THE EFFECTS OF MASTERY LEARNING AND IMPROVED TEACHING

ON MATHEMATICS ACHIEVEMENT

FOR SEVENTH GRADE TURKISH STUDENTS

AT A PRIVATE SECONDARY SCHOOL

by

Boniface Nwabueze

B.Sc.,Engineering, College of Engineering Sofia, 1979

B.Sc., Engineering, Boğaziçi University Istanbul, 1981

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A B S T R A C T

The aim of this study is not only to test the effectiveness of Mastery Learning method of instruction on achievement levels but principally to check if Improved Teaching could have an additive effect when used with Mastery Learning in raising achievement levels. THe study was carried out in Robert College including for classes of Orta II mathematics.

The hypotheses for this Study include:

Hypothesis I: The achievement level of the class under Mastery Learning method of instruction will be significantly higher than the control class..

Hypothesis II: The achievement level of the class under Improved Teaching will be significantly higher than the control class.

Hypothesis III: Improved Teaching will have an additive effect to Mastery Learning method of instruction. The class under Mastery Learning method of instruction combined with Improved Teaching will not only score higher than the control class but will also have the highest mean scores when compared with Mastery Learning or Improved Teaching Class.

These three hypotheses of the study were statistically tested using t-test analyses, Kendall's tau correlational analyses and analysis of variance. The results of these analyses show that:

1- The achievement level of the Mastery class is significantly higher than the control class at the .001 level of significance.

2- The achievement level of the Improved Teaching class is significantly higher than the control class at the .001 level of significance.

3- The class under the combined Mastery and Improved Teaching methods scored significantly higher than the control class at the .001 level of significance. The class under Mastery Learning combined with Improved Teaching scored significantly higher than the Mastery class at the .005 level and higher than the Improved Teaching at the .025 level of significance.

In this study, Mastery Learning alone accounted for 15 % of the variance in achievement, Improved Teaching accounted for 17.6 % of the variation in achievement and the combined Mastery with Improved Teaching accounted for 33 % of the variation in achievement among learners. The effects of Mastery Learning and Improved Teaching are additive according to the results of this study.

Ö Z E T

Bu çalışmanın amacı yalnızca Tam Öğrenme Yönteminin başarı düzeyi üzerindeki etkisini sınamak değil, aynı zamanda Tam Öğrenme yöntemi ile birlikte kullanılan ve öğretimin etkinliğini arttıran (Etkin Öğretim) diğer faaliyetlerin başarı düzeyini birikik bir şekilde etkileyip etkilemediğini incelemektir.

Bu çalışmanın denenceleri şunlardır :

Denence   I: Tam Öğrenme yönteminin uygulandığı sınıfın başarı düzeyi, geleneksel öğretimin uygulandığı sınıfın başarı düzeyinden önemli derecede daha yüksek olacaktır.

Denence   II: Etkin Öğretimin uygulandığı sınıfın başarı düzeyi, geleneksel öğretimin uygulandığı sınıfın başarı düzeyinden önemli derecede daha yüksek olacaktır.

Denence III: Tam Öğrenme ve Etkin Öğretimin başarı düzeyi üzerindeki etkileri toplumsaldır. Tam Öğrenme ile Etkin Öğretimin birlikte uygulandığı sınıfın başarı düzeyi yalnız geleneksel sınıfın başarı düzeyinden yüksek olmakla kalmayıp, aynı zamanda sınıf Tam Öğrenme veya sırf Etkin Öğretimin uygulandığ sınıfların başarı düzeyinden de önemli derecede daha yüksek olacaktır.

Bu üç denence t-testleri, Kendall-Tau korelasyonları ve iki yönlü varyans analizi ile sınanmıştır.

Bu analizler sonucu, üç denence de desteklenmiş ve Tam Öğrenme yöntemi ile birlikte kullanılan ve öğretimin etkinliğini arttıran faaliyetlerin başarı düzeyini birikik bir şekilde etkilediği ortaya çıkmıştır. Bu birikik etkinin yalnız Tam Öğrenme veya sırf Etkin Öğretimin etkilerinden daha yüksek olduğu ortaya çıkmıştır.

Tek başına Tam Öğrenme yöntemi başarıdaki değişkenliğin % 15'ini açıklarken, Etkin Öğretim % 17.6'sını açıklamaktadır. Birleşik olarak ise, Tam Öğrenme ve Etkin Öğretim başarıdaki değişkenliği % 33'ünü açıklamaktadır.

Bu çalışmanın sonuçları, Tam Öğrenme ve Etkin Öğretimin birleştirilerek kullanıldığı, durumlardaki başarının bunların kullanılmadığı veya tek olarak kullanıldığı durumlara kıyasla daha yüksek olduğunu açıkça göstermektedir.

CHAPTER I

INTRODUCTION: STATEMENT OF THE PROBLEM

The process of education necessarily involves the concepts of teaching and learning. Psychologists define learning as a process or operation inferred from relatively permanent change of behaviour that results from practice (Klausmeier and Goodwin 1975 pp 12). Teaching can be defined as the embodiment of planning, organization and implimentation of a series of learning tasks for the achievemed of some predetermined educational goals (Oğuzkan 1977) Education therefore involves the process of teaching and learning (Oğuzkan 1977)

Sociologists, psychologists and Educations primarily view the function of schools as the distribution of the knowledge and the culture of a society (Afreşa 1983 P1) Learning can here be looked at as a process of acquiring knowledge as a result of teaching (Afreşa 1983 p 2) The effectiveness of this culture and knowledge distribution, is directly related to the quality of instruction. This implies that the lower the

quality of instruction, the less effective will be the distribution of knowledge and culture of a society to its target population. Some researches indicate that schools do not perform their duties well, since wastage is a natural phenomenon in most systems of formal education (Coleman 1966, Jencks 1972). Wastage is refered to mean any failing performance involving learner within learning context at schools.

Bloom (1976), on the other hand thinks that school systems should be effective enough not only to decrease and or eliminate wastage, but also to reduce variances in achievement among learners so that a greater number of learners can attain higher levels of learning expected from the few alone. We define adequate achievement levels in learning to mean the capability of the learner to reach a criterion level of performance. This criterion level is usually predetermined, by the instructoor.

While advocating for effectiveness of schools we are now aware of some variables which affect achievement. Among those, is the quality of instruction. By quality of instruction we mean "the extent to which the practice and reinforcement of the learning are appropriate to the learner" (Bloom 1976 P II).

Bloom in his book <u>Human Characteristics and School</u> <u>Learning</u> (1976) states that "most students can attain a higher level of learning capability if instruction is approached sensitively and systematically, if students are helped when and where they have learning difficulties, if they are given sufficient time to achieve mastery and if there is some clear criterion of what constitutes mastery (p.4). It will be useful to briefly summarize Bloom's Theory and Method of instruction called Mastery Learning.

Mastery Learning Theory and Method

Mastery Learning is both a theory and a method of instruction. It aims to bring all or almost all the students to very high levels of learning. The theory has been tested under both quasi-laboratory and school conditions. Under both conditions research has shown that studying under Mastery Learning method of instruction usually leads to levels of archievement about a standard deviation above the mean in comparison to the students studying under traditional methods of instruction. Research has shown that in addition to enabling all or almost all of the students to reach very high levels of learning Mastery Learning method of instruction also enables students to build better academic selt-concept. By academic self-concept, we mean the subjective perceptions of the student about himself/herself and his/her performance in relation to others.

Bloom as well as many psychologists and educators think that successful experiences in school and school learning have a direct relationship to the individuals development of positive academic self-concept, which in turn increase the likelihood that the student will have a general positive self-concept. It is not unlikely that repeated successes or failures in schools have some significant effect on the students personality development and his/her general mental health.

Bloom states that"... if the school environment provides the individual with evidence of his/her adequacy over a number of years and especially in the first six years, there is some evidence that this provides a type of immunization against mental illness for an infinite period of time. The impact of academic success or failure consequently goes beyond learning the multiplication tables or history facts. It is essential on this point that the academic success is not to be minimized" (Bloom 1978 p 571).

The basic idea underlying Mastery Learning method of instruction is that all the students or most of them can learn any given subject to relatively high leves of learning. The normal distribution in achievement which is obtained as a result of individual differences in learning generally shows that only 15-20 % of the learners adequately learn what the teacher teaches and the rest leave the learning situation with inadequacy in learning (Afresa 1983, P.11-12). For Bloom, the normal distribution in achievement is unnecessary and

reprensents considreable social and individual loss. Repated
failures increase the probabilty of negative views towards
learning and towards the self.

The instructional model derived from Blooms Mastery
Learning Theory can be applied in every classroom at every
level and with every subject in any educational system. Major
variables in this instructional model are shown in Figure 1.

Student   Instruction   Learning
Characteristics   Outcomes

Cognitive Entry   ┌─────────────┐   ──→ Level and Type of
Behaviours ──────→ │ LEARNING   │ ·   ·· Achievement
                   │ TASK(S)   │
                   └─────────────┘   ──→ Rate of Learning
Affactive Entry   ↑   ↘ Affactive Outcomes
Characteristics

                   Quality of
                   Instruction
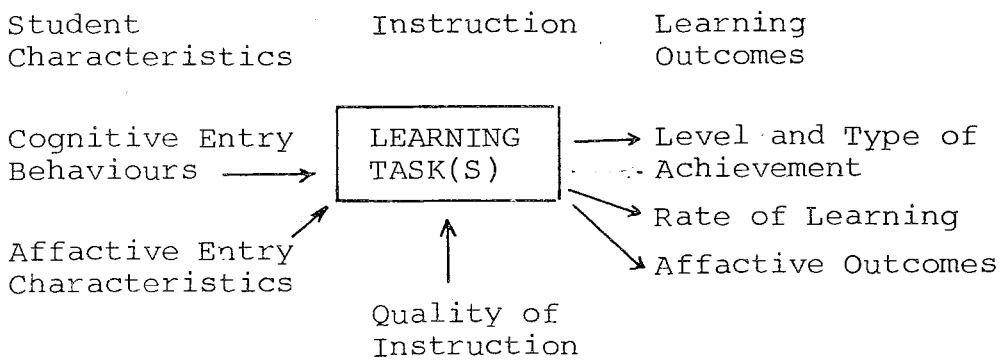
FIGURE I: The Model of Mastery Learning

It will be useful to define the variables in this Model
to have a clear understarding of what the whole system is. The
Independent variables are the students Characteristics, the
Learning task and the Quality of Instruction. There are two
kinds of student Characteristics;

Cognitive Entry Behaviours are defined as the extent to
which the student has already learned the prerequisites for
the learning task to be accomplished. It has been found that
about 50 % of the variance in achievement is accounted for by
the Cognitive Entry Behaviours.

Affective Entry Characteristics refer to the motivational
attitudes of the learners towards learning and the self before
they start on a learning task. Affective Entry Characteristics
are a function of the students' learning history, related to
learning tasks, school and self perceptions. This variable can
account for about 25 % of the variance in learning achievement.

Learning Task is defined as a basic unit which can be
analysed, evaluated and taught. It can be learned over a
relatively small period of time, usually between two to ten
hours of instruction.

Quality of Instruction is defined to mean the degree to
which the presentation, explanation and ordering of elements
of the task to be learned approach the optimum for a given
learner "(Bloom 1976 p III)". Where the Quality of Instruction
approaches the optimal for a given learner we would expect
that the limiting effects of the previous history could be
decreased while the effects of the current history (the
quality of instruction provided in a particular set of
learning tasks) could be greately increased" (Bloom 1976
p. 137). Usually, a high quality of instruction can be reached
through the use of cues, student participation, reinforcement
and most importantly, through the use of feed back and
correctives.

Cues tell the student what is to be learned, what to do and how to do it. Participation is the extent to which the students' involvement is gained. Usually a high quality of instruction is expected to trigger maximum involvement of the learners in the learning process. Participation can be overt as well as covert. Overt participation is the observable involuement of the students in the learning process while covert participation is the involvement of the learner by thinking relevantly about the subject matter.

Reinforcement is the stimulus created by the teacher which increases the probability of reoccurence of the behavior pre ceding it.

Feed back procedures generally are made up of brief ungraded formative tests given to the students at the end of every learning task. The results of the formative test tell the teacher what the student has learned and what he needs to learn more. The purpose of the formative test is to provide the tacher with the information about the students performance. Those who do not reach the predetermined level of learning are given appropriate correctives by going over the learning task again. Having corrected the errors, a parallel form of the formative testis given to those students who have not reached the Mastery criterion in the first formative test. Should there be still students who do not reach the criterion on the second parallel test, correctives are again administered to them; and a third parallel form of the formative test is given to them. Central here is that the teacher has to bring most

if not all of the students to the criterion level of learning before moving to the next learning task. This provides the students with the necessary cognitive entry behaviours for the next learning task as well as reducing the variance in learning at the initial stages preparatory to reducing learning variance in the final achievement. This procedure of feed back and correctives is followed until the final learning task is completed.

It is expected that when Mastery Learning is used, the higher the students go up on the sequentially arranged learning tasks, the less will be the variance in learning out comes as well as the time required to reach the predetermined level of learning. Cognitive Entry Behaviours, Affective Entry Characteristics and the Quality of Instruction account for about 90 % of the variation in achievement. These independent variables so far discussed have direct effect on the learning outcomes, or the dependent variables.

Dependent Variables of the model include level and type of achievement, rate of Learning and affective outcomes.

Level and Type of Achievement: As the Quality of instruction approaches ideal for a given student, that is, when the student recives help when and where he/she needs it, when feedback and corrective procedures are systematically followed, the cognitive entry behaviours and affective entry characteristics of the student will be positively altered. The students will begin to resemble each other in achievement. More than 80 % of the students will reach levels of learning

expected from 15-20 % of the students under nonmastery condition.

Rate of Learning: Through the use of Mastery Learning method, the students are given feedback and correctives in prior learning tasks. They, therefore, become cognitively ready for the following learning tasks. This reduces the time required to master the subsequent tasks. Thus, rate of learning increases and the variance among the students in terms of learning rate decreases.

Affective Out comes: Improved quality of instruction promotes achievement. Successful performances energize the students, and make them develop positive views about their own competence, learning and self.

The assumption behind Bloom's instructional method called Mastery Learning is "What any person in the world can learn, almost all persons can, provided with appropriate conditions of learning (Bloom 1976 p 564). It is in order here, to mention that the work of Benjamin Bloom and his associates which gave birth to Mastery Learning method of instruction greatly inspired the interests to undertake this study. However, the researcher essentially wants to check if Improved Teaching can be additive to Mastery Learning method of instruction.

Improved Teaching

Bloom recently stated that improving teaching in addition to using Mastery Learning as an instructional method has an additive effect in terms of student achievement. In this study, not only the Mastery Learning method of instruction was compared with traditional methods of instruction but teaching was improved by giving the teacher feedback in terms of the amount of time and help she was giving to various groups of students. In this way, the effect of Mastery Learning method of instruction as well as the effect of Improved Teaching was compared to traditional methods of instruction. It is expected that where Mastery Learning is used in addition to Improved Teaching, achievement levels will be higher than when Mastery Learning or Improved Teaching is used alone.

The Problem

Our main concern in this study is to test the effects of Mastery Learning method of instruction and Improved Teaching on student achievement. It has been shown that Mastery Learning method of instruction not only reduces the variance among learners, but it also helps to bring most students to a predetermined mastery criterion. When compared to traditional methods of instruction, Mastery Learning used alone produces an achievement distribution where the average is one standard deviation above the mean in the control class and where the variance among students is less than the control class. When Mastery Learning and Improved Teaching are used together, we

expect this difference to approach two standard deviations.

To test the effectieness of Mastery Learning and Improved Teaching, four groups of students were used. The use of four groups of students was as a result of the four learning methods applied in this study. With one group, Mastery Learning method of instruction is used in combination with Improved Teaching (ML + IT). Instruction was improved by giving feed back to the teacher about her interactions with various groups of students. Another group studied under Mastery Learning conditions alone.(ML)

The third group studied under traditional methods of instruction where only the effect of Improved Teaching was added via giving feed back to the teacher about her inter- action with various subgroups of students (IT). The final condition was the control group (C) where only traditional methods of instruction were used.

The problem of the study is whether Mastery Learning used in conjuction to Improved Teaching yields higher levels of learning than either Mastery Learning or Improved Teaching produces alone. Furthermore, it is desirable to find interventions whose effects are additive in raising levels of learning. Another important problem of the study is to test if the effects of Mastery Learning and Improved Teaching are additive.

CHAPTER II

SURVEY OF LITERATURE

This study is essentially concerned with the effects of Master Learning and Improved Teaching on students' archievement. Classroom environments can be altered for the promotion of learning outcomes. Mastery Learning and Improved Teaching are the two chosen methods here which influence archievement levels. Mastery Learning method of instruction, originally developed by Benjamin Bloom in 1968 was chosen because of available evidence in support of its effectiveness.

Research findings show that Mastery Learning enables a large percentage of students to reach a level of achievement that is reached by less than one fourth of students under traditional method of instruction. Studies done by Airasion (1969), Hogwan at al (1970), Kersh (1971), using Mastery Learning methods show that there is a difference of a standard deviation between the Mastery and the Control

classes. These studies show distinct differences in learning archievement in favour of mastery groups. Those studies also show that the achievement variance of the mastery groups when compared with the control groups is sharply reduced.

Bloom attributes the reason why a majority of the students reach high levels of learning when mastery is used to the fact that the learning errors are corrected as they occure during instruction. He explicated that one of the most important factors that create and enlarge individual differences in learning is the compilation of uncorrected errors which appear during instruction. Error correction therefore, becomes central and inevitable in the application of mastery learning. This error correction is carried out through formative tests. Through the use of formative tests, the teacher finds out which of the objectives the student has accomplished and which ones he/she has not. With this knowledge, the teacher corrects the errors and furnishes the missing lines. After this correction, a parallel form of the same formative test is given, to inform the teacher about the effect of this correction.

In addition to the use of Mastery Learning method of instruction, in this research, teaching was improved by giving feedback to the teacher about her interaction with various groups of students in the classroom. Where necessary, the teacher was advised about her interactional mode.

Research has shown that teachers interact differentially
with various groups of students. A study done by Brophy and
Good (1974) shows that teachers intaract with the students
in ways that are unfavourable to lower achieving students.
Brophy and Good found that teachers' responces to low achievers
include not allowing enough time for the pupil to answer
his/her questions, not following up when a pupil answered in-
correctly, rewarding inappropriate behaviour and not
providing feedback to such pupils," (Sprinthall and
Sprinthall 1977, p 409)

Jackson states, "schools are places in which rewards
and punnishments are administered in abundance, smiles
compliments, special privilages, good grades and high scores
on tests are occasioned by certain kinds of classroom behaviour.
Frowns, scoldings deprivation poor grades and low scores on
tests are occassioned by other kinds. Further, these
satisfying and annoying experiences are not evenly distributed
among the students but, instead tend to be concentrated in
both kind and number, some students become accustomed to
receiving classroom rewards, others to receiving classroom
punishments", (Jackson 1968 p 73).

These students who are encouraged more through the teachers smiles and special privilages, whom the teachers talk to, ask questions and reinforce more, will not only develop positive affect towards the teacher, the subject and the school as a whole, but they are more prone to participate more actively in the class, at least overtly. Participation and positive attitudes are positively correlated to achievement (Bloom 1976). Along the same lines, the effectiveness of performance depends in part on the motivation and involvement of the performer (Jackson 1968, p.74). Those students who receive little or no reinforcement no supportive statements, who, not only are least encouraged but are most scolded and annoyed will in contrast become least motivated and least involved in the learning process. Subsequently, they are expectedly going to be the faling students who with passage of time will be sinking further and further down in the academic heap and their frowns will be deepening more as they descend (Jackson 1968 p 74).

In a study relating teacher expectations with gains in achievement, Rosenthall and Jacobson stated that "teachers create different environments-different sets of stimulation and expectation for children in the same classroom" (Rosenthall and Jacobson 1968). Teacher expectation is one of the direct factors associated with the achievement of the learners. In a situation where the teacher expects very few of the students to be excellent, many to pass and few to fail, it is not unlikely that he/she will gear his/her efforts towards the actualization of such a state. In the study done by

Rosenthall and Jacobson, a group of students randomly selected was for the purpose of the study said to make the greatest gains. Teachers whom these randomly selected students were assigned were told that these students would show gains in intellectual development more than other students. It was later found that those students did demonstrate intellectual gains more than those that were not designated as capable of making great gains. What happened was that the teachers created a classroom atmosphere that was favourable to the intellectual growth for those learners.(Rosenthall and Jacobson 1968) In fact, when the teacher creates different environments for different students, some profit and some do not. According to Mc Keachie "some instructor are worm, friendly, personally interested in each student; other instructors are subject or self-oriented and elicit few expectations of affiliative satisfaction" (Mc Keachie 1968, p 113)

The study done by Page (1968) showed that there exists a significant relationship between teacher comments and students achievement. By teacher comments, Page referes to such statements like; "Good work, keep at it". C:perhaps try to do still better". "A: excellent! keep it up" In page's study, there were three groups of students; The "specified comment" group which was given automatic impersonal comments the "free comment" group, which received individual comments from the teacher and the "No comment" group. The study showed that the comment groups achieved significantly higher than the no-comment group.

Brophy (1976) stated that successful teachers communicate high expectations to their students. They do this by providing a warm and supportive atmosphore to the students. Brophy also found that encouragement and praise correlated with learning gains especially with the students from low socioeconomic status (Brophy 1976 p 89-90) Criticisms such as "That's a dumb answer, what's the matter with you, are more probable to produce resentment than motivation to improve (Brophy 1976 p 98). In this study, such criticisms are addressed as negative statements. It is likely that students who receive such negative statements will develop low motivation for learning.

Barnes in his book called From Communication to Curriculum states that "As the form of communication changes, so will the form of what is learned" (Barnes, 1976 p 15) This may be said to imply that if interactional communication is differentially formed in a way that it is favourable to some students and less favourable to others, archievement distribution will expectedly follow such a pattern; some students will have more learning gains than others.

Carkhuff, Barenson and Pierce (1973) discuss teacher-learner relationships. They advocate that the teacher has to organise himself/herself and his/her efforts to fascilitate the development of constructive learning relationships with the students. The teacher has to promote a classroom environment and interaction to maximize learning activities.

The teacher is expected to behave in ways that are appropriate to learning (Carkhuff, Barenson and Pierce 1973 p 12). Flanders (1970) states that students learn more and enjoy learning more when their own ideas are given some considerations and when the learning conditions provide good opportunity for them to show initiative. It is highly probable that the amount of spontaneous student discussion will have a direct relationship with the learners achievement gains (Flanders, 1970 p 17). Flanders stated that, "Techniques for analysing current average classroom interaction reveal a high degree of teachers domination in setting learning tasks and in thinking through problems so that pupils' ideas and initiative are underdeveloped. As a result, teachers and pupils rarely experience thoughtful, shared inquiry (Flanders, 1970 p 16).

In this research project, we are not only interested in the effect of Mastery Learning on achievemen, but also in the combined effect of Improved Teaching as well as Mastery Learning on the level of learning. It has been shown that Mastery Learning raises the level of learning about one standard deviation over the mean of a nonmastery group. In this study, it is expected that effect of Mastery Learning in addition to Improved Teaching raises the level of learning higher than either Mastery Learning or Improved Teaching can alone.

CHAPTER III

METHODOLOGY

This section presents the research design, the concerns of the stury, followed by a section dealing with the hypotheses and their operationalizations.

Research Design

Subjects of the study: The subjects of this study were chosen from Robert College; a private high school in Istanbul teaching in English. The students in this school are mainly the children from upper and uppermiddle class families. Robert College is a co-educational school with a total of about nine hundred students. It has an average ratio of thirty students per teacher. The researcher previously had two successful study programs in this school and was familier with the schools' administrative staff, the teachers and the students. It was therefore not difficult to obtain the administrations permission

as well as the cooperation of the teachers and the staff.

The sample for this study was chosen from orta II students. The grade levels in this school range from six through eleven. Orta II corresponds to the seventh grade in the Turkish educational system. There were four sections in this grade level and all of them were used for the study. This sample comprised a total of hundred and twenty eight students; thirty two students in each of the four sections. These were section A, section B, section C and section D and were independently taught by a teacher.

Subject Area   The subject area for this study was mathematics. All the orta II students participated in the study. The text book used was written by: (Mary P. Dolciani, Richard C , Brown, Frank Ebos and William L Cole 1981) The researcher chose the area of mathematics on preferential basis. Orta II students were chosen because three differnt teachers were teaching the four classes. Only one teacher was teaching two classes. There were three mathematics teachers for the four groups; the largest number of teachers for all the sections of a grade level. The researcher would have prefered four teachers here , however, the conditions of the study made three teachers adequate.

One teacher instructed using Mastery Learning method of instruction. This class was section A, called the ML class. Another teacher used Mastery Learning in addition to Improved Teaching. Improved Teaching was attained by giving feedback to the teacher regarding the time and amount of interaction she was having with the various groups of students. This class was the D-section, called ML+IT group. Another class was taught using traditional method of instruction combined with Improved Teaching through the process of feedback to the teacher in terms of her interaction with the students. This was the B-section called IT class. The fourth class was taught using only traditional method of instruction and this was the C-section called the control class(C). The B(IT) and D (ML+IT) sections were taught by the same teacher.

The learning unit chosen for this study was Chapter six of the Algebra text book. This chapter was headed Fractions. This unit was, for the purpose of this study divided into four learning tasks. These four learning tasks are:

1. Simplifying Fractions
2. Dividing/Multiplying Fractions.
3. Least Common Donominators.
4. Adding/Subtracting Fractions.

This Algebra text book was usually followed sequencially from chapter one through twelve by the teachers. Chapter six was chosen three weeks prior to the implimentation of the study. At this time the students were starting Chapter five.

The three weeks before the study started were used to train the experimental teachers as well as stating the objectives for every learning task.

Design of the Study

This study was a field experiment carried out in school classrooms. The two major independent variables in this study are Mastery Learning (ML) and Improved Teaching (IT). The model of the design is shown in figure 2.

Figure 2-The Design of the study.

In the two by two table shown above, the D section received Mastery Learning and Improved Teaching methods of instruction (ML+IT). There were four learning tasks to be learned to criterion level by the students. The criterion level was set at 80 % level of learning. At the end of every learning task, a formative test was given to all of the students. Students who did not reach the criterion level of achievement were given feedback and carrectives through going over the points they did not learn well in the unit. After this feed-back and correctives a parallel test of the formative test was

given to them. Students who still did not reach this criterion
in the first parallel form were given additional feedback and
correctives and the second parallel form was administered to
them. In this class, teaching was improved through the process
of giving feedback to the teacher with reference to the ways
she was interacting with the low, average and high achieving
students.

In section A (ML) only Mastery Learning was implimented
in the same way as it was done in the D section. However,
in the A-section there was no interactional feedback to the
teacher.

In section B (IT), instruction was non-mastery but the
teacher was given feedback about her interaction with the
low,, average and high achieving students. Finally, section C
(C), the control class was taught without Mastery and Improved
Teaching. This section was taught with traditional method of
instruction. Sections D (ML+IT) and B (IT) were taught by
the same teacher while section A (ML) and section C (C) were
taught by two different teachers.

There were 32 students in each of the four classes.
All the four sections started the first learning task on the
same day. All of the students in each of the four classes
took the formative tests given at the end of every learning
task. Correctives, additional time and help were given to
those students in the Mastery classes who did not score up
to the criterion level on the formative tests. Following
these corrections a parallel form of the formative test was

given to them. Those who again did not reach this criterion
on the first parallel form were given correctives and help
they needed and a second parallel test was given to them.
A summative test was administered to all of the students at
the end of the unit. The four classes took the summative
test on the same day. The whole study lasted five months.

Preparation for the Study

The preparation for this study was done in three stages.
The first stage was a pilot stury. The second stage
comprised systematic observation of the students in the
classrooms. The third and the final stage involved the
training of the experimental teachers, stating the objectives
of each of the four learning tasks and designing testing
instruments as well as gathering other necessary materials
for the study.

Pilot Study

The purpose of the pilot study was to identity some
of the interactional variables used in classrooms. Some of
these variables were used by other researches and some were
discovered during the pilot study. During this period, eleven
classrooms with different subject areas and different grade
levels were observed. The variables were related to the teachers'
kind and time of interaction with the students. In general,
during the 11 hours of classroom observation, 10 inter-
actional categories were identified. The list below includes

these variables and their operational definitions.

Interaction kind

1.   Teachers' Questions: The teacher ask questions to the students and the students try to answer them.

2.   Supportive Statement: These are short positive and random statements kthe teachers make to the students. They are general and free statements. They are neither contingent upon nor are they preceded by a behaviour of the student, (Leacock 1969)

3.   Rainforcement:This referes to the stimulus presented to the student which increases the probability of the behaviour occuring before it. If the student shows his/her mark to the teacher and the teacher says "Excellent! keep it up," this is recorded as reinforcement. In other words, if what would be recorded as a supportive statement follows the students behavour, it was recorded as reinforcement, (Brophy and Good 1974)

4.   Negetive Statement: Negetive statements are the statements the teacher makes to the student which tend to debase, shame and degrade the student in the class. These statements include such statement as "That's a dumb answer", (Leacock 1969)

5.   Students Questions: Students ask questions to the teacher in relation to the subject being studied (Identified by the researcher 1984).

6.   Eye Contact: Eye contact is defined to include any facial or bodily expression which the teacher uses to

communicate with the individual students while maintaining contact with the learner's eyes, (Karkhuff, Berenson and Pierce 1976)

7.   <u>Proximity in Space (nearness)</u> :By proximity in Space or physical Nearness, the researcher referes to the instances where the teacher places himself/herself near the students location in the class. Physical nearness to the learner communicates to the student that the teacher is paying attention to what the student says and does (Karkhuff, Berenson and Pierce 1976 p 85). The teachers nearness also tend to communicate to the student that the teacher cares for him/her.

8.   <u>Priviledges and Duties:</u> Teachers assign to some students certain duties and priviledges. Some teachers assign some class-related responsibilities to some students. Examples of such other duties include: "Ayşe will be responsible for the class chalk and duster", "Burak will care for the register and Ercan is tall and strong enough to open and close the windows as may be required", and "Lale will be incharge of the class money". This category is developed by the researcher (1984).

These kinds of extra responsibilities have some motivational effects on the students. These students tend to have positive views of themselves not only as active members of the class but also as responsible members on whose good services the smooth running of the group is entrusted.

Interaction Time

9.   Waiting Time: The length of time the teacher waits for a student to answer his/her question, (Broughy and Good 1974).

10.   Explanation Time: The length of time the teacher takes to explain or answer the students question. (Brophy and Good 1974)

The researcher's expectation that teachers use these interactional categories differentially in favour of the high achieving students is supported by the findings from the four sections of orta II. (see figures 3,4,5,6,7,8,9 and 10 pages in the result section). It must be remembered that the development of some of these interactional elements was done through observations in II classrooms of various subject areas. The orta II grade classrooms were not used for the development of these categories.

The subjects for this study were made up of all the students and teachers in Orta II mathematics classes, including four sections. Each of the teachers came from different nationality; A Scottish teacher was teaching the ML+IT and the IT classes. An English man was teaching the control (C) class and a Turkish teacher was teaching the ML class.

Observation of the four classrooms

Prior to the systematic observation of the subjects in their classrooms, a check was made as to whether there were any significant differences in terms of achievement between the mean performances of the four sections. The average previous mathematics performances of the four groups were compared and there were no significant differences among them. The mean performances of the groups regarding their general commulative averages were also compared and there no significant differences among them either.

Using their one year previous mathematics grades, each of the four sections was further divided into three subgroups that were for the purpose of this study classified as Low, average and high achieving Subgroups of students. The school's passing score in any subject is five, the maximum grade being 10. The reseracher therefore classified students whose grades were five as low achievers since those who scored below five must have faild the year. Those students whose grades were six or seven were considered as average achievers and those students who received grades of eight through 10 were grouped as high achieving students. The purpose of this subdivision of each of the four sections into three groups regarding achievement was to enable the researcher to identify and record which subgroup of students was receiving the teachers' interaction more and which subgroup received it least. These data were then used to give the teacher feedback about his/ her pattern and style of interaction with the various sub-groups of students.

Each of the four sections was observed for ten different
teaching periods and each period took fourty five minutes of
teaching. This observation was aimed at recording and coding
teacher/student interaction including the time of interaction
and the extent to which the teacher used those interactional
variables as well as his/her interactional pattern with the
various subgroups of students. The researcher studied the
names of the students as well as the location and the position
of each of the students in each of the four classes. This
helped him to identity which students were interacting with
the teacher. The observer was physically present in each of
the ten different classroom observations in each of the four
classrooms. Each of those interactional elements was recorded
as having occured "x" number of times in one class period and
with which student, for example, if the teacher asked a
question to Ayşe, following Ayşe's name   under
the columne headed "Teacher's questions" the researcher marks
"I", if another question went to Ayşe at the same class period
we mark another "I" in the same space for Ayşe. See tables 17,
18, 19 and 20 P 97-100 for this recording procedure for the
four classes. Interaction time was recorded in munites. Inter-
actions that lasted less than ten   seconds were represented
in those four tables as dots. "."Seven such interactions were
considered as having lasted for one minute. Interactions that
lasted from ten   through 40 seconds were represented in
these tables by dashes. "-"Three such interactions were recorded
as having lasted one minute.

Intergudge Agreement

To assure the reliability of the observation, one of the school's counselors was given one week training on methods of observation recording and coding. Following the training, a class was observed for one hour by both the researcher and the counselor as a practice. Subsequently, each of the four mathematics sections of orta II was independently but simultaneously observed by the researcher and the counselor. Each observer recorded and coded the events as they occured. Percentage agreement between the two observers was calculated by the following formular: $\frac{2\Sigma \text{ agreement}}{\text{Total A+Total B}} \cdot \frac{100}{1}$

In section A, 80 % agreement was obtained between the two gudges. In section B, 83 % was obtained. In section C, 95 % agreement was obtained and in section D, 89 % agreement was obtained. The differences in observation and recording between the researcher and the counselor were in terms of the time an event took. In recording the time for example, where the conselor recorded 30 seconds the researcher might record 27 seconds. There was almost no difference in recording of the actual events as they occured. Intergudge reliabilities in the four sections of orta II mathematics classes based on the occurence of events ranged between 80 % and 95 % agreement.

Training the Experimental Teachers

Two weeks before the introduction of the different instructional strategies into classes the researcher had a meeting with the three concerned teachers and explained what the study was all about as well as what was to be expected from the teachers while implimenting the study. This meeting was conducted preparatory to securing the teachers' agreement and commitment. However, one of the teachers expressed a Lack of readiness to devote such extra time and energy which the study would inevitably call for. In view of this unwillingness from one of the teachers, assignment of the teachers to the teaching/learning strategies was done on basis of availability. The unwilling teacher was assigned to the control group. One teacher was assigned to the Mastery (ML) class and the other teacher was assigned to the Mastery with Improved Teaching (ML+IT) and to the Improved Teaching (IT) classes.

The researcher had three meetings with each of the two experimental teachers. These teachers were instructed on what they would do and how they would do it when the study started. Each of the two experimental teachers was advised and requested not to tell any other teacher what she was doing with her students in connection with the new teaching/learning strategies. The learning objectives for the unit were shown to the three teachers and discussed. After correcting these objectives developed by the researcher, the teachers accepted them to be appropriate to the learning unit.

Formative texts tapping each objective in each of the four learning taks were prepared. These formative tests were given to the students at the end of each learning task. A parallel form for each of the four formative tests was also developed for those students in the Mastery classes who would need feedback and correctives to reach the criterion level in each of the learning tasks. A second parallel form of the formative tests was again prepared for those students who still could not reach the criterion level after the first parallel form.

Procedure

Four days before the implimentation of this study, feedback was given to the same teacher who used Improved Teaching in classes B and D. The analysed interaction figures in these two classes were given to this teacher (see Figures 4 and 6). These figures were explained to the teacher two times, after which they were left with her for two days so that she could better understand her pattern of interaction with the students. This teacher was told that she was interacting most with the average and high achieving students and was advised to change her interaction in ways that would triger overt participation of the low achieving students, she was also suggested to increase her interaction with the low achieving students.

The study started on the 15th day of January 1984. The teacher who was assigned to use improved teaching method started to interact with the students more evenly according to the advices from the researcher. Each learning task took an average of two hours to be tought. A formative test was given to all of the students in each of the four classes at the and of every learning task. Feedback and correctives and parallel tests were given to those students in the mastery classes who did not reach the criterion level of achievement on the first formative test. Correctives and parallel forms of the formative tests were administared to those mastery students who needed extra help and these parallel form tests were corrected before moving to the next learning task. Additional help in the form of feedback and correctives was again given to the students in the Mastery classes who still did not reach the criterion level on the parallel form of the formative test. These correctives and parallel form tests were given and corrected by the mastery teachers. The study was completed in a total of three weeks. At the end of the unit a summative test was administered to all of the students in this study on the 29th of February 1984 at 9.45 am.

Date Collection

Initial Measures: Data with regards to the students' previous academic performances in mathematics and their general cummulative averages in the school subjects were gathered from the school records. Although the students were randomly assigned to classes, t-tests were nevertheless used to check if there were any significant differences among the groups' mean performances in mathematics and in their general grade point averages for the previous year. There were no significant differences among the groups in terms of mean mathematics performances and cummulative grade point averages. This comparisms are shown in tables 1 and 2 in pages 44 and 45

Data in terms of teacher/student interaction was calculated during the process of observation of the four clases. The frequency of each of the interactional variables was calculated following observation. The pattern of the teachers' interactions with the students were obtained from these observations. Table 3 shows the frequency of these interactional variables in each of the four sections. Teachers' interaction per student was calculated by dividing the number of interactions of the teacher with a subgroup by the number of students in that subgroup. In addition, interaction time was calculated in the same manner and the findings are shown in tables 3 and 5 pages 47 and 56

Process Measures: At the end of each of the four learning tasks, a formative test was given to the students. The mean performances of each of the four classes were obtained. The groups were again compared regarding their mean performances in the first formative test, t-test was used to check if there could be any difference among their mean scoresin the first formative test. Significant differences were not found among them. Table 6 page 61 in the result section shows this comparison.

Final Measures:When the learning unit was completed, a summative test was given to all of the students that made up the sample. The mean performance of each group was calculated. Using this test, a comparism was made among the four groups in terms of achievement scores. Table 14 shows this comparisons using t-test, The percentage of students who reached the criterion level of achievement from each of the four classes was calculated (Table 7) Shows this analyss. Table 7 shows the number and the percentage of students in each section who reached the mastery criterion in the four formative and the summative tests.

Analysis of Data

To compare the achievement levels of the four groups, and to test the hypotheses of this study, statistical methods used includes t-tests, Kendall Tau Rank order correlational analysis and two way analysis of variance.

Concerns of the Study

Stated in this section are the hypotheses, their variables and the operational definitions of these variables. In this study, the researcher's concern was not only centered on the effects of Mastery Learning on the learning achievement of orta II mathematics students at a private secondary school in Turkey, but also on the combined effects of Improved Teaching and Mastery Learning on achievement.

Research done over a decade using Mastery Learning method of instruction showed that it has been an effective learning strategy capable of bringing most of the learners to very high levels of achievement. In addition, under this instructional strategy, the variance among students in terms of their achievement dimishes when compared with students under non-mastery conditions. Improved Teaching, a process of giving the teacher feedback about his/her interaction with the students is expected to have positive relationship with learning gains. The researcher expected that higher achievement and more reduced variation in learning outcomes would be realized when Mastery Learning is combined with Improved Teaching than using Mastery Learning or Improved Teaching alone. The hypotheses of the study include the following:

<u>Hypothesis I</u>: THE GROUP OF STUDENTS UNDER MASTERY LEARNING METHOD OF INSTRUCTION WOULD ACHIEVE SIGNIFICANTLY HIGHER THAN THE CONTROL CLASS.

Variables and their Operational Definitions

Mastery Learning method of instruction applied to the mastery class and Traditional method of instruction applied to the control group are the two major independent variables in this hypothesis. The main subvariables of the Mastery Learning method of instruction used in this study are, cues, participation, reinforcement feedback and correctives defined on page 7 . The ways these subvariables were used are stated below:

<u>Cues:</u> The objectives for each of the four learning tasks were formulated by the researcher first, and approval of the teachers on these objectives was later obtained. Further, these objectives were separated into lower vs higher mental processes. Each learning task was analysed with reference to facts principles and possible application of these facts and principles based on the objectives. Those analyses were done in advance to provide cues to both the teacher and the students, see Appendix pages 89 to 94 for these objectives).

Participation: Students' participation especially in the Mastery Classes was highly encouraged at every step in the learning process through question-response procedures and through application of the facts and principles in relation to the objectives of the learning tasks.

Reinforcement: The students were well involved in the learning process; the high scores they received as a result of the new instructional method were positively reinforcing. Feedback and correctives given by the teacher also helped to reinforce the students.

Feedback and Correctives: At the completion of each learning task, a formative test was given to the students. Feedback and correctives were given to the mastery students who did not reach the criterion level of learning, followed by a parallel form of the formative test. Additional help in the form of extra feedback and correctives were again given to those students in the mastery classes who still did not reach the criterion level on the first parallel form test, and a second parallel test was given to them. The criterion level was set at 80 %.

The control class just followed the traditional method of instruction. This class however took the formative tests at the end of each of the four learning tasks, feedback and corrective procedures as in the mastery classes were not applied to them. No parallel form was given to them.

Dependent Variables: The dependent variable in this first hypothesis was achievement in mathematics, chapter six of the school Algebra text book dealing with fractions. The achievement level for both classes was measured by a summative test given at the end of the unit. This test comprised sixteen questions to be answered correctly in 25 minutes. There were four questions from each of the four learning tasks (see appendix p q5 for the summative test items).

Controlled Variables: The previous orta I mathematics grades of the groups were the controlled variables. Compared using t-tests, there were no significant differences among the groups regarding their previous performances in mathematics. Secondly, the curmulative averages of these groups in previous subjects were obtained and following a comparison of these groups there were no significant differences among them in terms of their mean cumulative averages.

Hypothesis II: THE ACHIEVEMENT LEVEL OF THE CLASS OF STUDENTS USING IMPROVED TEACHING WILL BE SIGNIFICANTLY HIGHER THAN THE CONTROL CLASS.

Variables and their Operational Definitions

The independent variables in this hypothesis are traditional methods of teaching and Improved Teaching. By Improved Teaching as independent variable reference is made to teacher/student interaction. The teacher who used Improved

Teaching was observed for ten class hours. It was found that she was interacting with the average and high achieving students in both classes much more than she did with she students who were below average in mathematics. This teacher was then given advice regarding her interaction with the students. She was therefore advised to increase her interactions with the low achieving students in both sections (B and D-IT and ML+IT sections)

Dependent Variables The dependent variable for all the four classes were their achievement. This was measured following a summative test given to all the classes at the end of the four learning tasks, as mentioned in the first hypothesis Controlled variables for the four classes remained the previous performances in mathematics and general grade point averages stated earlier.

Hypothesis III: IMPROVED TEACHING WILL HAVE AN ADDITIVE EFFECT TO MASTERY LEARNING METHOD OF INSTRUCTION; THE GROUP OF STUDENTS UNDER MASTERY LEARNING METHOD OF INSTRUCTION COMBINED WITH IMPROVED TEACHING WILL NOT ONLY SCORE HIGHER THAN THE CONTROL GROUP, BUT WILL ALSO HAVE THE HIGHEST MEAN SCORE WHEN COMPARED WITH MASTERY LEARNING OR IMPROVED TEACHING CLASS.

While Improved Teaching and Mastery Learning remain the Independent Variables in this hypothesis, level of achievement is again the Dependent Variable. The Controlled Variables were the same previous students grades in Mathematics and their cummulative averages. The level of achievement was measured following the same summative test given at the and of the unit. These three hypotheses were tested statistically by comparing the achievement levels of the four sections by t-tests, by Kendall Tau rank order correlations and by two-way analysis of variance.

CHAPTER IV

RESULTS AND DISCUSSIONS

This study was desinged to test three major hypotheses. The first hypothesis was that the achievement level of the class under Mastery Learning method of instruction will be significantly higher than the control class. The second hypothesis was that the achievement level of the class using improved Teaching will be significantly higher than the control class. Teaching was improved by giving feedback to the teacher about her interactions with low, average and high achieving students. The third hypothesis was that Improved Teaching will have an addifive effect to Mastery Learning method of instruction; the group of students under Mastery Learnning method of instruction combined with Improved Teaching will not only score higher than the control group, but will also have the highest mean score when compared with Mastery Learning or Improved Teaching class.

It is the aim of this research to illuminate whether the effect of Mastery Learning in addition to Improved Teaching would have a bigger effect on achievement in comporison to the effect of Mastery Learning alone.

The above stated hypotheses were tested under four learning conditions. One class studied under Mastory Learning (ML) conditions another class studied under traditional methods of instruction with Improved Teaching; implemented by giving the teacher feedback about her intraction with various groups of students (IT). The third class studied with just the traditional methods of instruction (c). The fourth class studied under the combinied effects of Mastery Learning and Improved Teaching conditions (ML+IT). There were thirty two students in each of the four classes and they all participated in the study.

Results of the Data Analyses prior to Instruction

To test those hypotheses, several data analyses were performed. Although the students were randomly assigned to classes, to ensure that there were no significant differences in the · previons mean performances of the four groups of students in mathematics as well as in their cumulative grade point averages (GPA), these groups were statistically compared with each other. These comparisons are shown in table 1,where t-test analyses were used for comparisons.

TABLE   1

Comparisons of the ML, IT, ML+IT, and C Groupss' GPA's

One Year Prior to Instruction

	ML A	IT B	C	ML+IT D	significance level
Possible Points	10	10	10	10	A>B NS
Mean	7.06	7.00	7.18	7.00	A<C NS A>D NS
Standard deviation	.87	.63	.74	.57	B<C NS
Number	32	32	32	32	B=D NS C>D NS

Table 1 shows that there are no significant differences among the four groups in terms of their G.P.A's from the previous year.

Further analyses were done using their mathematics guades from the previons year. Although there were no significant differences among them in terms of G.P.A's, it is possible that the groups differ in terms of their mathematics grades. This is why the comparisons of the mathematics grades were done for the four group in the study. Table 2 showes these comparisons

TABLE 2

COMPARISON OF THE PREVIOUS YEAR MATHEMATICS GRADES OF THE

FOUR GROUPS;   (ML), (ML + IT), (IT) AND (C) CLASSES.

	ML A	IT B	C	ML+ IT D	Significant Level
Possible Points	10	10	10	10	A<B NS
Mean	6.875	7.00	6.906	7.100	A<C NS A<D NS
Standard Deviation	1.105	1.342	1.507	1.170	B<D NS B>C NS
Number	32	32	32	32	C<D NS

Table 2 shows that there are no significant differences
among the classes regarding their previous mathematics grades
from the year before. Table 1 and 2 indicate that the classes
are not only similar in terms of their general G-P-A's but
also in terms of their mathematics grades from the previous
year.

Observational Analyses of Teaching Interactions

Classes not included in this study were observed for
11 class hours. While some interactional categories existed
in previons research (Jackson 1968, Leacock 1969, Flanders
1970 and Brophy and Good 1974) other categories of teacher
student interaction not found in previous research were
developed through these 11 hours of observation by the researcher.
in the methodology for the list of these categories.

The freguency of these interactional categories and its
distribution among the three subgroups of each class as well as
the total teacher/student interactions in each class is shown
in table 3.

Table 3 shows that the average group in each section
attains the highest number of interactions. This group is
followed by the group of high achieving students in each
of the four sections. There is little interaction in each
class with the lower achieving group of students. This
confirms Brophy and Good's research findings 1974. Though this
school is in a different culture, where three different
teachers comming from different nationalitiies taught the
four classes in the study, the findings hold here as well.
Secondly, the table shows that teachers vary in terms of the
friguency of interaction with the students; some interacting
much more than others. However, the same teacher teaching
two different sections showed stability over sections;
(see sections B and D in table.3.)

The percentage of the kind of interaction utilized in
each of the four classes as well as the percentage of the
usage of each kind of interaction in each subgroup in the
classes is shown in figures 3-6.

In section A. (as seen from figure 3) which later
used Mastery Learning instruction, the teacher used 29% of the
total interaction for students Questions; 63% of these
questions come from the average students and 37% came from high
achieving students. No questions came from the low achieving

TABLE 3

Frequency in each interactional Category for Low average and high achieving Subgroups prior to instruction.

Section/Subgroups	A (ML)			B (IT)			C (Control)			D (ML+IT)		
	Low N=4	Average N=15	High N=13	Low N=2	Average N=20	High N=10	Low N=3	Average N=19	High N=10	Low N=3	Average N=15	High N=14
1. Teachers question per subgroup	5	18	10	3	79	29	4	15	11	0	49	41
2.Teach. Sup. Statement per Subgroup	2	6	6	0	3	0	0	2	3	0	0	0
3.Proximity in space per subgroup	4	6	4	0	0	0	0	2	3	0	0	0
4.# of reniforcements per subgrup	0	0	0	0	0	0	0	0	1	0	0	0
5.# of Negetive Statements per Subgroup	0	1	0	0	1	0	3	3	1	0	4	3
6-# of studen. questions per Subgroup	0	22	13	3	24	20	2	12	13	4	24	21
7.# of EyeCon. per Subgroup	0	11	7	0	5	1	0	3	3	1	8	5
8.# of special duties p. s.g	1	2	1	0	5	0	0	4	6	0	0	0
9.# of inter. per student	12	66	41	6	112	50	9	41	31	5	85	70
11.# of inter. per class.	3	4.4	3.1	3	5.6	5	3	2.2	3.1	1.7	5.7	5
Σ of Category 9 per class		119			168			81			160	

43%
Average
14%
Low
63 %
Average
63%
Average

43%
High

12%
Supportive
Statement

Students
Questions
29%

3%
Special duties

37%
High

43%
Average
12%

28%
Proximity
Low

28%
High

15%

1% negetive Statement

28%
Teacher's guestions

30%
High

Eye Contact

61%
Average

39%
High

15%
Low

55%
Average

Figure 3 : Frequency of Usage of Each Interactional
Category and its Distribution to Low Average and High
Achieving Subgroups in Section A Master Class Prior to
Instruction.

This was followed by Teacheir Questions, 28% of the teacher
interactions was for Teacher Questions; 55% of this was
directed to average students, 30% to high and 15% to low
achieving subgroups. Eye contract comprised 15% of this
teachers interactions with the students; average students took
61% of this and high achieving students took the remaining
39%. There was no eye contact with the low achieving students.
Supportive Statements comprised 12% of this teachers interactions
43% of this going to high subgroup of students, another 43%
going to average and only 14% was going to low achieving stu
students. Close proximity took 12% of this teachers interac-
tions with the students; 44% going to the average students,
28% to high achieving and 28% to the Low achieving students.

Special Duties and privilages took 3% of this teachers
interactions; 50% of this was given to the average students,
25% to the the high and 25% to the low achieving students.
Negetive statements took only 1% of this teachers interactions
and this was directed to the average students only

Figure 4   shows the same analysis for section B which
later used Improved Teaching.

In this class, (as seen in figure 4) Teacher Questions
comprised 66% of the teacher-student interactions;71% of this
event to the average students, 26 to the high and 3% to low
achieving students, 28% of the teachers-students interactions
was taken by Student Questions. This was shared in the
order of 51% from the average, 43% from high and 6% from the
low achieving students.

Figure 4 : Frequency of Usage of Each Interactional Category
and its Distribution to Low, Average and High Achieving
Subgroups in Section B-Improved Teaching Class Prior to
Instruction.

Eye Contact comprised 3% of this teachers interactions; 83%
to average students and 17% to high achieving students.
There was no eye contact with the low achieving students.
Supportive Statements comprised only 2% of the teacher-student
interactions and this was wholly directed to average students.
Negetive Statements comprised only 1% interactions in this
class and this was directed to the average students alone.

Figure 5 shows the interactions in section C which
later became the control group.

In this section (figure 5) 37% of the teacher-student
interactions was devoted to Teacher Questions; 50% of this went
to average, 37% to high and 13% to low achieving students.
Student Questions comporised 21% of total interactions in this
class; 70% of this was from the average students, 18%from high
and 12% from low achieving students. Special Duties comprised
12% of this class interactions; 60% of this was given to high
students and 40% to average students. There were no Special
Duties given to low achieving student. Negetive Statement
carried 9% of this teacher's interactions; 43% going to average
students, 43% to low and 14% to the high achieving students.
Eye Contact comprised 8% of the interactions; 50% going
to average and 50% to high achieving students. There was no
Eye Contact with the low achieving students. Supportive
Statements took 6% of this teacher's interactions;52% this
went to the high achieving and 48% went to the average
achieving students. There were no supportive statements given
to the low achieving students.Proximity in space took

Figure 5 : Frequency of Usage of Each Interactional Category
and its Distribution to Low, Average and its Distribution
to Low, Average and High Achieving Subgroups in Section
C, Countrol Class Prior to Instruction.

6% of this teacher's intaractions . ᵗ with

the students; 52% of this went to high students and 48% to

low students. Reinforcement had only 1% of the teacher's total

intaraction and this was given to the high achieving students

only.

Figure 6 shows the interactional analysis in section

D, which later used Mastery Learning combined with Improved

Teaching.

In section D. (figure 6) 56% of the teacher-student

interactions was Teacher's Questions; 54% of this was directed

to average students and 46% to high students. Low achieving

students were not asked any questions. Student Questions took

31% of the total interactions in this section;49% of this

coming from average students, 43% from high and 8% from low

achieving students. Eye Contact comprised 9% of this teachers

interactions; 58% of this went to average students and 42% to

high achieving students. There were no Eye Contacts with the

low achieving students.

Negetive Statements comprised 4% of teacher-student

interactions; 56% of this went to avarage students and 44%

to the high achieving students. There were no Negetive Statement

made to low achieving students.

As seen from those figures, teachers interact most

with the average and high achieving students and least or

not at all with the low achieving students. This is seen to be

the case across the four classrooms observed for 10 hours each.
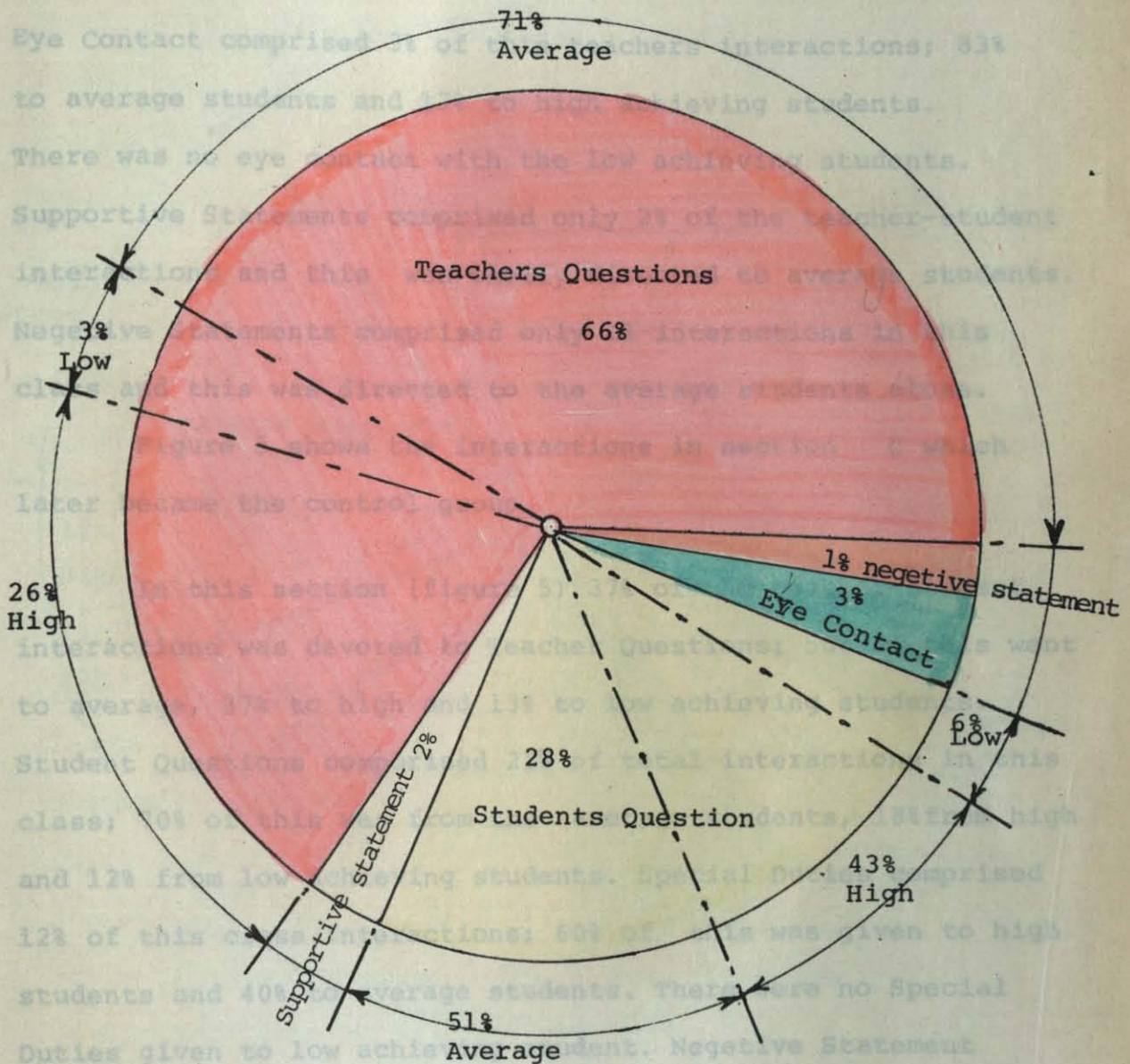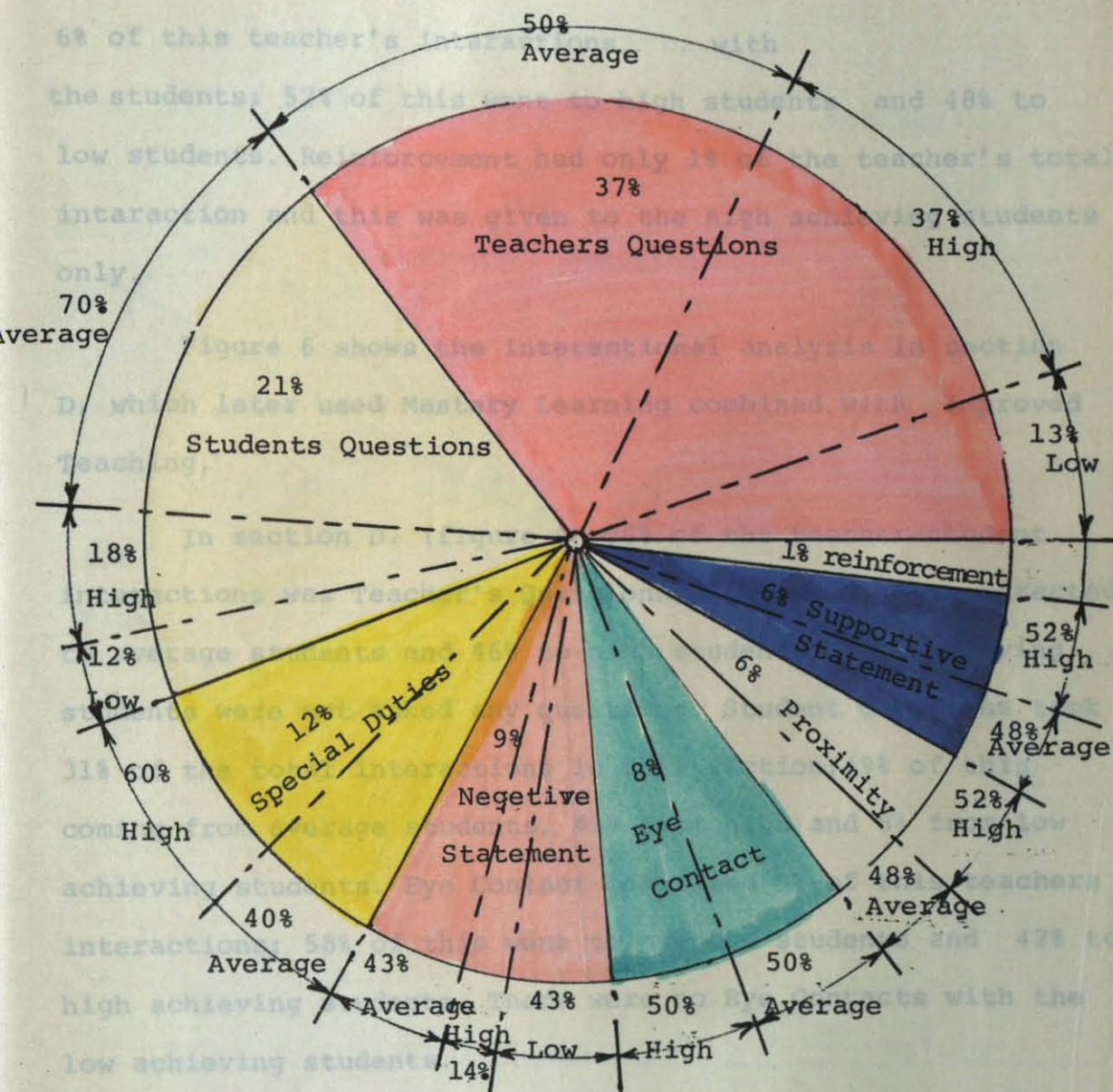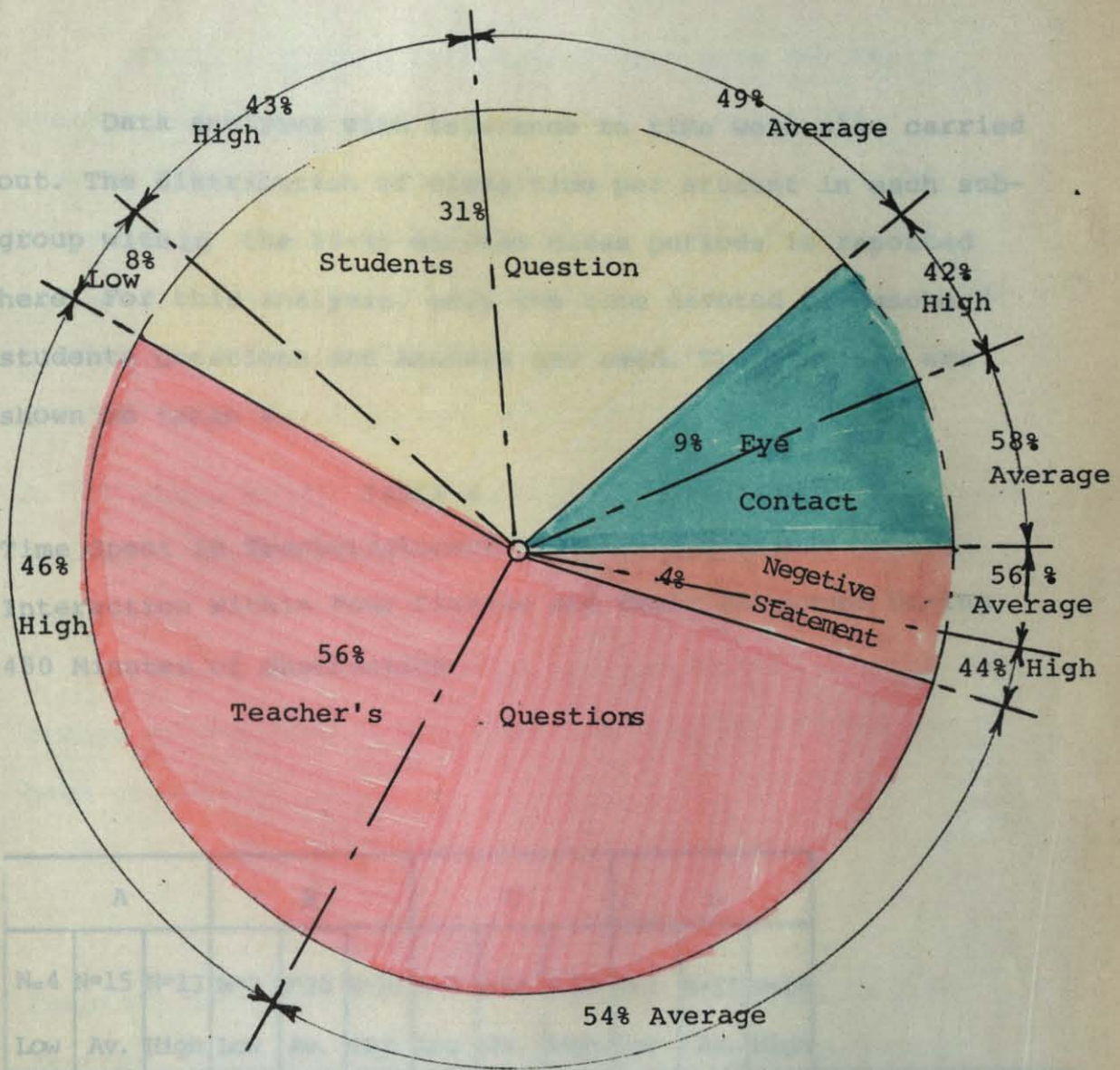
Figure 6 : Frequency of Usage of Each Interactional Category
and its Distribution to Low Average and   High Achieving Subgroups
in Section D Mastery Improved Teaching Class Prior to
Instruction.

Data analyses with reference to time were also carried out. The distribution of class time per student in each subgroup within the 10-45 minutes class periods is reported here. For this analysis, only the time devoted to teacher/students Questions and Answers are used. The findings are shown in table 4.

TABLE 4

Time Spent In Teacher/Student Question and Answer Interaction Within Four Classes and Their Subgroups During 450 Minutes of Observation

A			B			C			D			
N=4 Low	N=15 Av.	N=13 High	N=2 Low	N=20 Av.	N=10 High	N=3 Low	N=19 Av.	N=10 High	N=3 Low	N=15 Av.	N=14 High	
2.75	2.53	1.54	0.00	2.4	1.30	.66	.42	1.10	0	2.20	2.14	Average amount of time teacher waits for answers per student in each subgroup.
0	2.33	1.46	5.50	1.15	1.90	4.00	2.74	1.00	2.33	2.33	1.64	Average amount of time teacher takes to respond to a students question in each subgroup

Table 4 shows that teachers wait more for their average and high students to respond to questions. They do not wait as much for responses coming from the low achieving students. This finding is in accordance with Brophy and Good's research findings (1974).However, in two of the four classes, teachers took more time to answer the questions comming from the lower subgroups.

Table 5 shows the average interaction time regarding teacher/student question-responses for the four classes combined.

This was done by adding the interaction for the low groups of the four classes, for the average and for the high groups.

TABLE 5

Combined Average Time in The Four Classes Given to Low, Average, and High Achieving Students in Question/Answer Interaction.

Low	Average	High	
3.41	7.55	6.08	Time spent in waiting for answers from students
11.83	8.55	6.00	Time teachers take in answering students questions.

Table 5 shows the amount of time teachers wait for answers from students and time teachers take to answer questions themselves. This table shows that teachers wait longer for the answers of average and high achieving students in comparision to low achieving students. This is in accordanice with Brophy and Good's research findings (1974). However, teachers seem to take more time to answer questions coming from low achieving students in comparison to the average and high achieving students.

Time for teacher/students questions and answers was converted into percentages of the total amount of time spent in question and answers (figure 7) shows the percentages for each subgroup in class A.

32%

59%
Average

9% Low
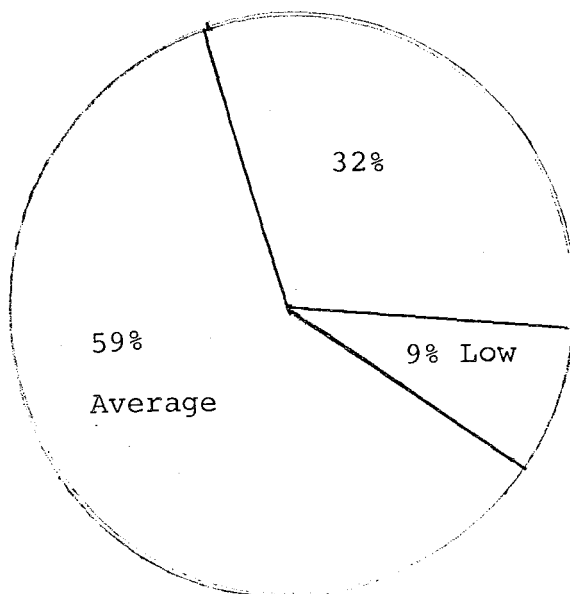
Figure 7   : Percentage of Question/Respanse Interaction Time Per Subgroup in Section A

Figure 7 shows that the teacher in section A spends 59% of the teacher / student question and response time with the average students. 32% with the high and only 9% with the low achieving students.
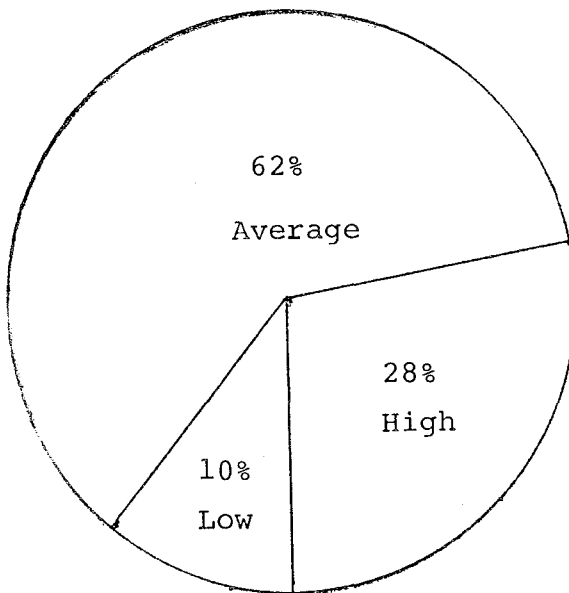
Figure 8 : Percentage of Question/Response Interaction Time Per Subgroup in Section B.

Figure 8 shows that the teacher in section B spends 62% of the total question/response time with the average students 28% the high students and 10% with the low group of students.
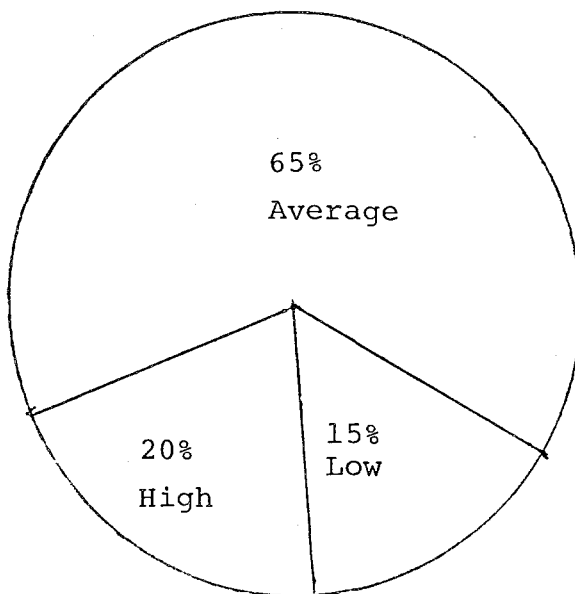
Figure 9 Percentage of Question-Response Interaction Time Per subgroup in Section C.

Figure 9 shows that the teacher in section C spends 65% of the Question and Response interaction time with the average students. 20% with time high students and 15% with the low Subgroup of Students.
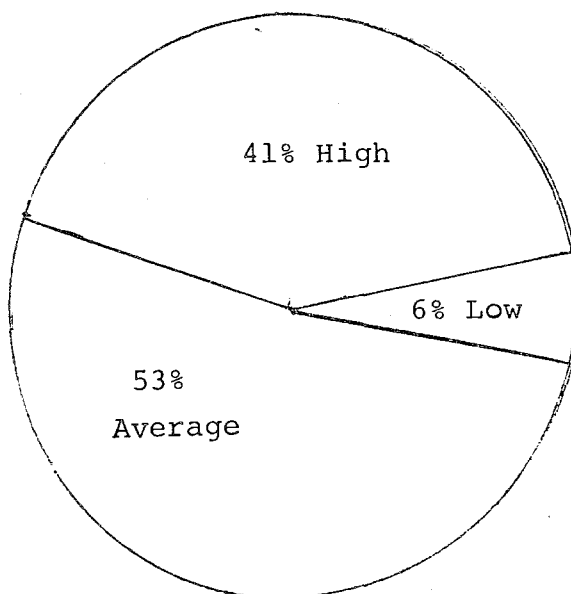
Figure 10: Percentage of Question/Response Interaction Time Per Subgroup in Section D.

Figure 10 shows that the teacher in charge of section D spends 53% of the total Question — response interaction time with the average students. 41% with the high subgroup and only 6% with the low subgroup of students.

Figures 7-10 show that the teachers spend greater percentage of teacher-student Questions and Answers with the average students. This is followed by the subgroup of high achieving students. Low achieving students are given the least percentage of time.

Further Comparison of the Groups

Following the introduction of the learning strategies into classes, the four classes were again compared with each other to further check if there could be some significant differences in their achievement levels at the start of the study.

Even though the students were randomly assigned to classes, and statistically, there were no significant differences among them both in their previous mathematics grades and their general cumulative averages, it could be possible that they started to differ in achievement in orta two classes.

t- test analyses were therefore used to compare the mean scores of the groups on the first formative test before correctives. This comparison is shown in table 6

TABLE 6

Comparison of the Four Classes Mastery (ML), Improved Teaching (IT), Control (C) and Mastery with Improved Teaching (ML+IT), on the first formative Test Scores.

	ML A	IT B	Control C	ML+IT D	Significant Levels
Possible Points	100	100	100	100	A<B NS A>C NS
Mean	58.61	60.62	56.69	59.44	A<D NS
Standard Devia-tion	30.72	32.39	17.46	33.44	B>C. NS B>D NS
Number	31	31	29	26	C<D NS

Table 6 shows that there are no significant differences between the groups mean performances in the first formative test. This table shows that the groups are still similar at the begining of the instructional strategies.

Analysis of Effectiveness of Instruction

The criterion level of achievement in this study was set at 80% level of learning. The comparison of the groups in terms of the number of students who reached this criterion level of performance in each of the four formative tests and the summative test was computed. The percentage of students reaching the critrion level in each class is reported. Table 7 shows these comparisms.

TABLE 7

Number and Percentage of Students Reaching the 80% Criterion Level of Learning in Formative and Summative Tests.

	A ML		B IT		Control C		ML+IT D	
FT 1	$\frac{12}{31}$	39%	$\frac{15}{31}$	48%	$\frac{10}{29}$	35%	$\frac{11}{26}$	42%
FT 2	$\frac{17}{28}$	61%	$\frac{21}{31}$	68%	$\frac{7}{29}$	24%	$\frac{14}{24}$	58%
FT 3	$\frac{6}{31}$	19%	$\frac{11}{32}$	34%	$\frac{3}{30}$	10%	$\frac{19}{32}$	59%
FT 4	$\frac{16}{32}$	50 %	$\frac{16}{32}$	50%	$\frac{4}{30}$	13%	$\frac{21}{32}$	66%
ST	$\frac{14}{26}$	54%	$\frac{16}{28}$	57%	$\frac{6}{29}$	21%	$\frac{23}{31}$	74%

Table 7 shows the number and percentage of students who reached the critarion level in the formative (FT) and sumniative (ST) tests. As seen from the table 74% of the students under the combined effects of Mastery Learning and Improved Teaching reached this criterion level, 57% of those students under traditional method of instruction with Improved Teaching reached this level, 54% of the students under Mastery Learning method of instruction reached this level and only 21% of those in traditional class alone reached this criterion level.

The mean performances of each group were plotted to show graphically how the groups started to differ in performances after the first formative test as a result of Mastery and Improved Teaching methods used. This graph is shown in figure 11.

Figure 11 shows how the four groups that were very similar in the first formative test in terms of achievement started to diverge and differ and became quit dissimilar in achievement in the summative tests favouring the Master and Improved Teaching classes.

- - - - - - - - - - - - - -

The sharp drop in the mean performances of each group in the third formative test was as a result of a two-week holiday they had before the test; during this time of their holiday, teachers were instructed not to give any class assignment or home works to the students. For raw scores,, means and standard deviations of each group in each test see table.21.. page 101 in the appendix section.

Scores

95
90
85
80
75
70
65
60
55
50
45
40
35
30
25

Classes

D ML + IT

B. IT Class

A ML Class

C Control
Class

PTI PT2   PTI PT2   PTI PT2   PTI PT2

FT1   FT2   FT3   FT4   ST
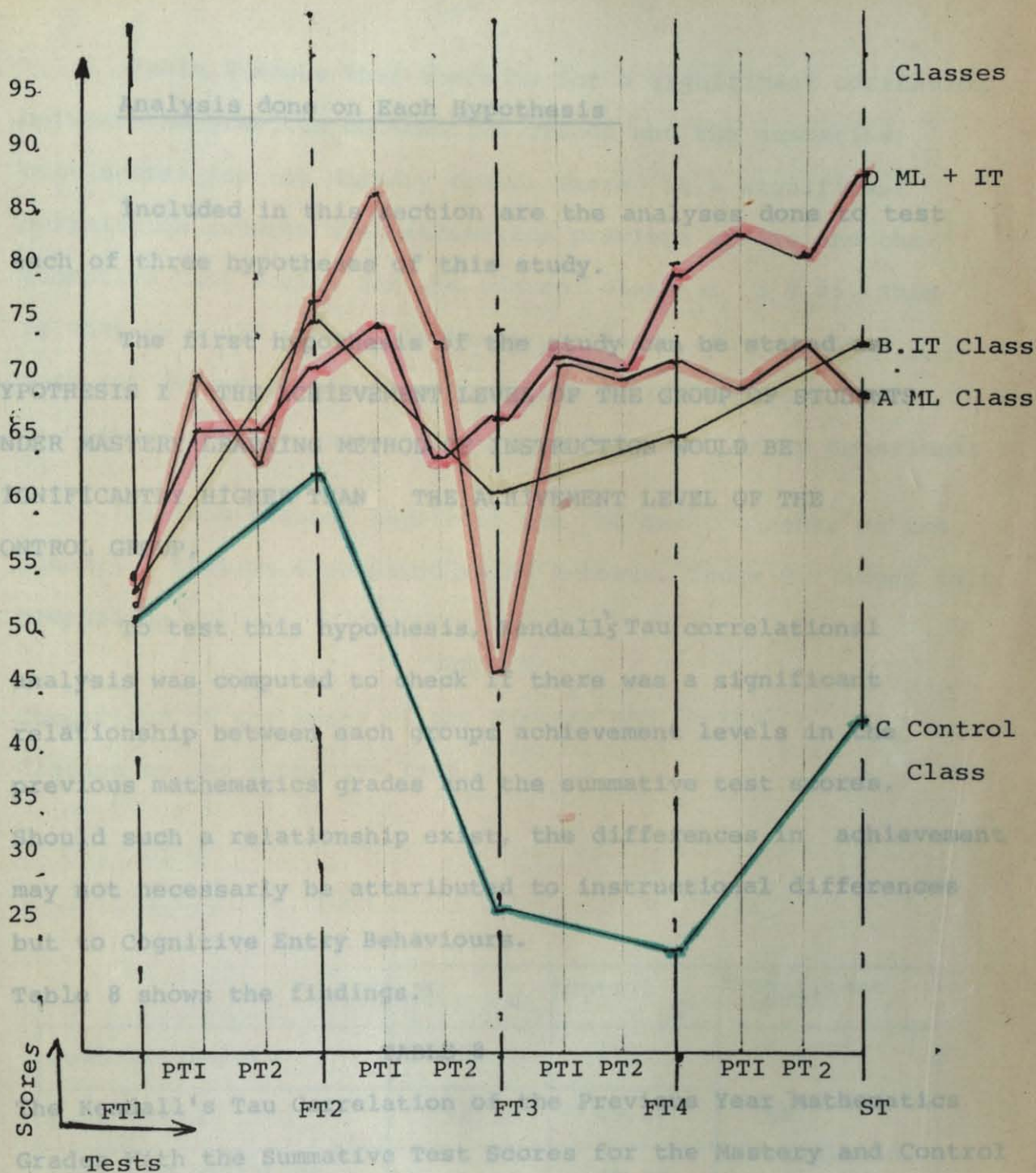
Tests

Figure 11: The Graph of the Mean Performances of Each Class
on the Formative and Summative tests.

Analysis done on Each Hypothesis

Included in this section are the analyses done to test each of three hypotheses of this study.

The first hypothesis of the study can be stated as: HYPOTHESIS I : THE ACHIEVEMENT LEVEL OF THE GROUP OF STUDENTS UNDER MASTERY LEARNING METHOD OF INSTRUCTION WOULD BE SIGNIFICANTLY HIGHER THAN THE ACHIVEMENT LEVEL OF THE CONTROL GROUP,

To test this hypothesis, Kendall's Tau correlational analysis was computed to check if there was a significant relationship between each groups achievement levels in the previous mathematics grades and the summative test scores. Should such a relationship exist, the differences in achievement may not necessarly be attaributed to instructional differences but to Cognitive Entry Behaviours.
Table 8 shows the findings.

TABLE 8

The Kendall's Tau Correlation of the Previous Year Mathematics Grades With the Summative Test Scores for the Mastery and Control Classes (ML and C)

	ML A	Control C
Correlation	.220	.421
F	.374	.361
Number	26	29
Significant Level	NS	$P < .05$
Difference between Correlations	NS	

Table 8 shows that there is not a significant corrdation between the previous mathematics grades and the summative test scores for the Mastery class. There is a significant correlation between the mathematics previous grades and the summative test scores for the control class at $\alpha = .05$. This is what we would expect. In Mastery classes, achievement does not depend on previous Cognitive Entry Behaviours but in Control classes, achievement does depend on Entry Behavionss.

The achievement levels of the ML and C classes on the summative test were compared using t-tests. Table 9 shows this comparison.

TABLE 9

Comparison of the Means of the Mastery and Control Classes on the Summative Test.

	ML A	Control C	Significant Level
Possible Points	100	100	$\alpha = .001$
Mean	74.15	49.69	$t_{56} = 3.476$
Standard Deviation	21.12	26.80	Calculated
Number	28	30	$t = 3.89$

Table 9 shows that there is a significant difference at $\alpha = .001$ between the mean performances of these two groups. The mean performance of Mastery class is significantly higher than the mean performance of the control class.

According the evidence from both the correlational analysis and the t-tests, it is clear that Mastery Learning method of instruction produces higher levels of learning in comparison to traditional methods.

There is difference of about a standard deviation (.91) (1) between the means of the two classes. This is in line with previous research done using Mastery Learning method of instruction. Furthermore, this difference is not due to initial differences as seen from the correlational analysis but due to Mastery Learning method of instruction. In light of this evidience, this first hypothesis is confirmed.

The second hypothesis of the study tests the effect of Improved Teaching by comparing the mean performance of the class where teaching was improved by giving feedback to the teacher about her interactions with the students and the control class. The second hypothesis of the study is:

HYPOTHESIS II: THE ACHIEVEMENT LEVEL OF THE GROUP OF STUDENTS UNDER IMPROVED TEACHING WILL BE SIGNIFICANTLY HIGHER THAN THE ACHIEVEMENT LEVEL OF THE CONTROL CLASS.

To test this hypothesis, correlational analysis was carried to check if there was a relationship between the students previous achievement in mathematics the year before and their performances on the summative test. The finding are shown in table 10.

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(1) Formular for difference in means: $\dfrac{\bar{X}_1 - \bar{X}_2}{S_2}$

TABLE 10

Cerrelation of the Previous Year Mathematics Grades and
the Summative Test Scores for Improved Teaching and
Control Classes (IT and C).

	IT B	Control C
Correlation	.550	.42
F	.367	.361
Number	28	29
Significance Level	P< .05	P< .05
Difference Between r	N S	

Table 10 shows that there is significant correlation
between the previous mathematics grades and the summative test
scores for both classes, at $\alpha = .05$ Level of significance.

However, there is no significant difference between the
correlations found in the two classes. This is in line with
theoretical expectations when traditional methods of instruction
are used, initial entry behaviours determine achievement levels.
Since both classes studied under traditional methods, high
correlations between initial entry behaviours and final
achievement are expected.

To check the differences in levels of achievement of the
two classes t-tests were used. Table 11 shows the findings.

TABLE 11

Comparison of the Mean Scores of the Improved Teaching
and Control Classes (IT and C) on the Summative Test
Scores.

	IT B	Control C	Significant level
Possible points	100	100	$\alpha = .001$
Mean	78.50	49.69	$t_{57}=3.476$
Standard Deviation	18.66	26.80	Calculated
Number	29	30	t=4.777

Table 11 shows that the mean scores of the students
under traditional method of instruction using Improved Teaching
is significantly higher than the mean scores of the control
group of students on the summative test at $\alpha=.001$ level of
significance. The findnigs shown in this table indicate that
Improved Teaching,giving feedback to the teacher in terms of
her/his   interactions with the students increases learning
out comes significantly. There is a difference of over one
standard deviation (1.075) between the mean scores of the
two classes in favour of the Improved Teaching Class,With
reference to the above evidiances, this second hypothesis
is confirmed.

The third hypothesis deals with the combined effects of Mastery Learning and Improved Teaching on achievement. The hypothesis states that this effect on achievement is significant and is additive. Mastery Learning usually raises the mean performance about a standard deviation over that of a group under traditional methods of instruction. Improved Teaching in addition to Mastery Learning is expected to raise the level over about 2 standard deviations. The third hypothesis of the study can be stated as;

HYPOTHESIS III:

IMPROVED TEACHING WILL HAVE AN ADDITIVE EFFECT TO MASTERY LEARNING METHOD OF INSTRUCTION, THE GROUP OF STUDENTS UNDER MASTERY LEARNING METHOD OF INSTRUCTION COMBINED WITH IMPROVED TEACHING WILL NOT ONLY SCORE HIGHER THAN THE CONTROL GROUP, BUT WILL ALSO HAVE THE HIGHEST MEAN SCORE WHEN COMPORED WITH MASTERY LEARNING OR IMPROVED TEACHING CLASS.

A correlational analysis was done to test whether there is any relationship between the previons one year mathematic grades and the scores on the summative test for the two classes (ML+ IT and C) classes. Table 12 shows the findings.

TABLE 12

Correlation of the One Year Previous Mathematics Grades and
the Summative Test Scores for the Mastery with Improved
Teaching and the Control Classes (ML+IT and C)

	ML+IT D	Control C
Correlation	.315	.420
F	.361	.367
Number	29	28
Significance Level	NS	P$<$.05
Difference Between r	NS	

Table 12 shows that there is no significant correlation
between the students mathematics grades a year before and
their scores on the summative test for the Mastery with
Improved Teaching class. Significant relationship between
previous mathematics grades and the summative test scores was
found in the control class at α=.05 level of significance.
Again this is in line with our expectation. The achievement
level of the ML+ IT class was compared to the control class
through t-test using their summative test scores. Table 13
shows this comparism.

TABLE 13

Comparison of the Mean Scores of the Mastery with Improved
Teaching and the Control Classes (ML+IT) and (C) on the
Summative Test Scores

	ML+IT D	Control C	Significant Level
Possible points	100	100	$\alpha = .001$
Mean	89.04	49.69	t58=3.460
Standard Deviation	13.71	26.80	Calculated
Number	30	30	t=7.230

Table 13 shows that the class under the combined Mastery
Learning and Improved Teaching methods has a mean performance
significantly higher than the control class at $\alpha = .001$ level
of significance. There is a difference of one and a half
standard deviations (1.500) between the two classes in
favour of the Mastery with Improved Teaching class.

Table 14 shows the comparisons of ML + IT class with the
other three classes-Ml,IT and the Control(C) classes, on the
summative test.

TABLE 14

The Comparisons of the Four Classes on the Summative
Test Scores

	ML+IT D	ML A	IT B	Control C	Significance Level
Possible points	100	100	100	100	D≥Aα =.005
					A≥Cα =.001
Mean	89.09	74.15	78.50	49.69	D>Bα =.025
Standard Deviation	13.71	21.12	18.66	26.68	D>Cα =.001
Number	30	29	29	30	B>A NS
					B>Cα=.001

Table 14 shows that the mean score of the class under
ML + IT methods of instruction is significantly higher than
the mean scores of the Ml class at α=.005 level of signifance.
There is differance of more than half a standard deviation (.71)
between the two classes in favour of the ML + IT class.

Table 14 also shows that the mean score of the ML + IT
class is significantly higher than the mean score of the IT
class at α=.025 level of significance. There is a difference
of over half a standard deviation (.57) between the two classes
favouring the ML + IT class. The group of students under the
combined effects of Mastery Learning and Improved Teaching
methods has the highest mean score on the summative test
in comparison to the control as well as the Mastery or
Improved Teaching class. In addition, Mastery Learning and
Improved Teaching classes were compared with each other.

There was no significant difference between the mean scores of the two classes on the summative test.

A two way analysis of variance, has been utilized to test the effects of being under Mastery Learning as well as having Improved Teaching. Table 15 shows this analysis.

TABLE 15

Two-way Analysis of Variance of the Effects of Mastery Learning and Improved Teaching.

SOURCE	DF	MS	F	Significant level
ML	1	9741	23.25	.001
IT	1	11572	27.62	.001
MLXIT Intenaction	1	1246	2.97	NS
Error	99	418.94	–	–

Table 15 shows that Mastery Learning method of instruction effects achievement significantly, $\alpha=.001$ level. This table also shows that Improving Teaching by giving the teacher feedback about his /her interaction with the students effects achievement significantly, $\alpha=.001$. It also shows that ML + IT interaction is not significant.

To further check if the effects of Mastery Learning
and Improved Teaching are additive or not, the achievement
curve by each method (Mastery Learning and Improved Teaching)
was investigated. The findings are shown in table 16.

TABLE 16

Multiple Correlation Analysis of the Amount of Variance
Accounted for by Mastery Learning and Improved Teaching
Methods of Instruction.

	Correlation	Amount of variance accounted for
r of ML and Achievement	.39	15 %
r of IT and Achievement	.42	17.6 %
Multiple r	.57	33 %

As seen from table 16 the effects of Mastery Learning
and Improved Teaching are additive in reducing variance among
learners in terms of achievement. Mastery Learning method
of instruction alone accounted for 15% of the variation in
achievement and Improved Teaching accounted 17,6% of the
variation in achievement. Together, they accounted for 33%
of the variation in achievement. In the light of the above
evidiences, the third hypothesis of the study is confirmed.

CHAPTER V

SUMMARY AND CONCLUSIONS

This chapter concludes the study by summarizing the problem, the meothodology and the results sections. The limitations and implications of the study are stated for evaluation and generalizability of the findings.

The Problem

The purpose of this study was not only to test the effect of Mastery Learning method of instruction, but principally to check the combined effects of Mastery and Improved Teaching strategies. Improved Teaching is recently being advocated by Benjamine S. Bloom as having an additive effect which raises level of learning to two standard deviations above the mean of the control classes, while Mastery Learning alone raises the level one standard deviation. In this study, the concern is mainly on the joint effects of Mastery Learning and Improved Teaching on

the students learning levels. In this case, four independent learning strategies were put to test; Mastery Learning combined with Improved Teaching, Mastery Learning used alone, Traditional method of instruction in connection to Improved Teaching by giving feedback to the teacher regarding his/her interactions with the students, and a control group using only conventional methods of instruction. Highest learning gains were expected from the group of students using the combined Mastery and Improved Teaching methods and the least learning gains were expected from the control group of students.

Methodology

This study was done in Rober College; a privately owned high school in Istanbul. The preparation for the implimentation of the learning strategies took a total of three and a half months. Firstly, a pilot study was carried out to check and record the interactional variables the teachers used while teaching students. This was followed by a careful and systematic observation in classrooms for 40 class hours to record the extent the teachers used the identified interactional variables in relation to Low, Average and High achieving students. This information was given to the teacher, teaching under Improved methods of instruction.

It was found that the teachers differed in terms of the amount and frequency of interaction with the students; some interacting much more than others (see table 3 page 47). It was also found that teachers interact most with the average and high ahcieving students and least or not at all with the Low achieving students. The teacher using Improved Teaching techniques was advised to change her pattern of interaction to get equal involvement from the low achieving subgroups of students as well.

The study was implimented in four orta II classes (these are second year junior high school classes) studying mathematics. Altogether there were 128 students in the study. Section A studied under Mastery Learning method of instruction used alone, Section B studied under traditional methods of instruction but the teacher was given feedback about her interactions with the students (Improved Teaching). Section C was the control group studying under traditional method of instruction alone and section D studied under the combined Mastery Learning and Improved Teaching methods. Feedback regarding the teacher's interaction with the students was given to the teacher in charge of sections B and D four days before the study started. The same teacher taught both Mastery with Improved teaching (D) and the Improved Teaching (B) classes. This teacher was also given the analysed figures of her interactions with various groups of students.

The researcher had five meetings with the experimental teachers where the mastery procedures were explained to them before the stury started. Some of the objectives of the study and some of the formative test items and their parallel forms were developed by the teachers with the help of the researcher. There were four learning tasks altogether and each took an average of two hours to be taught. The implimentation of the learning tasks lasted three weeks. The basic requirements for Mastery Learning were met. A summative test prepared by the researcher and one of the teachers in the study was given to all of the students at the end of the unit. The summative test comprizing 16 questions took 25 minutes and all of the students in the study took the test at the same time.

Hypotheses and Results

The three hypotheses of the study conducted on orta II students in Robert College Istanbul, are related to the effectiveness of Mastery Learning and Improved teaching as well as Mastery Learning combined with Improved Teaching on learning achievement. To test the hypotheses of the study, comparisms of the four sections (section A, section B, Section C and section D) were made through several statistical tests. These four classes were very similar in achievement in terms of their previous grades in mathematics and also in terms of their general grade point averages (G-P.A) one year before the study. A further comparison of the groups using t-tests showed that there was no significant difference among them in the first formative test scores, before correctives were given

to some students in the Mastery classes.

As a result of the Mastery procedures in Class A, 54 % of the students in this class reached the 80 % criterion level of achievement and only 21 % of the students in the control class reached this level. The comparison of the Mastery and Control classes on their summative test scores was done with t-tests and a significat difference in achievement at =.001 was found in favour of the Mastery class. There was a difference of .91 standard deviation between the two classes favouring the Mastery class. These findings strongly substantiate the first hypothesis of the study which states that: THE ACHIEVEMENT LEVEL OF THE CLASS UNDER MASTERY LEARNING METHOD OF INSTRUCTION WILL BE SIGNIFICANTLY HIGHER THAN THE ACHIEVEMENT LEVEL OF THE CONTROL CLASS OF STUDENTS.

The second hypothesis is concerned about the effectiveness of Improved Teaching by giving feedback to the teacher about her interactions with low, average and high achieving students on achievement levels. Teaching was improved in class B by giving the teacher feedback in terms of her interactions with the students. Following the summative test taken by all of the students at the end of the study, 57 % of the students in the Improved Teaching class (B) reached the 80 % criterion level of achievement against only 21 % of the students reaching this level from the control class. A comparison of the two groups' mean scores in the summative test was made and class (B) students scored significantly higher than the control (C) class, at =.001 level. There was a difference of 1.075

standard deviations between the two classes favouring the
Improved Teaching class. Thus the second hypothesis of the
study which states: THE ACHIEVEMENT LEVEL OF THE CLASS OF
STUDENTS USING IMPROVED TEACHING WILL BE SIGNIFICANTLY HIGHER
THAN THE ACHIEVEMENT LEVEL OF THE CONTROL CLASS is clearly
supported.

The third hypothesis stresses the additivences of
Mastery Learning and Improved Teaching. It is expected that
the students under the combined Mastery and Improved Teaching
methods will not only out perform the control class but will
have the highest mean score on the summative test in compar-
ison to the Mastery or Improved Teaching class. Summative
test scores were used to compare the class of students under
Mastery Learning with Improved Teaching ad the other three
classes. 74 % of the students in this class reached the 80 %
criterion level of achievement on the summative test as
against 57 % reaching this level in the Improved Teaching
class, 54 % in the Mastery class and 21 % in the control
class. t-tests were used to compare the mean performance of
the Mastery with Improved Teaching class with the other three
groups. The mean score of this group under Mastery with
Improved Teaching is significantly the highest mean score
in the summative test. It is 1.50 standard deviation over
the control class, .57 of a standard deviation over the
Improved teaching class and .71 of a standard deviations
over the mastery class. Analysis of variance was used to
test the additiveness of Mastery Learning and Improved
Teaching. Results show that Mastery Learning accounted for

15 % of the variation in achievement and Improved Teaching accounted for 17.6 % of the variance in achievement and Mastery Learning with Improved Teaching accounted for 33 % of these variations in achievement.

These results are clear evidences which support the third hypothesis of the study stated as: IMPROVED TEACHING WILL HAVE AN ADDITIVE EFFECT TO MASTERY LEARNING METHOD OF INSTRUCTION; THE GROUP OF STUDENTS UNDER MASTERY LEARNING COMBINED WITH IMPROVED TEACHING WILL NOT ONLY SCORE HIGHER THAN THE CONTROL GROUP, BUT WILL ALSO HAVE THE HIGHEST MEAN SCORE WHEN COMPARED WITH MASTERY LEARNING OR IMPROVED TEACHING CLASS.

Generally, the study clearly shows that:

1. The achievement level of the Mastery Learning class is significantly higher than the control class at .001 level of significance.

2. The achievement level of the Improved Teaching class is significantly higher than the control class at .001 level of significance.

3. Improved Teaching is additive to Mastery Learning method of instruction. The achievement level of the class under Mastery Learning method of insruction with Improved Teaching is not only higher than the control class but also significantly higher than the Mastery class and the Improved Teaching class at .001 .005 and .025 level of significance.

Limitations of the study and Suggestions for further research

This research was carried out in a private junior high school in Istanbul. The language of instruction is English except for subjects like history, geography, religion etc. About half of the teachers are not Turkish (mostly English and Americans) The researcher chose this school not only on basis of familiality but also, because the language of instruction is English.

There were four sections of students with only three teachers. Four teachers would have been more appropriate but there were not four separate teachers for four classes in any grade level in the school. The assignment of teachers to teaching strategies was not randomized because of unwillingness of one teacher to engage in the time and energy consuming activities that characterizes Mastery Learning method of instruction. Assignment of teachers was therefore done on availability basis. It is suggested that more extentions be carried to increase the generalizability of the study.

Teachers did not cooperate fully; essential objectives and most of the definition problems were rejected by the teachers as being unnessary. As a result, the study did not incorparate many objectives in lower mental processes. Feedback to the teacher in terms of her interactions with the students was given to her four days before the study started. This feedback and the teachers interactional adjustments were not controlled; The teacher was not systematically and continually advised on how to channel her interactions with

the students, especially with the low achieving groups. The effect of systematic feedback to teachers about their interactions with the students studying under Improved Teaching methods of instruction should be tested by further research. In other words, the teachers' interactional patterns checked before instruction will be rechecked after feedback so that the differences in achievement can be attributed to the differences in interactional pattern.

Formative tests and parallel test forms were constructed by the researcher. Although these testing instruments were crosschecked by the teachers and irrelevant ones deleted, they were not jointly designed by the researcher and the teachers. The summative test was prepared by the researcher with the help of only one of the teachers.

Conclusion and Implications

The intentions of this study were threefold: It aimed to test the effectiveness of Mastery Learning method of instruction with the seventh grade mathematics students in a private school in Istanbul. It also developed and implimented a programe based on B.S. Blooms recent statements that improving teaching through a process of giving feedback to the teacher in terms of his/her interactions with the students in addition to using Mastery Learning method of instruction will positively effect learning achievement more than when Mastery Learning is used alone.

The researcher systematically observed students and their teachers in classrooms for three and a half months. During this period of observation, he identified some interactional categories that are used in classrooms. These interactional elements developed by the researcher include: Eye cotract, Proximity in space (physical nearness), and students questions. Combined with other interactional variables found in literature (see page 26 for these categories). The researcher recorded the extant and frequency the teachers used these interactional categories with respect to low, average and high achieving students. The results of the findings were used to improve teaching by giving feedback to the teacher regarding her interactions with the students in the two classes where Improved Teaching was used.

This study was primarily designed to find a variable which would have an additive effect to Mastery Learning method of instruction in raising achievement levels still further. Mastery Learning combined with Improved Teaching produced increments in learning which is much higher than the effects of traditional methods or Mastery Learning alone. Clearly, Mastery Learning method of instruction combined with Improved Teaching has an additive effect on achievement levels. We no longer can accept that excellence in learning is a function of unalterable student characteristics where the failures of learners are based upon these characteristics. The results of this research show that most students can learn what the schools teach when appropriate instructional methods are used.

The findings in this study are essentially important in guiding our teachers and school administrators as to the best teaching methods to be used when high levels of achievement is needed. It is wished that Mastery Learning method of instruction combined with Improved Teaching which has been proved to be very effective will be applied in schools to aleviate most of the teaching/learning difficulties that characterize most educational systems.

APPENDIX

This section presents the learning unit, the objectives
of each of the four learning tasks that comprise the unit,
It also presents the facts and principles associated with
these objectives. Sets of testing instruments in the form
of formative tests and their parallel forms used to tap these
objectives as well as the dates of these tests are also shown
here. It must be remembered that the parallel forms of these
formative tests were taken only by those students in the
Mastery classes who were given extra help via feedback and
correctives. Answers to each question are presented in the
answer column.

The Learning Unit

The learning unit was Chapter Six of the School Algebra
text book headed <u>Fractions</u> by Mary P.Dolciani, Richard G.
Brown, Frank Ebos and William L.Cole, published by Houghton

Mifflin Company Boston 1981. This unit was divided hierarchically into four learning tasks and was followed in that order.

Learning tasks I - <u>Simplifying Fractions</u>

<u>Objectives:</u>

1. The students will be able to recognize fractions LMP

2. The students will be able to apply the cancellation rule HMP.

3. The students will be able to simplify algebraic fractions HMP.

Formative Test I - 10 Minutes	Objectives	Answers
1. Circle all nonfractional expressions in following 3/8, 8, 5/8, 9	1	8 9
2. Simplify: $(x^2-xy)/(x^2+xy)$	2,3	$(x-y)$ $(x+y)$
$(5-6)^2/(36-5)^2$	2,3	$(5-6)/(6+5)$
3. Simplify: $(x^4-10x^2+9)/(3-2x-x^2)$		$-(x+1)(x-3)$
4. The width of a ractangle is $(2x-6)$cm and its area is $(12x^2-44x+24)$cm^2 find the length.	2,3	$6x-4$

<u>Parallel form 1 - 10 minutes</u>

	Objectives	Answers
1. Circle all fractional expressions in the followings: 5, 7/8, 3, 2/3	1	7/8 2/3
2. Simplify: $(x^2-36)/(2x-12)$	2, 3	$(x-6)/2$
$(3x-6)/(9x^2-18)$	2, 3	$(x-2)/3(x^2-2)$
3. Simplify: $(64y^2-4x^2)/(x^2+3xy-4y^2)$		$4(4y+x)/(x+y)$

Objectives   Answers

4. All natural outmeal cookies cost

(5n-3)cents each. How many can you

by for $(30n^2+2n-12)$ cents   2, 3 $6n+4$

Parallel form II - 10 minutes

1. Circle nonfractional expressions

in the followings: 1/2, 2, 10,

4/5, 6   1   2 10 6

2. Simplify: $(y^2-yx)/(y+yx)$ $(y-x)/(y+x)$

$(a-b)^2/(,36+a^2)$ $(a-b)/(a+b)$

3. Simplify: (

$(x^4-10x^2+9)/(3-2x-x^2)$ 2, 3 $-(x+1)(x-3)$

4. The length of a rectangle is

(6x-4)cm and its area is

$(12x^2-44x+12)cm^2$ find the

width   2, 3 $(2x-6)$ cm

Learning Task II - Miltiplying/Dividing fractions

Objectives:

4. The students will be able to apply multiplication rule HMP.

5. The students will be able to multiply algebraire

fractions HMP.

6. The students will be able to apply Division rule HMP.

7. The students will be able to Divide algebraic fractions HMP.

Principles connected with these objectives

a) If c, d, x and y are any real numbers such that d≠0, and y≠0, then c/d, x/y = cx/dy

b) a/b ÷ c/d = a/b.d/c

c) cx/cy = x/y

Formative Test II - 10 minutes	Objectives	Answers
1. Divide: 5/8 by 25/16	6 7 b c	2/5
2. Multiply: x/y by $y^2/2$	4 5 b c	xy/2
3. Multiply: (x-1)/3 by $12/(x^2-1)$	4 5 b c	4(x+1)
4. Divide: $(3a)^2/2$ by $(6/a)^2$	6 7 b c	$a^4/16$
5. Simplify: $6x/(6x-14).(9x-21)/21:x^2/35$	4 5 6 7 b c	15/x

Parallel form I - 10 minutes		
1. Divide: 3x/y by x/12	6 7 b c	6/y
2. Divide: $9 a^2/4b$ by 6 ab	6 7 b c	$3a/8b^2$
3. Multiply: (x+2)/x by $x^2/(x^2-4)$	4 5 b c	x/(x-2)
4. Multiply: $12/(x^2-1).(x-1)/3$	4 5 b c	4/(x+1)
5. Simplify: $c^2/(c^2-d^2).(c-d)/(c+d):c/(c+d)^2$	4 5 6 7 b c	c

Parallel form II - 10 minutes.	Objectives	Answers
1. Divide p^2/q by $p/2q^2$	6 7 b c	$2pq$
2. Divide $4x^2/y$ by $-2x/y^2$	6 7 b c	$-2xy$
3. Multiply: $(x+2)/x$ by $x^2/(x^2-4)$	4 5 b c	$x/(x-2)$
4. Divide: $(x^2-36)/(2x-12)$	6 7 b c	$(x+6)/2$
5. Simplify: $2(x+2)/3.9/(2x+2):(x+2)/(x+1)$		3

Learning Task III - least Common Denominations (L C D)

Objectives

8. The students will be able to define Least Common denominators L M P

9. The students will be able to find Least Common Denominators H M P

10. The students will be able to arrange fractions in terms of their Least Common Denominators H M P.

Formative Test III - 10 minutes	Objectives	Answers
1. Define Least Common denominator(LCD) Least common denominator is the smallest number divisible by each number in a set of given numbers	8	18
2. Find the LCD: $5/6$, $4/9$ $4/9c$, $5/3d, 1/d^2$	9	$9cd^2$
3. Find the missing number: $4x/5=?/30$	9	$24x$

	Objectives	Answers
4. Find the LCD for 7/20, 11/45	9	180
5. Arrange these fractions from the least to the highest 2/5, 7/20, 3/18, 1/4	9 10	3/8,1/4, 7/20,2/5

Parallel form I - 10 minutes

1. What is L C D?	8	
2. Find the L C D for: $1/4a^2$, 5/6a	9	$12\ a^2$
3. Find the missing number 8a/11=?/33	9	24 a
4. Find the L C D for: 4/7, 12/5	9	105
5. Arrange the following fractions from the highest to the smallest: 2/5, 7/17, 3/10, 1/5	9 10	2/5, 7/17, 3/10, 1/5

Parallel form II - 10 minutes

1. Define L C D	8	
2. Find the L C D for 5/8, 4/11	9	88
3. Find the missing number $x/q=?/9x^2$	9	x^3
4. Find the L C D for x/y^2, 2/x, t/y	9	y^2x
5. Arrange the following fractions from the least to highest 3/5, 5/7, 9/13, 15/26	9 10	15/26,3/5, 9/13, 5/7.

Learning Task IV - Adding/Subtracting Fractions

Objectives:

11. The students will be able to apply Addition rule HMP.

12. The students will be able to apply subtraction rule HMP.

13. The students will be able to add algebraic fractions HMP.

14. The students will be able to subtract algebraic fractions HMP.

Principles connected with these objectives are:

d) $a/c + b/c = (a+b)/c$

e) $a/c - b/c = (a-b)/c$

Formative Test IV - 10 minutes	Objectives	Answers
1. Solve: $5/2a - 3/a^2$	12 14 d e	$(5a-6)/2a^2$
2. Solve: $(2a-b)/3 - b/6-(2b-3a)/4$	9 13 14 e	$(17a-12b)/12$
3. Solve: $(4-2y)/20-(y+3)/25$	9 13 15 e	$(3b+20)/5ab$
4. Solve: $3/5a + 4/ab$	12 14 d g	$(3b+20)/5ab$
5. Solve: $x/(x+y)+y/(x-y)$	9 12 14 d	$(x^2+y^2)/(x-y)$ $.(x+y)$

Most oof the objectives in Low mental processes (LMP) were
rejected by the teacher who claimed that they neither teach
nor ask definition problems in mathematics.

LMP → Low Mental Processes

HMP → High Mental Processes

	Objectives	Answers
<u>Parallel Form I</u> - 10 minutes		
1. Solve: $5/2a+3/a^2$	9 12 14 d	$(5a-6)/2a^2$
2. Solve: $(2a-2)/m5-(3a+2)/10$	9 13 15 e	$-(a+2)/6$
3. Solve: $x(2x-1)+(x-1)/(2x+1)-$ $2x/(4x^2-1)$	9 12 13 14 d e	$(2x-1)/(2x+1)$
4. Solve: $3a/(a-2b)+6b/(2b-a)$	9 12 14 d	.3
5. Solve: $(x^2+1)/(x^2-1)+1/(x-1)+1/(x-1)$	9 12 14 d e	$(x+1)/(x-1)$
<u>Parallel form II</u> - 10 minutes		
1. Solve: $3/a^2+5/2a$	9 12 14 d	$(6+5a)/2a^2$
2. Solve: $(2n+4)/5-n/6+(3n-2)/10$	9 12 13 14 d e	$(8n+q)/15$
3. Solve: $4/a+1/b-2$	9 12 13 14 d e	$(4b+a-2ab)/ab$
4. Solve: $x/(x+y)+y/(x-y)$	9 12 14 d	$(x^2+y^2)/(x-y)$ $.(x+y)$
5. Solve: $n/(n-1)-2n/(n^2-1)$	9 13 14 e	$n/(n+1)$
<u>Summative test</u> - 25 minutes		
1. Simplify: $5/2a-3/a^2$	3 4 5 6 7	$(5a-6)/2a^2$
$\qquad(2a-2)/15-(3a+2)/10$	9 10 12 13 14 d e	$-(a+2)/6$
2. Simplify: $(x+2)/x.x^2/(x^2-4)$	3 4 5 6	$x(x-2)$
3. Simplify: $c/(c-d).(c-d)/c+d)$ $c^2/(c^2-d^2).(c-d)/(c+d):c/(c+d)^2$	2 3 7 4 5 8	c

	Objectives	Answers

4. Simplify:

   $x/(2x-1)+(x-1)/(2x+1)-2x/(4x^2-1)$ ... 9 12 13 14 | $(2x-1)/(2x+1)$

5. Simplify:

   $(x-10x+9)/(3-2x-x)$ ... 3 4 c 5 6 | $-(x+1)(x-3)$

   $3r^2 5/7t.14t^2/$ ... 3 4 5 6 7 | $2rt/35$

6. Simplify: $(x^2-36)/(2x-12)$ ... 9 12 14 d | $(x+6)/2$

7. Divide: 5/8 by 25/16 ... 4 5 6 7 | 2/5

   $4x/y$ by $-2x/y$ | $-2xy$

   $(3a/2)^2$ by $(6/a)^2$ | $a^4/16$

8. All natural outmeal cookies cost $(5n-3$ cents.

   How many can you buy for

   $(30n^2+2n-12)$ cents? ... 4 5 6 7 | 6n+4 cookies

9. Find the LCD for 7/20, 11/45 | 180

   $1/4a^2$, 5/6a ... 9 | $12a^2$

10. İbrahim had one orange which he wanted to share with

    his two friends, he gave one friend 2/7 of the orange

    and gave the other friend 2/5 of the same orange. What

    fraction of the orange did he cut?

    6 7 9 12 13 14 | 11/35

TABLE 17:

RECORD SHEET OF CLASSROOM INTERACTION PATTERN IN CLASS A
PRIOR TO INSTRUCTION

	Teachers Questions	Time teacher waits	Supportive statement	Proximity	Reinforcement	Negetive Statement	Students Questions	Time teacher takes to ans	Eye Contact	Special Duties
1		2								
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										

TABLE 18:

RECORD SHEET OF CLASSROOM INTERACTION PATTERN IN CLASS B

PRIOR TO INSTRUCTION

		Teachers Questions	Time Teacher wait	Supportive Statement	Proximity	Reinforcement	Negetive Statement	Students Questions	Time teacher takes to ans.	Eye contact	Special Duties
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											

TABLE 19:

RECORD SHEET OF CLASSROOM INTERACTION PATTERN IN CLASS C

PRIOR TO INSTRUCTION

	Teachers Quest.									Time teacher waits	Supportive Statements	Proximity	Reinforcement	Negetive Statement	Student Questions	Time Teacher takes to ans.	Eye Control	Special Duties
1		I			I	//				•	•				//	/	3		
2														/	//	/	I		
3																			
4																			
5	I			/			/			•		/							
6																			
7	I		//							•	/	/			/ /	•	•		
8															/	•			
9																		/	/
10																			
11																		/	/
12	/									•					/ /	• •			
13														/					
14															/ / /	•	/ /	
15		//								•	/			/	/	•			
16																			
17		/	/							•	•								
18															/ //		/		
19															/	•			
20			/							•		/					/		
21	/		//			•													
22															/ // •	/ •	• • •		
23																			
24	/					•													
25		/				•									/	•			
26		//				•										/	•	/	/
27												/							
28		/	/ //		•	• •	/					/		/ /	• •	/	/
29	//						/	/						/	•		
30																			/
31		/				•								/ //	• •		/
32		/			•		/								•	/

RECORD SHEET OF CLASSROOM INTERACTION PATTERN IN CLASS D

PRIOR TO INSTRUCTION

		Teachers Questions	Time teacher waits	Supportive Statements	Proximity	Reinforcement	Negetive Statement	Students Questions	Time teacher takes to ans.	Eye Contact	Special Duties
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											

TABLE 21

THE MEAN AND STANDARD DEVIATION OF EACH OF THE FOUR CLASSES
ON THE FORMATIVE AND SUMMARIVE TESTS AS WELL AS THE NUMBER
OF STUDENTS IN EACH TEST

GROUPS	FTI	PTI a	PTI b	FT2	PT2 a	PT2 b	FT3	PT3 a	PT3 b	FT4	PT4 a	PT4 b	ST	Stat.
A	58.61	77.48	69.84	80.90	88.13	76.48	50.66	75.75	73.90	76.41	75.00	78.50	74.15	$\bar{X}$
	30.72	28.30	21.44	20.44	13.33	9.42	30.81	20.20	15.65	16.67	19.90	4.79	21.12	σ
Mast.	31	21	9	28	16	7	30	20	10	29	13	6	28	n
B	60.62			79.84			66.56			71.25			78.50	$\bar{X}$
Feed-	32.39			2-09			21.16			23.88			18.66	σ
Back	31			331			32			32			29	n
C	56.69			68.23			32.42			31.01			49.69	$\bar{X}$
	17.46			19.02			26.00			26.10			26.80	σ
Con.	29			30			31			31			30	n
D	59.03	73.33	71.03	76.88	78.00	70.01	72.19	75.33	74.43	81.38	82.06	78.75	89.09	X
	33.44	30.48	24.51	23.62	26.06	19.84	29.81	18.08	12.15	19.17	14.96	9.04	13.71	σ
Mast. Feed-back	26	19	8	24	15	5	32	12	7	32	9	4	30	n

TABLE 22

SUMMARY OF RECORD SHEET OF CLASSROOM INTERACTION RECORDED
BY THE TWO JUDGES

Class A ML	Class B IT	Class C Control	Class D ML+IT		Variables
+++++	+++++++	++++	+++++++ ++	1	Teachers
+++++	+++++++	++++	+++++++	2	Questions
+		+		1	Supportive
+	+	++		2	Statement
+				1	Proximity
∓				2	in space
				1	Reinforce
+				2	ment
				1	Negetive
				2	Statement
+++	+++	+++	++++	1	Students
					Questions
+++	++++	+++	++++	2	
			+	1	EyeContact
++	+		++	2	
		+		1	Priviledges
				2	and Duties

TABLE 23

THE TIME FLOW CHART OF THE STUDY

ML + IT	Control C	IT B	ML A	Activits	Tasks
18/1/84	18/1/84	18/1/84	18/1/84	Started	
19/1/84	19/1/84	19/1/84	20/1/84	Finished	
19/1/84	20/1/84	20/1/84	20/1/84	FT1	
20/1/84	–	–	23/1/84	C 1	1
20/1/84	–	–	23/1/84	PT 1	
25/1/84	–	–	25/1/84	C 2	
25/1/84	–	–	25/1/84	PT 2	
23/1/84	23/1/84	23/1/84	23/1/84	Started	
24/1/84	24/1/84	24/1/84	24/1/84	Finished	
25/1/84	25/1/84	25/1/84	25/1/84	FT 2	
25/1/84	–	–	25/1/84	C 1	
26/1/84	–	–	26/1/84	FT 1	2
26/1/84	–	–	26/1/84	C 2	
26/1/84	–	–	26/1/84	PT 2	
27/1/84	26/1/84	26/1/84	27/1/84	Started	
13/2/84	27/1/84	27/1/84	13/2/84	Finished	
13/2/84	13/2/84	13/2/84	13/2/84	FT 3	
13/2/84	–	–	13/2/84	C 1	3
14/2/84	–	–	14/2/84	PT 1	
14/2/84	–	–	14/2/84	C 2	
14/3/84	–	–	14/2/84	PT 2	
14/2/84	14/2/84	14/2/84	14/2/84	Started	
15/2/84	15/2/84	15/2/84	15/2/84	Finished	
15/2/84	16/2/84	16/2/84	15/2/84	FT 4	
15/2/84	–	–	15/2/84	C 1	4
16/2/84	–	–	16/2/84	PT 1	
16/2/84	–	–	16/2/84	C 2	
16/2/84	–	–	16/2/84	PT 2	
17/2/84	17/2/84	17/2/84	17/2/84	ST	

F.T. : Formative Test, P.T.: Parallel Test, C: Correctives

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