
6. Which of the following has shortest bond length? A. O_2 B. N_2 C. H_2 D. F_2
7. The strongest of inter molecular force is:-A. dipole-dipole B. dipole-induced dipole C. London D. Hydrogen bond
8. Which of the following molecules represents a non-polar covalent bond? A. B-Cl B. C-Cl C. Cl-Cl D. Mg-Cl
9. Which of the following has high boiling point? A. Xe B. Ar C. Kr D. Ne.
10. Only one has linear geometry. Which one is it? A. OF_2 B. CS_2 C. H_2O D. CH_4
11. Which of the following rate law is third order over all ? A. $\text{Rate} = k[\text{A}]^1[\text{B}]^3$ B. $\text{Rate} = [\text{A}][\text{B}]^2$ C. $\text{Rate} = [\text{A}]^3[\text{B}]^3$ D. $\text{Rate} = [\text{A}]^5[\text{B}]^2$
12. Which of the following factors doesn't affect the rate of chemical reaction that is zero order? A. Concentration of the reactant B. Surface area of reactant C. Temperature D. Presence of catalyst
13. The reaction between NO and I_2 is second order in NO and first order in I_2 .What change occurs in the rate of reaction if the concentration of NO is doubled and I_2 left unchanged ? A. doubled B. quadruple C. eight time D. three time
14. A reaction is 50% complete in 2 hours and 75% complete in 4 hours .What is the order of the reaction? A. 0 B. 1 C. 2 D. 3
15. All the following pre-condition for reaction to occurs according to the collision theory except
16. A. the particle of reacting substances must collide B. the particle of reacting species must have proper orientation. C. the particle of the reacting must collide with energy

greater than or equal to the activation energy. D. in effective collision result desired product.

17. For reaction $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightleftharpoons \text{H}_2\text{O}(\text{l})$ $K_f = 1.4 \times 10^{11}$ and $K_r = 2.5 \times 10^{-5}$ at 25° then which one of the following is the value of K_c for this process? A 5.6×10^{15} B 1.8×10^{-16} C 1.4×10^{11} D 3.5×10^6
18. At certain temperature $K_c = 7.5$ for the reaction $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$. If 2.0 mol of NO_2 is placed in a 2.0 L container of NO_2 and N_2O_4 at equilibrium? A. $[\text{NO}_2] = 0.23\text{M}$, $[\text{N}_2\text{O}_4] = 0.39\text{M}$. B. $[\text{NO}_2] = 0.40\text{M}$, $[\text{N}_2\text{O}_4] = 0.20\text{M}$ C. $[\text{NO}_2] = 2.00\text{M}$, $[\text{N}_2\text{O}_4] = 1.00\text{M}$. D. $[\text{NO}_2] = 0.15\text{M}$, $[\text{N}_2\text{O}_4] = 0.29\text{M}$ E. $[\text{NO}_2] = 0.39\text{M}$, $[\text{N}_2\text{O}_4] = 0.23\text{M}$
19. For the equilibrium $\text{C}(\text{s}) + \text{CO}_2(\text{g}) \rightleftharpoons 2\text{CO}(\text{g})$ $K_p = 16.75 \text{ atm}$. At 500° , what is partial pressure 0.50atm ? A. $2.99 \times 10^{-2}\text{atm}$. B. $1.49 \times 10^{-2} \text{ atm}$. C. 0.25atm D. 0.05atm
19. According to Le Chatelier's principle the addition of heat to the following reaction :- $\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CH}_4(\text{g}) + 2\text{O}_2(\text{g})$, will cause it to shift to the right. The reaction can there for described as : A. spontaneous . B. unimolecular C. exothermic . D. endothermic
20. For the equilibrium :- $\text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{H}_2\text{O}(\text{g})$, $K_p = 3.17 \text{ Kpa}$ at 25° . How many mole of gaseous are there in 1L of closed vessel ? (Hence $K_p = P_{\text{H}_2\text{O}} = 3.17\text{Kpa} = 3.17 \times 10^3 \text{ pascal}$) A. 0.13 B. 1.28×10^{-3} C. 7.8×10^3 D. 77 E. none
21. For reaction $\text{A}(\text{g}) + 2\text{B}(\text{g}) \rightleftharpoons 2\text{C}(\text{g}) + \text{heat}$, formation of C is favored if : A. temperature increased B. pressure decreased C. amount of A increased D. catalyst is added
22. For reaction at equilibrium, which one of the following is true? A. $Q_p = K_p$ B. $Q_p > K_p$ C. $Q_p < K_p$ D. $Q_p = 0$
23. Which one of the following is correct about dynamic equilibrium? A. is the form of static equilibrium B. occur when the rate constant of the forward process is equal to the rate constant of the reverse process. C. only occurs in chemical equilibrium D. exist when the rate of the forward reaction is equal to the rate of the reverse reaction
24. The unit for K_c for the reaction $\text{H}_3\text{A}(\text{aq}) \rightleftharpoons 3\text{H}^+(\text{aq}) + \text{A}^{3-}(\text{aq})$ is A. mol/L B. mol^3/L^3 C. mol^2/L^2 D. L^3/mol^3
25. Which of the following affect the value of equilibrium constant (K) of reaction? A. addition of catalyst B. change in concentration of reactant C. change in concentration of product D. change in temperatures

7.3 Appendix III

Post test

Choose the best answer from the following alternative

1. Which of the following statement describes a system that is at equilibrium? A. the rate constant for the forward and reverse reaction are equal. B. the concentration of reactant and product are equal. C. the reaction is easiest. D. the forward and reverse rates are equal.
2. Consider the equilibrium, $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$ for which $\Delta H = +41 \text{ kJ}$. How the amount of H_2 affect in the system when it is subjected to an external stress? A. addition of CO_2 increase the amount of H_2 . B. increasing temperature decrease the amount of H_2 . C. addition of catalyst increase the amount of H_2 . D. decrease in volume increase amount of H_2 .
3. Consider the following equilibrium $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$. What happen if the total pressure is increased by adding nitrogen gas? A. K_c increase. B. the equilibrium shift to left. C. the equilibrium shift to right. D. the position of equilibrium not affected.
4. Consider reaction $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$ in closed container at equilibrium at constant temperature. What will be the effect of adding more PCl_5 on the equilibrium concentration of $\text{Cl}_2(\text{g})$. It---. A. decrease B. cannot be predicted without the value of K_p C. remain unaffected D. increase.
5. Which the following reaction has equal value of K_c and K_p ? A. $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{g})$. B. $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$. C. $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$. D. $\text{Ni}(\text{s}) + 4\text{CO}(\text{g}) \rightleftharpoons \text{Ni}(\text{CO})_4(\text{g})$
6. For reaction $\text{A}(\text{g}) + 2\text{B}(\text{g}) \rightleftharpoons 2\text{C}(\text{g}) + \text{heat}$, formation of C is favored if; A. temperature is increased. B. pressure decreased. C. amount of A increased. D. catalyst is added.
7. For reaction at equilibrium, which of the following is true? A. $Q_p = K_p$ B. $Q_p > K_p$ C. $Q_p < K_p$ D. $Q_p = 0$
8. For reaction $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g})$, $K_c = 1.00$ at about 1100k. Which of the following most always be true concerning this reaction at equilibrium at 1100k? A. $[\text{CO}] = [\text{H}_2]$ and $[\text{CO}_2] = [\text{H}_2\text{O}]$ B. $[\text{CO}] \times [\text{H}_2\text{O}] = [\text{CO}_2] \times [\text{H}_2]$ C. $[\text{CO}] = [\text{H}_2\text{O}]$ and $[\text{CO}_2] = [\text{H}_2]$ D. $[\text{CO}] \times [\text{H}_2\text{O}] = [\text{CO}_2] \times [\text{H}_2] = 1.00$

9. In which of the following yield of the product in the reaction $A_2(g) + 2B(g) \rightleftharpoons V(g) + \text{heat}$, would be higher? A. high temperature and high pressure. B. high temperature and low pressure. C. low temperature and high pressure. D. low temperature and low.
10. Which of the following is correct about a dynamic equilibrium? A. is a form of static equilibrium. B. occur when the rate constant of forward process equal to the rate constant of reverse process. C. only occurs in chemical equilibrium. D. exist when the rate of the forward reaction is equal to the rate of reverse reaction.
11. For reaction $H^+(aq) + OH^-(aq) \rightleftharpoons H_2O(l)$ $K_f = 1.4 \times 10^{11}$ and $K_r = 2.5 \times 10^{-5}$ at 25° then which one of the following is the value of K_c for this process? A. 5.6×10^{15} B. 1.8×10^{-16} C. 1.4×10^{11} D. 3.5×10^6 .
12. For the equilibrium $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ $K_P = 16.75 \text{ atm}$. At 500° , what is partial pressure 0.50 atm ? A. $2.99 \times 10^{-2} \text{ atm}$. B. $1.49 \times 10^{-2} \text{ atm}$. C. 0.25 atm D. 0.05 atm
13. The gas reaction $A + 2B \rightleftharpoons C$ is exothermic. A. an increase of temperature will drive the equilibrium toward the left. B. high pressure will favored the dissociating of C to A and B. C. the synthesis of C from A to B is favor by high temperature and low pressure. D. pressure has no effect on equilibrium.
14. Which of the following factors does not affect the position of chemical equilibrium? A. temperature. B. concentration. C. pressure. D. catalyst.
15. The unit for K_c for the reaction $H_3A(aq) \rightleftharpoons 3H^+(aq) + A^{3-}(aq)$ is A. mol/L B. mol^3/L^3 C. mol^2/L^2 D. L^3/mol^3
16. The system, $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ has: - A. 3 component, 1 phase and 2 degree of freedom. B. 3 component, 3 phases and 1 degree of freedom. C. 3 component, 3 phases and zero degree of freedom. D. 2 component, 2 phases and 2 degree of freedom.
17. According to Lech atelier's principle the addition of heat to the following reaction :- $CO_2(g) + 2H_2O(g) \rightleftharpoons CH_4(g) + 2O_2(g)$, will cause it to shift to the right. The reaction can there for described as : A. spontaneous. B. unimolecular. C. exothermic. D. endothermic.
18. Lech atelier's principle state that: - A. reaction equilibrium obtained only in certain condition of temperature and pressure. B. increases temperature while reducing pressure at the same time, enhance equilibrium. C. stress applied to system at equilibrium, shifts the system in such away as to relief the stress. D. Neither temperature nor pressure has a major effect on chemical equilibrium.
19. A reaction can be considered going to completion when K_c is A. less than one B. less than 1000. C. zero D. slightly less than one E. none of this.

20. Which of the following affect the value of equilibrium constant (K) of reaction? A. addition of catalyst .B. change in concentration of reactant. C. change in concentration of product. D. change in total pressure .E change in temperature.
21. The equilibrium constant for reaction $2x + y \rightleftharpoons x_2y$ is K. Then what is the equilibrium constant for reaction $3x_2y \rightleftharpoons 6x + 3y$. A. K^3 B. $3K$.C. $(1/K)^3$.D $(1/K)^{1/2}$ E. none.
22. At certain temperature $K_c = 7.5$ for the reaction $2NO_2(g) \rightleftharpoons N_2O_4(g)$. If 2.0 mol of NO_2 is placed in a 2.0 L container of NO_2 and N_2O_4 at equilibrium? A. $[NO_2] = 0.23M, [N_2O_4] = 0.39M$. B. $[NO_2] = 0.40M, [N_2O_4] = 0.20M$ C. $[NO_2] = 2.00M, [N_2O_4] = 1.00M$. D. $[NO_2] = 0.15M, [N_2O_4] = 0.29M$ E. $[NO_2] = 0.39M, [N_2O_4] = 0.23M$.
23. In reverse reaction represented by an equation $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$. The equilibrium partial pressure of hydrogen can be increased by :- A. adding catalyst B. increase partial pressure C. increase the total pressure .D. decrease the amount of iron. E. none above.
24. For the equilibrium $H_2O(l) \rightleftharpoons H_2O(g)$, $K_p = 3.17$ Kpa at 25° . How many mole of gaseous are there in 1L of closed vessel ? (Hence $K_p = P_{H_2O} = 3.17Kpa = 3.17 \times 10^3$ pascal)
A .0.13 B. 1.28×10^{-3} C. 7.8×10^3 D. 77 E .none
25. For the reaction :- $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$, an equilibrium mixture has a partial pressure for CO_2 and CO of 4.0 and 8.0 atm respectively . K_p for the reaction is :- A. 0.5 B. 2 C. 16 .D 32 E. none of the above

7.4 Appendix IV

Questionnaire and Interview

Introduction

The purpose of questionnaire and interview is to collect information regarding to “Implementation of cooperative learning in preparatory schools of kellem Wollega zone”.

Accordingly, the success of this study depends on the sincerity and frankness of your responses. Be sure that information you provide will be kept confidential and used only for the academic purpose.

Thank you in advance for your cooperation.

Name of school: _____

I Questionnaire for students,

1. How would you observe about cooperative learning in your school? Is it implemented in your school? If it was implemented in the class, what are the advantage and disadvantage of cooperative learning? Discuss.
2. When cooperative learning instructional method was used what are the challenges among the group member.
3. In the group working (cooperative learning style) are the students take the responsibility equally?
4. What do you gain before cooperative learning implemented in the lesson and after the use of cooperative learning in the chemical equilibrium and your achievement test?(only for experimental group).
5. Generally, what about your interest before the use of cooperative learning and after learning by cooperative method? (Only for experimental group).

II For teachers and school administrators interview questions

1. From educational police of Ethiopia cooperative leaning is the best way of instructional among other active learning. What do you think about the implementation and use of this method in your school?
2. If it was implemented in class instruction what change do you observe about students achievements?
3. If it is simple design what is the main challenges to do this?
4. What about the interest and skill of teachers to implement this instructional method?
5. From your observation is cooperative learning is valuable for increasing academic achievement of students?
6. What condition do you prepare to implement this strategy for the school (only for school administrators)?