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The Effects of Mastery Learning and Cooperative, Competitive and Individualistic Learning Environment Organizations on Achievement and Attitudes in Mathematics

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Motivation for learning is important for positive learning outcomes as well as for measured achievement levels. When students come to our classes, they bring with them learning histories in which we as individual teachers, most likely, did not have an input. Our students do not only bring with them different levels of prerequisite leanings but also different levels of affect for what they will be learning.

If we leave their final learning at the mercy of these entry characteristics, a test given the first day before the course will have almost isomorphic results with their achievement levels on the last day. The ones who had 'it' on the first day will be the ones who in the future will also have 'it', not too different from what the present situation is all over the world. These circumstances will tend to be the case ad infinitum, unless of course, we *want* to change the situation. This research clearly shows that effective instructional methodologies coupled with cooperative peer interactions not only have an impact on achievement but also on positive attitudes toward one's learning.

Keywords: mastery learning, attitudes towards mathematics, learning environment organization, cooperation, competition, individualization, cooperative mastery learning.
ZDM Classification: D43
MSC2000 Classification: 97D40

STATEMENT OF THE PROBLEM

The purpose of this study was twofold. The first aim was to investigate the combined effects of mastery learning (ML) and learning environment organization (LEO) as cooperative, competitive, and individualistic on the achievement levels of students studying mathematics in a private junior high school in Istanbul, Turkey. The second goal was to investigate the direction and magnitude of the combined effects of mastery learning and learning environment organization on the attitudes of these students toward mathematics.

There is a sizable amount of research on classroom learning environments comparing cooperative, competitive, and individualistic organizations. The term 'cooperative learning' refers to instructional environments and procedures in which students work on academic material in small groups and are rewarded for doing well in the group (Slavin & Karweit 1981). Under cooperative learning environment organizations, the goals of individuals are

Bassano & Christison (1988) identify some benefits of cooperative learning classrooms related to management. They state that cooperative learning orders the classroom environment and social tasks and is useful in selecting content and setting goals in addition to assisting in monitoring progress and evaluation. Evidence suggests that cooperative instruction fosters positive student attitudes (Wheeler & Ryan 1973; Johnson, Johnson & Scott 1978; Gunderson & Johnson 1980; Sharan 1980; Slavin & Karweit 1981; Jacobs 1988; Dalton, Hannafin & Hooper 1989). D. W. Johnson & R. T. Johnson (1987) in their meta-analysis of 33 studies concludes that cooperative strategies have both cognitive and affective advantages. These researchers state that cooperative strategies not only promote higher achievement levels, but are also facilitative of positive interpersonal relationships, social support, and self-esteem. It is likely that cooperative learning environments provide frequent, open, accurate, and effective communication among students, while closed and inaccurate communication patterns can dominate the competitive classroom (ibid).

Reid (1992) studied the effects of cooperative learning strategies on mathematics achievement of seventh graders, using an ex-post facto design, collecting information based on school records indicating whether students were under cooperative, competitive, or individualistic learning strategies. He found that the means of the cooperative groups were significantly higher than the other groups, and concluded that for mathematics achievement, cooperative strategies were more primitive of achievement.

In competitive organizations, there is a negative correlation between the goal attainments of students. Organization of groups either heterogeneously or homogeneously based on past school performance, in which members of the group have to compete with one another or where different groups are in competition with each other, comprise competitive learning environments (Skon, Johnson & Johnson 1981; Johnson, Johnson & Stanne 1986). Kohn (1986) in a literature review argues that competitive interactions are exhibited in teacher dominated learning environments where approval is disseminated in a limited fashion, requiring students to compete for the scarce amount of reinforcements and positive outcomes.

Individualistic learning environments refer to strategies in which students work individually. In individualistic learning environments, students' goal attainments are independent (D. W. Johnson & R. T. Johnson 1978). Under such organizations, students are instructed to avoid interaction with other students in the same setting (Skon, D. W. Johnson & R. T. Johnson 1981; D. W. Johnson, R. T. Johnson & Stanne 1986).

D. W. Johnson, R. T. Johnson & Stanne (1986) compared the impacts of cooperative, competitive, and individualistic computer-assisted instruction on student achievement. The researchers reported that cooperative instruction promoted greater quality and quantity of daily achievement, more successful problem solving, and higher performance on factual recognition, application, and problem solving items. In a meta-analysis of 122 studies (Johnson, Maruyama, Johnson, Nelson & Skon 1981), it is shown that cooperative strategies were superior to competitive ones in 53% of the 122 studies, while competitive strategies were superior in 5% of the total. In the comparison of the individualistic and cooperative strategies, it was found that cooperative strategies were more successful in raising achievement levels in 106 of the 156 studies, where only 6 studies found individualistic strategies to be more effective. In a larger meta-analysis of 349 studies (Johnson & Johnson 1987), the mean effect size of cooperation over competition was reported to be 0.66 standard deviations, while the effect size of the cooperative strategies over individualistic ones was reported to be 0.63. Slavin's (1983) meta-analysis of 46 studies, investigating the effects of cooperative strategies on achievement by comparing these with competitive and individualistic strategies showed that in 29 studies (63.04%), cooperative strategies produced more favorable results while 2 studies (4.35%) favored either competitive or individualistic approaches. There were no significant differences between the strategies in 15 studies (32.61%). Similarly Okebukola & Ogunniyi (1984) investigated the effects of cooperative, competitive, and individualistic student-student interactions on affective processes (objectivity, open-mindedness, curiosity) and found that students with teachers trained in cooperative interaction patterns reached higher affective scores.

The reviews by C. Kulik, J. Kulik & Bangert-Drowns (1985), Guskey & Pigott (1988) indicated the effectiveness of mastery learning on learning outcomes. Mastery methods yielded promising outcomes also in mathematics lesson achievement (Hannafin 1983;

Dalton & Hannafin 1989).

According to (Bloom 1984, 1987) the effect of mastery learning and another treatment strategy will be stronger than the effect of the method when used alone, which approximates the effect of a very good one-to-one tutoring, two standard deviations above the control class. This effect which is sometimes called; the 2-sigma effect (Slavin 1987), is strongly verified in the studies done in Turkey (Yildiran & Eginlioglu 1987; Yildiran & Sayar 1988; Yildiran & Cetin 1991; Yildiran & Nwabueze 1991; Hackenberg 1993; Kirkic 1994; Kirkic 2000).

When relevant literature is reviewed, it is seen that mastery learning can also produce satisfactory affective outcomes of learning. This is verified in Guskey & Pigott's (1988) meta-analysis, in which 38 studies which use affective measures are reviewed. The affective variables measured were students' affect (attitudes) toward the subject they were studying, their affect toward schooling, their academic self concept, and their grade expectations. Thirty-one effect sizes that were reported, were positive (82 %), while others were negative (18 %) in comparison to control conditions.

Twelve effect sizes were reported in Guskey & Pigott's (1988) meta-analysis for affective outcomes of mastery learning method used in mathematics instruction. Nine effect sizes were found to be positive (75.00 %), three others were negative (25 %). Of the 7 studies that assessed students' affect toward mathematics, five were positive (71 %), while others were negative (19 %). Three effect sizes were for academic self concept in mathematics, two of which were positive (66.66 %), and one was negative (33.33 %). One effect size was reported for attrition which was positive. The relatively high rate of negative affective outcomes of mastery learning methods (18.42 %) can be attributed to the fact that affective characteristics in students are very difficult to alter in short periods of time.

There is an increased attention in recent years to investigate the effectiveness of mastery learning used with cooperative learning strategies. Mevarech (1985, 1991), for example, has tried to synthesize mastery learning method of instruction with cooperative learning techniques in mathematics lessons, which she calls 'cooperative mastery learning' (CML). According to Mevarech (1985), cooperative mastery learning involves students studying in heterogeneous groups, where mutual cooperation between the students is emphasized. Then, they are individually tested on the learning task followed by corrective activities to reach mastery. The results of both the 1985 and 1991 studies indicate that students in the CML condition reached the highest mean and the lowest variation in mathematics achievement.

According to Mevarech, singly implemented, both mastery learning and cooperative learning strategies have drawbacks. When implemented together, these deficiencies may not occur. Mevarech states (1985) that the feedback-corrective cycles in cooperative learning (without mastery learning) have serious problems. Teams may make mistakes, and be unaware of it. Groups as a whole may reach mastery, but some members of the group may not, since the work of the groups alone is evaluated.

There are three problems that Mevarech voices (1991) in implementing mastery learning singly, without cooperative learning strategies. The first is related to Slavin's (1987) "Robin Hood effect." Mevarech (1991) states that it is hard to implement mastery learning in a highly heterogeneous class (without cooperative learning strategies) because faster learners have to wait for the others. The second problem is related to the quality of the feedback-corrective procedures in mastery learning, especially in mathematics. She claims that modeling processes used in the correction of misconceptions in mathematics are ineffective because of the usage of printed materials. Students who are unsuccessful in mathematic will also tend to be unsuccessful in reading materials.

The third concern of Mevarech (1991) is affective. Since low achieving students lack motivation and may have high mathematics anxiety and low confidence in their ability, they do not want to be involved in the process of correction. According to Mevarech (1991), in the cooperative mastery learning condition since all team members progress at the same rate and misconceptions are immediately corrected by team members, motivation strengthens and anxiety decreases.

Laney et al. (1996) examined concept learning and retention in 121 first and second graders who were randomly assigned to four instructional conditions: cooperative learning, mastery learning, cooperative mastery learning, or control treatment in an undergraduate economy course. They report that cooperative mastery method was superior to other methods in promoting learning and retention as their posttest and delayed posttest scores indicated.

The Krank & Moon (2001) study, also, attempted to combine mastery learning and cooperative learning instructional strategies to 104 undergraduate social science students enrolled in three sections of a required course. Their results also confirmed the effectiveness of cooperative mastery group in producing significant achievement gains and positive change in self-concept compared to either mastery learning or cooperative learning alone.

In light of the above stated research, the following were the hypotheses of the study: There will be a significant effect of both mastery learning method of instruction and learning environment organization on achievement levels of students in mathematics as measured by the summative test.

The mathematics achievement level of the class studying under mastery learning method of instruction in the cooperative learning environment organization will be the highest, followed by the mastery learning class in the competitive learning environment organization, followed by the class studying under mastery learning method in the individualistic learning environment organization, followed by the conventional class under cooperative learning environment organization, followed by the class under competitive learning environment organization, the least achieving class being the conventional one under individualistic learning environment organization. There will be a significant effect of both mastery learning method of instruction and learning environment organization on attitudes toward mathematics.

The mathematics attitude level of the class studying under mastery learning method of Instruction in the cooperative learning environment organization will be the highest, followed by the mastery learning class in the competitive learning environment organization, followed by the mastery learning class on the individualistic learning environment organization, followed by the conventional class under cooperative learning environment organization, followed by the conventional class under competitive learning environment organization, the least positive attitudes being exhibited by the conventional class under individualistic learning environment organization.

There will be a positive high correlation between mathematics achievement and attitudes toward mathematics.

METHODOLOGY

Subjects of the Study

The subjects were 158 students in their second year of junior high school, studying mathematics in English in a private school in Istanbul, Turkey, which selects its students on the basis of a centralized entrance exam, admitting those of average scholastic ability. Most of the students in this school come from middle and upper-middle SES families. There were six classes at this level, all of which were included in the study. Students and experimental conditions were randomly assigned to classes. Four classes had 26, while two classes had 27 students each.

Subject Area

The subject area in this study was second year, first semester junior high school mathematics. There were three learning tasks which were completed in three weeks, including discount, commission, and profit. Six objectives comprised the first learning task related to discount, three sampling lower and three higher mental processes; for objectives were included for the second learning task on commission, two sampling from lower, and two from higher mental processes; and four objectives were developed for the third learning task on profit, two on lower and two on higher mental processes.

The Design of the Study

The study was a field experiment with a two by three factorial design. The two independent variables were instructional methodology (mastery learning versus conventional instruction), and learning environment organization (LEO; cooperative, competitive, and individualistic). The two dependent variables were achievement levels of students, and their attitudes toward mathematics.

Of the six classes in the study, one class was under mastery learning with a cooperative learning environment organization (ML+CpLEO); the second was a mastery learning class with a competitive learning environment (ML+CmLEO); the third was a mastery learning class with an individualistic learning environment organization (ML+InLEO). These three classes had their counterparts under conventional instruction comprising the C+CpLEO, C+CmLEO and C+InLEO. The criterion level of learning was set at 85% in the three mastery learning classes. At the end of each of the three learning tasks, a formative test was given to all students in the three classes under mastery learning conditions. Those who had not reached the criterion level of learning were given correctives, after which a parallel form of the formative test for the particular learning task was issued. This procedure was repeated for all learning tasks. No mastery learning class required a second parallel form of the formatives, as all students reached the 85% level of learning under mastery conditions after the first parallel form of the formative tests.

In terms of the learning environment organization (LEO), students were divided into 3 groups of high, average, and low achieving students on the basis of their grades. In the two classes under cooperative LEO (mastery learning and conventional) heterogeneous student groups of 4 students were formed with one high one low, and 2 average achieving students in each group. In the mastery learning class with CpLEO, there was a problem session following each formative test where the students worked on their worksheets including questions derived from the objectives (same for all 6 classes) as well as on the items which they missed on their formative tests for the learning task proper, for one class period cooperatively with the following instructions:

- Work together as a group, completing the worksheet as a group.
- Share materials and ideas.
- Seek help from each other rather than from the teacher.
- Make sure that each member is involved in group work.
- Bonus points will be given on the basis of how well students in the group cooperate.

The parallel form of the formative test for those who had not reached the criterion level was followed by another period of cooperative work in the mastery learning class.

In the conventional class with CpLEO, each learning task was followed by a class period of cooperative work in the same way as the mastery learning class. However, since students were not required to reach the 85% criterion level in the conventional class with CpLEO, after cooperative work the students went on to the next learning task without taking the parallel form of the formative test.

The two competitive LEO classes were grouped the same way as the cooperative. In the 2 competitive LEO classes the following instructions were given to students:

- Compete for the first place in your own group; the highest achiever in the group will get bonus points.
- Compete for the first, second, and third places in the class; the top three will get extra points.
- Be aware of the progress of other students in your groups and in the class by noticing when others raise their hands when the teacher asks questions during the lesson.

In these two classes under CmLEO, there was both intra and inter-group competition. The same materials were used in the same pattern as the classes under cooperative learning environments. However, students performing the highest in each group, and the three best in the class were praised. Again the mastery learning group had two hours of group work on the worksheets and missed items, one after the formative test and another after its parallel form, while the conventional class which was not required to reach the 85% level of learning had one hour after each learning task using the same worksheets.

In the 2 individualistic LEO classes the following instructions were given:

- Work alone.
- Ignore others.
- Work at your own pace doing your best.
- Receive help from the teacher when necessary.

In these two classes there were no groupings so that peer interaction could be minimized. After the completion of the learning task in the ML+InLEO, students were given the formative test on the learning unit. If students could not reach the specified criterion level of learning, they received the worksheet that all other classes received where the errors for each student were marked. Students worked on the worksheet alone; neither cooperation nor competition was encouraged. After this corrective procedure, the parallel form of the formative test was issued, after which students went on to the next learning task. In the C+InLEO class, students responded to the same worksheet alone after the completion of each learning task. They, then, went on to the next learning task.

Data Collection Procedures

Initial Measures

Of the three initial measures, two were obtained from the students' files. The first was the students' previous year mathematics grades while the second was their preparatory year English grades (as this school taught mathematics and the sciences in English. These measures were obtained in order to check the equivalence of classes in terms of variables which might have an effect on the outcomes of the study. The third measure given before the interventions was the Mathematics Attitude Inventory (MATE). This instrument was administered to all students prior to the implementation of different strategies.

Process Measures

In the three mastery learning classes, a formative test was given at the end of each learning task, covering the objectives for that particular learning task. If students could not reach the 85% level of learning, a parallel form of the formative test for the learning task was given after corrective procedures which included the worksheets.

The control classes did not take the formative tests. For the first learning task, the formative test included 10 questions covering the six objectives for that learning task. There were six questions on the second formative test tapping the four objectives for the second learning task, while there were again 6 questions on the third formative test tapping the four objectives for the final learning task of the study. The parallel forms of the formative tests had the same number of items as the first forms tapping the same objectives.

After the completion of each learning task, all six classes were given a worksheet including questions derived from the objectives for the learning task proper. The students in the four classes of cooperative and competitive groupings worked on their worksheets according to the directions for their particular grouping strategy, while the students in the two individualistic learning environment organizations worked alone on the same worksheets.

Final Measures

The two dependent variables were measured by two separate instruments, the summative test assessing achievement levels, and Mathematics Attitude Inventory (MATE) developed by Aydın (1995) measuring the attitudes towards mathematics.

At the completion of all learning tasks, a summative test of 15 items, covering 9 objectives (6 items from 4 objectives of the first, 5 items from 3 objectives of the second, 4 items from 2 objectives of the third learning tasks) was given to the students of the 6 classes. MATE was developed in several steps (Aydın 1995) and used a domain-referenced approach (Gable 1986). Several scales on attitudes toward mathematics were used as the bases for the development of MATE (Sandman 1980; Fennema-Sherman 1976 ; Erol 1989). This was followed by the detection of adjectives and verbs related to particular domains. The domains and sub-domains of MATE were identified as:

A. Attitudes related to the person
  A1. Perceived interest in mathematics
  A2. Perceived ability toward mathematics
  A3. Perceived attitude toward the mathematics book
B. Attitudes related to other persons with whom the person is in contact
  B1. Parents' perceived attitudes toward mathematics
    B1a. Perceived interest
    B1b. Perceived ability
  B2. Perceived attitude of the mathematics teacher
    B2a. Perceived interest
    B2b. Perceived ability
    B2c. Perceived effort
  B3. Peers' perceived attitude toward mathematics
    B3a. Perceived interest
    B3b. Perceived ability
C. Attitudes toward mathematics as a domain
  C1. Perceived value of mathematics in society
  C2. Mathematics and intelligence
D. Perception of mathematics as a male domain

From these 93 items were developed. Items having means of 2.5 out of 4 points given to experts were kept as representing the domains. The items were thus reduced to 59. The item-remainder correlations of the 59 items led to keeping 51, the deleted items having either minus or lower than 0.10 correlations. The internal consistency of the total instrument yielded an alpha coefficient of 0.79, the highest sub-domain being 'Perceived Ability toward Mathematics' (0.82) followed by 'Parents' Perceived Ability' (0.80), and the lowest 'Peers' Perceived Ability' showing an alpha of 0.21.

Training of the Teachers

There were two teachers responsible for teaching the mathematics courses in the six classes. One teacher taught the three mastery learning classes under the three learning environment organizations, while the second teacher taught all three counterparts under conventional instruction. Both teachers were trained in learning environment organization; the teacher of the mastery learning conditions was also trained in the theory and implementation of mastery learning, prior to the interventions.

HYPOTHESES AND RESULTS

Prior to the interventions, all six classes were compared with each other in terms of their previous year mathematics grades as well as their preparatory year English grades. One-way ANOVA on both types of grades showed no significant differences among the 6 groups prior to instruction ($F = 1.0006$, $df = 3, 152$, $\alpha = 0.4195$ for mathematics and $F = 1.7677$, $df = 5, 152$, $\alpha = 0.4195$ for English grades). The 6 conditions did not differ in terms of their attitudes toward mathematics (MATE scores) prior to the interventions ($F = 1.3958$, $df = 5, 151$, $\alpha = 0.2290$). The first hypothesis states that both instruction type (mastery learning or control) and learning environment organization (LEO) will have a significant effect on the achievement levels of students as measured by the summative test. A two-way analysis of variance was carried out to check the effects of both interventions. Table 1 shows this analysis.

Table 1. *Two-way analysis of variance* showing the effect of instruction type (mastery learning or conventional instruction) and learning environment organization (cooperative, competitive, or individualistic) on achievement levels of students measured by the summative test

Source of Variation	Sum of Square	*df*	Mean Squares	*F*	Significance Level
Instruction (ML or conventional)	461.182	1	461.182	77.811	0.000
learning environment organization	72.068	2	36.034	6.080	0.003
Interaction	9.480	2	4.740	0.800	0.451 N.S.
Error	212.109	58	11.834	–	–

The results of the analysis indicate that both interventions significantly affect achievement levels, however the effect of mastery learning is more than 12 times stronger (MS Instruction (461.182) / MS LEO (36.034) = 12.7995; F of instruction type = 77.811 versus F of LEO = 6.080).

E correlation ratios on the amount of variance accounted by each intervention on the achievement levels of students were also calculated. Table 2 shows this analysis.

Table 2 indicates that type of instruction explains 31.95% while learning environment organization explains about 5% of the variance in achievement. Furthermore, the effects of the two interventions are additive since the interaction of the two interventions is shown to be non-significant in the two-way analysis of variance in Table 1. Together, both interventions explain 36.94% of the variation in achievement.

According to the results of these two analyses, the first hypothesis of the study is clearly confirmed. Both instruction type and learning environment organization have significant impacts on achievement levels of students as measured by the summative test. In addition, their affects are additive.

Table 2. *E correlation ratios* and the amount of variance in achievement accounted by mastery learning and learning environment organization

	E Correlation Ratio	Amount of Variance (%)
ML and Achievement	0.5652	31.95
LEO and Achievement	0.2340	4.99
Multiple E Correlation Ratio	0.6078	36.94

Hypothesis 2 compares the four classes in more detail and states that the three mastery learning classes are expected to score higher than their conventional counterparts, and that classes under cooperative LEO are expected to score higher than those in competitive LEO, both scoring higher than those in individualistic LEO. So the ordering of the classes in terms of their achievement levels would be the following: ML+CpLEO > ML+CmLEO > ML+InLEO > C+CpLEO > C+CmLEO > C+InLEO. Table 3 shows the descriptive statistics in terms of the six classes.

Table 3. *Means* and standard deviations of the summative test

Groups	Mean	Standard Deviation	*N*	Possible Points
MLtot	12.3214	1.9584	79	15
Ctot	8.9459	3.0245	79	15
CpLEOtot	11.6154	2.4022	52	15
CmLEOtot	10.4151	2.9380	53	15
InLEOtot	10.2075	3.3215	53	15
ML+CpLEO	13.2308	0.9081	26	15
ML+CmLEO	12.3077	2.0153	26	15
ML+ InLEO	12.0000	2.0000	27	15
C+CpLEO	10.0000	2.3495	26	15
C+CmLEO	8.7592	2.8748	26	15
C+InLEO	8.1852	3.2438	27	15

Table 3 shows that mastery learning classes as a whole achieved higher than conventional classes; the classes under cooperative LEO scored higher than competitive and individualistic LEO in that order; and the ordering of the six classes in terms of their summative achievement scores is exactly aligned with the second hypothesis.

Table 4 shows the comparisons of achievement levels in the six classes, using the Newman-Keuls formula.

Table 4. Comparison of the *summative* test scores of the six groups using the *Newman-Keuls* formula on the basis of the two-way ANOVA

Class Comparisons	*df*	MS Error	Calculated *q*	Significance Level
MLtot & Ctot	156	11.8340	8.4754	$q = 0.01$ (3.64)
CpLEOtot & CmLEOtot	102	11.8340	3.1112	N.S. (3.38)
CpLEOtot & InLEOtot	104	11.8340	3.6493	$q = 0.05$ (3.38)
CmLEOtot & InLEOtot	104	11.8340	3.5381	$q = 0.05$ (3.38)
ML+CpLEO & C+CpLEO	50	11.8340	8.3743	$q = 0.01$ (5.05)
ML+CmLEO & C+CmLEO	50	11.8340	8.9671	$q = 0.01$ (5.05)
ML+InLEO & C+InLEO	52	11.8340	9.6840	$q = 0.01$ (5.05)
ML+CpLEO & C+CmLEO	50	11.8340	11.5645	$q = 0.01$ (5.05)
ML+CpLEO & C+InLEO	51	11.8340	13.0783	$q = 0.01$ (5.05)
ML+CmLEO & C+CpLEO	50	11.8340	5.9816	$q = 0.01$ (5.05)
ML+CmLEO & C+InLEO	51	11.8340	10.6856	$q = 0.01$ (5.05)
ML+InLEO & C+CpLEO	51	11.8340	5.1840	$q = 0.05$ (4.20)
ML+InLEO & C+CmLEO	51	11.8340	8.4028	$q = 0.01$ (5.05)
ML+CpLEO & ML+CmLEO	50	11.8340	2.3927	N.S. (4.20)
ML+CpLEO & ML+InLEO	51	11.8340	3.1903	N.S. (4.20)
ML+CmLEO & ML+InLEO	51	11.8340	0.7965	N.S. (4.20)
C+CpLEO & C+CmLEO	51	11.8340	3.2188	N.S. (4.20)
C+CpLEO & C+InLEO	50	11.8340	4.7040	$q = 0.05$ (4.20)
C+CmLEO & C+InLEO	51	11.8340	1.5137	N.S. (4.20)

Table 4 shows that the difference between the achievement levels of all mastery learning classes (ML+CpLEO, ML+CmLEO and ML+InLEO combined) and the conventional learning classes C+CpLEO, C+CmLEO, and C+InLEO combined) is significant at 0.01 level ($q = 8.4754$), favoring the mastery learning groups. The table further shows that the classes under both cooperative and competitive LEO reached significantly higher achievement levels in comparison to classes under individualistic

LEO (ML+InLEO and C+InLEO combined). Each mastery learning class reached a significantly higher achievement level in comparison to its conventional counterpart at $p < -0.01$ level. There were no significant differences among the three mastery learning classes in terms of their achievement levels. Although not significant, the largest difference under mastery learning conditions is between the cooperative mastery learning LEO and individualistic mastery learning LEO, favoring the cooperative LEO. The smallest difference among the mastery learning classes is between the competitive and the individualistic LEO, aligned with the hypothesis. Among the three conventional classes, the only significant difference is between the cooperative and individualistic LEO ($q = 4.7040, p < 0.05$).

Table 5. Comparison of the differences on the *summative* achievement scores of the six groups using the *effect size analysis*

Class Comparisons	Mean Difference	Standard Deviation	Effect Size
MLtot & Ctot	3.3755	3.0245	1.1160
CpLEOtot & CmLEOtot	1.2003	2.9380	0.4085
CpLEOtot & InLEOtot	1.4079	3.3215	0.4239
CmLEOtot & InLEOtot	0.2076	3.3215	0.0625
ML+CpLEO & C+CpLEO	3.2308	2.3495	0.4181
ML+CmLEO & C+CmLEO	3.4995	2.8756	1.2347
ML+InLEO & C+InLEO	3.8148	3.2438	1.1760
ML+CpLEO & C+CmLEO	4.4716	2.8748	1.5554
ML+CpLEO & C+InLEO	5.0456	3.2438	1.5558
ML+CmLEO & C+CpLEO	2.3077	2.3495	0.9822
ML+CmLEO & C+InLEO	4.1225	3.2438	1.2709
ML+InLEO & C+CpLEO	2.0000	2.3495	0.8512
ML+InLEO & C+CmLEO	3.2418	2.8748	1.1277
ML+CpLEO & ML+CmLEO	0.9231	2.0153	0.4580
ML+CpLEO & ML+InLEO	1.2308	2.0000	0.6154
ML+CmLEO & ML+InLEO	0.3077	2.0000	0.1539
C+CpLEO & C+CmLEO	1.2408	2.8756	0.4325
C+CpLEO & C+InLEO	1.8148	3.2438	0.5596
C+CmLEO & C+InLEO	0.5440	3.2438	0.1677

In the cross comparisons, all differences are significant favoring the mastery learning groups, the largest difference being between the mastery learning class under cooperative

LEO and the conventional class under individualistic LEO ($q = 13.0783$, $p < 0.01$), favoring the mastery learning class with cooperative LEO. The smallest difference is between the mastery learning class with individualistic LEO (the lowest achieving mastery learning class) and the conventional class with cooperative LEO (the highest achieving conventional class; $q = 5.1840$, $p < 0.05$), showing the relative superiority of the cooperative learning environment organization, especially under conventional instruction. These findings are aligned with the hypothesis. Table 5 shows the effect size analyses among the six classes.

Table 5 shows that the effect size difference between the mastery learning groups combined and the control groups combined is more than one standard deviation (1.1160), favoring the mastery learning groups which is totally aligned with research done over the world. When learning environment organizations are compared regardless of instructional methodology, there is about half a standard deviation difference between the cooperative and competitive (0.4085), and cooperative and individualistic LEOs (0.4239), in both cases in favor of the cooperative LEO. The difference between competitive and individualistic LEOs is slight (0.0625 standard deviations). It seems that the cooperative learning environment organization is most enhancive of learning.

Comparing the ML classes under different LEOs with their counterparts, the largest effect size is observed between the mastery learning and conventional classes both under competitive LEO (1.2347 standard deviations), while the smallest difference is between the mastery learning and conventional classes, both under cooperative LEO (0.4181 standard deviations), indicating that cooperative learning environments are more conducive for learning, especially under conventional instruction.

When the mastery learning classes are compared with each other, the highest effect size is observed between the mastery learning class under cooperative and the one under individualistic LEO (0.6154), favoring the cooperative LEO. This is followed by the difference between the mastery learning class under cooperative and the one under competitive LEO (0.4580 standard deviations). There is only a slight difference between the mastery learning classes with competitive and individualistic LEOs (0.1539 standard deviations). The same pattern holds for the control classes, with a 0.5596 standard deviation difference between the cooperative and individualistic LEOs, and 0.4325 between the cooperative and competitive LEOs, in both cases favoring the cooperative LEO. The difference between the conventional classes under competitive and individualistic LEO is slight (0.1677 standard deviations).

In the cross comparisons, the largest difference in effect size is between the mastery learning group under cooperative LEO and the conventional class under individualistic LEO, which is more than 1.5 standard deviations (1.5558), favoring the mastery learning class with cooperative LEO. This difference is followed by another large effect size of

1.554 between the mastery learning class with cooperative LEO and the control class with competitive LEO. There is a difference of 1.2709 standard deviations between the mastery learning class with competitive LEO and the conventional class with individualistic LEO. The smallest difference in the cross comparisons is between the mastery learning class with individualistic LEO and the control class with cooperative LEO (0.8512 standard deviations), aligned with the hypothesis. The difference in effect size between the mastery learning with individualistic LEO and the control with competitive LEO (1.1277 standard deviations) is larger than the difference between the mastery learning with competitive LEO and the control with cooperative LEO (0.9822 standard deviations), showing that cooperative learning environments are helpful in raising the achievement levels of classes under conventional instructional methods.

These findings indicate that when classes are compared regardless of instructional methodologies, both cooperative and competitive arrangements reach significantly higher achievement levels in comparison to individualistic ones (Table 4). As a trend, cooperative learning environments both under mastery learning and conventional instruction are most conducive to learning, followed by the competitive and individualistic arrangements respectively, although there are no significant differences between the three mastery learning classes. Under control conditions there is a significant difference between cooperative learning environment organizations and those which do not include peer interaction, in favor of cooperative arrangements.

The second hypothesis that the ML+CpLEO would achieve the highest, followed by the ML+CmLEO, ML+InLEO, C+CpLEO, C+CmLEO, C+InLEO, in that order has been confirmed by the analyses of the data.

Table 6. *Two-way analysis of variance* showing the effect of instruction type (mastery learning or conventional instruction) and learning environment organization (cooperative, competitive, or individualistic) on *MATE*

Source of Variation	Sum of Square	*df*	Mean Squares	*F*	Significance Level
Instruction (ML or conventional)	1086.327	2	1086.327	30.162	0.000
learning environment organization	504.343	1	252.171	7.002	0.001
Interaction	39.917	2	19.958	0.554	0.576 N.S.
Error	5474.409	58	36.016	–	–

The third hypothesis of the study states that there will be a significant effect of mastery learning and learning environment organization on the post-intervention attitude scores of students toward mathematics as measured by MATE. Table 6 shows the two-way analysis of variance of the effects of instruction (mastery learning or conventional) and LEO (cooperative, competitive, or individualistic) on mathematics attitude (MATE) scores of students after the interventions.

Table 6 shows that the effects of both interventions are highly significant on the post-intervention attitudes toward mathematics, as measured by MATE. The table also shows that the effect of mastery learning is 4.3 times stronger than that of learning environment organization, although both effects are significant (MS of mastery learning / MS of LEO=1086.327 / 252.171 = 4.3). The table further indicates that the effect of both interventions is additive, since the interaction between them is not significant.

Table 7. *E correlation ratios* and the amount of variance in *MATE* accounted by mastery learning and learning environment organization

	E Correlation Ratio	Amount of Variance (%)
ML and Achievement	0.3919	15.36
LEO and Achievement	0.2670	7.13
Multiple E Correlation Ratio	0.4742	22.49

Table 7 shows the E correlation ratios indicating the amount of variance accounted by each intervention on the MATE. Table 7 shows that mastery learning accounts for 15.36% of the variance on mathematics attitudes, while learning environment organization explains 7.13%, together accounting for 22.49% of the variance. In light of the evidence, the third hypothesis of the study is clearly confirmed.

Table 8. *Means* and standard deviations of the post-intervention *MATE* scores of the six classes

Groups	Mean	Standard Deviation	*N*	Possible Points
MLtot	56.4405	5.8841	79	100
Ctot	51.2770	6.5549	79	100
CpLEOtot	56.3558	6.1448	52	100
CmLEOtot	53.5094	6.2876	53	100
InLEOtot	52.2453	7.0891	53	100
ML+CpLEO	59.3269	4.8620	26	100
ML+CmLEO	54.2115	6.3705	26	100
ML+ InLEO	56.2222	5.2226	27	100
C+CpLEO	53.3846	5.9183	26	100
C+CmLEO	50.6923	6.1369	26	100
C+InLEO	50.3510	7.3417	27	100

The fourth hypothesis of the study states that classes under mastery learning are expected to have more positive post-intervention attitudes toward mathematics as measured by MATE. Furthermore, the hypothesis also states that the cooperative will produce more positive attitudes toward mathematics, followed by the competitive and individualistic LEOs, in that order. Therefore in terms of MATE scores, the classes are expected to have the following order, ranging from the most positive to the least positive attitudes toward mathematics: ML+CpLEO > ML+CmLEO > ML+InLEO > C+CpLEO > C+CmLEO > C+inLEO.

The descriptive statistics of the post-intervention mathematics attitude (MATE) scores of the six classes are presented in Table 8.

Table 9. Comparison of the post-intervention *MATE* scores of the six classes, using the *Newman-Keuls* formula

Class Comparisons	*df*	MS Error	Calculated *q*	Significance Level
MLtot & Ctot	156	36.0160	4.9176	$q = 0.01$ (3.64)
CpLEOtot & CmLEOtot	104	36.0160	3.9148	$q = 0.05$ (3.38)
CpLEOtot & InLEOtot	102	36.0160	2.7109	N.S. (3.38)
CmLEOtot & InLEOtot	104	36.0160	1.2039	N.S. (3.38)
ML+CpLEO & C+CpLEO	50	36.0160	5.9183	$q = 0.01$ (5.05)
ML+CmLEO & C+CmLEO	50	36.0160	3.3516	N.S. (4.20)
ML+InLEO & C+InLEO	52	36.0160	5.0193	$q = 0.05$ (4.20)
ML+CpLEO & C+CmLEO	50	36.0160	8.2234	$q = 0.01$ (5.05)
ML+CpLEO & C+InLEO	51	36.0160	8.5488	$q = 0.01$ (5.05)
ML+CmLEO & C+CpLEO	50	36.0160	0.7875	N.S. (4.20)
ML+CmLEO & C+InLEO	51	36.0160	3.6785	N.S. (4.20)
ML+InLEO & C+CpLEO	51	36.0160	2.6072	N.S. (4.20)
ML+InLEO & C+CmLEO	51	36.0160	5.2666	$q = 0.01$ (5.05)
ML+CpLEO & ML+CmLEO	50	36.0160	4.8718	$q = 0.05$ (4.20)
ML+CpLEO & ML+InLEO	51	36.0160	2.9569	N.S. (4.20)
ML+CmLEO & ML+InLEO	51	36.0160	1.9149	N.S. (4.20)
C+CpLEO & C+CmLEO	51	36.0160	2.8883	N.S. (4.20)
C+CpLEO & C+InLEO	50	36.0160	2.5641	N.S. (4.20)
C+CmLEO & C+InLEO	51	36.0160	2.9149	N.S. (4.20)

The results are all aligned with the direction of the hypothesis, except for the mastery learning class under competitive LEO, which was expected to have more positive MATE scores than the mastery learning class under individualistic LEO. This is not the case. Under mastery learning conditions, students in individualistic LEO have more positive attitudes toward mathematics than students under competitive LEO. This may be due to the incompatibility of mastery learning strategies, where arrangements are made so that all students are able to reach the pre-set criterion level, and competitive learning environments, an oxymoronic paradox in terms of students' attitudes.

Table 9 compares all conditions with each other in terms of their attitudes toward mathematics as measured by the post-intervention MATE scores, using the Newman-Keuls formula.

Table 9 shows that the difference between the mastery learning groups taken together and the total conventional groups is significant at $p < 0.01$ level ($q = 4.9176$) on the MATE scores of students. This finding indicates that students under mastery learning have significantly more positive attitudes toward mathematics than students under conventional instruction.

The table also indicates that students under cooperative LEO have significantly more positive attitudes toward mathematics in comparison to students under individualistic LEO, while there are no significant differences between the cooperative and competitive as well as between the competitive and individualistic LEOs. When mastery learning classes are compared with their counterpart conventional learning environment organizations, there is a significant difference between the mastery learning and conventional classes under cooperative LEO ($q = 5.9183, p < 0.01$) as well as between the mastery learning and conventional classes under individualistic LEOS ($q = 5.0193$, $p < 0.05$); however, the difference between the two classes under competitive LEO is not significant in terms of students' attitudes toward mathematics. This shows that in terms of the attitudes of students toward their learning, competitive LEO's under mastery learning methods create a cognitive dissonance in the students because the environment is in contrast with the philosophy and praxis of mastery learning which enables almost all students to reach the criterion level of learning. Since the rewards are not scarce to merit competition under mastery learning, arrangements for competition pose a paradox which negatively affects the attitudes of students although it does not pose a problem in achievement, the mastery learning students still achieving significantly higher than their counterparts.

When ML classes are compared with each other, the only significant difference is between the cooperative and competitive LEOS ($q = 4.8718$, $p < 0.05$). It seems that for attitudes toward mathematics, competitive mastery learning organization is worse than individualistic, the cooperative arrangement being most conducive for positive attitudes. There are no significant differences among the control classes in terms of attitudes toward mathematics due to learning environment organization. When cross comparisons are made between the three mastery learning and conventional classes under three different learning environment organizations in terms of mathematics attitudes, there is a significant difference between the mastery learning class under cooperative LEO and the control class under individualistic LEO (which is the largest difference in the cross comparisons; ($q = 8.5488, p < 0.01$), favoring the mastery learning with cooperative LEO. Furthermore, there are also significant differences between the mastery learning with cooperative LEO and the control with competitive LEO, favoring the mastery learning class with cooperative LEO ($q = 8.2234, p < 0.01$). There is also a significant difference between the mastery learning with individualistic and the control with competitive LEO ($q = 5.2666, p < 0.01$).

Table 10. Comparison of the differences on *MATE* post-intervention scores of the six groups using *effect size* analyses

Class Comparisons	Mean Difference	Standard Deviation	Effect Size
MLtot & Ctot	5.1635	6.5549	0.757
CpLEOtot & CmLEOtot	4.1105	7.0891	0.5798
CpLEOtot & InLEOtot	2.8464	6.2876	0.4527
CmLEOtot & InLEOtot	1.2641	7.0891	0.1783
ML+CpLEO & C+CpLEO	2.9423	5.9183	0.4972
ML+CmLEO & C+CmLEO	3.5192	6.1369	0.5734
ML+InLEO & C+InLEO	5.2703	7.3417	0.7996
ML+CpLEO & C+CmLEO	8.6346	6.1369	1.4064
ML+CpLEO & C+InLEO	8.9759	7.3417	1.2225
ML+CmLEO & C+CpLEO	0.8269	5.9183	0.1397
ML+CmLEO & C+InLEO	3.8596	7.2317	0.5257
ML+InLEO & C+CpLEO	2.7376	5.9183	0.4526
ML+InLEO & C+CmLEO	5.5299	6.1369	0.9011
ML+CpLEO & ML+CmLEO	5.1154	6.3705	0.8030
ML+CpLEO & ML+InLEO	3.1047	5.2226	0.5622
ML+CmLEO & ML+InLEO	2.0107	5.2226	0.3156
C+CpLEO & C+CmLEO	2.9623	6.1369	0.4387
C+CpLEO & C+InLEO	3.0327	7.3417	0.0450
C+CmLEO & C+InLEO	0.3404	7.3417	0.0464

In terms of attitudes toward mathematics, the smallest difference is between the mastery learning class with competitive LEO and the control class with cooperative LEO, showing the positive effect of cooperative arrangements under conventional instruction.

Table 10 shows the effect size differences among classes in terms of mathematics attitude scores (MATE) of students.

Table 10 shows that there is an effect size difference of more than three quarters of a standard deviation (0.7577) between the total mastery learning and the total conventional classes, favoring the mastery learning in terms of positive attitudes toward mathematics. In terms of learning environment organizations, there is more than half a standard deviation difference between cooperative learning environments and individualistic ones (0.5798), and close to half a standard deviation (0.4527) difference between the cooperative and competitive learning environments in terms of positive attitudes toward mathematics, favoring the cooperative organizations. The difference between the competitive and individualistic organizations is slight (0.1783 standard deviations).

When the three mastery learning classes are compared to their conventional counterparts under different LEOs, the largest effect size is found between the mastery learning and control classes under individualistic LEO (0.7996 standard deviations), while the smallest is found between the mastery learning and conventional classes under cooperative LEO (0.4972). These findings are aligned with the hypothesis that cooperative learning environments lead to more positive attitudes toward mathematics.

When mastery learning classes are compared with each other, the biggest difference is between the cooperative and competitive LEOs (0.8030 standard deviations), showing that competitive arrangements under mastery learning lead to less positive attitudes toward mathematics than individualistic arrangements.

In classes under conventional instruction, the biggest difference in attitudes is between cooperative and competitive arrangements (0.4387 standard deviations), favoring the cooperative. This finding also points to the positive impact of cooperative arrangements in terms of student attitudes toward mathematics.

In terms of cross comparisons, the largest difference is between the cooperative mastery learning class and the competitive control class (1.4064 standard deviations), followed by the difference between the cooperative mastery learning class and the individualistic conventional class (1.2225 standard deviations), favoring the cooperative mastery learning class. The smallest difference is between the competitive mastery learning class and the cooperative conventional class (0.1397 standard deviations). These findings indicate that in terms of student attitudes toward mathematics, the competitive arrangement is the worst one under mastery learning, while the cooperative one is the best one under both mastery learning and conventional instruction.

In light of the evidence, the mastery learning classes have significantly more positive attitudes toward mathematics in comparison to conventional classes. Cooperative arrangements lead to significantly more positive attitudes toward mathematics in comparison to individualistic arrangements when mastery learning and conventional classes are combined (ML+CpLEO and C+CpLEO combined versus ML+InLEO and C+InLEO combined). Under mastery learning conditions, however, cooperative arrangements lead to significantly more positive attitudes toward mathematics in comparison to competitive arrangements. Competitive learning environments under mastery learning conditions lead to least positive attitudes. Under control conditions, there are no significant differences in attitudes toward mathematics for the different LEOs, the ordering showing a trend aligned with the hypothesis.

Consequently, the fourth hypothesis of the study is generally confirmed. The ordering of the classes in terms of their attitudes toward mathematics, ranging from the most positive to the least positive, is as follows: ML+CpLEO > ML+InLEO > ML+CmLEO > C+CpLEO > C+CmLEO > C+InLEO.

The fifth hypothesis of the study states that there will be a positive correlation between achievement in mathematics and attitudes toward this subject. The Pearson-product moment correlations between achievement and attitude scores of students were obtained for the total sample as well as for all groups. The most important correlation here is the one for the total sample, since it includes all subjects taking part in the study. One would not expect significant correlations of achievement and attitude for mastery learning classes since all students reach the criterion level where the variance is minimal in terms of student achievement. Thus the total sample and different LEOs were taken into the analysis. Table 11 shows this analysis.

Table 11. *Pearson-product correlation* coefficients of *summative* and post-intervention *MATE* scores, calculated for the entire sample

Groups	*N*	Correlation Coefficient	Significance Level
Overall	158	3207	000
CpLEOtot	52	0.4953	0.000
CmLEOtot	53	0.2449	0.077
InLEOtot	53	0.1822	0.192 N.S.

The table indicates that the correlation between achievement and attitude is highly significant ($p < 0.000$) for the total sample. Two other correlations are noteworthy. The correlation between achievement and attitude in cooperative learning environments is highly significant ($p < 0.000$), while the correlation approaches significance under competitive learning environments ($p = 0.77$).

The evidence for this hypothesis indicates that there is a significant relationship between achievement levels and post-intervention attitudes of students toward mathematics when the total sample is taken into the analysis. Students who reached higher levels of learning seem to have more positive attitudes toward mathematics. Thus, the fifth hypothesis of the study is confirmed.

DISCUSSION AND SUGGESTIONS FOR FURTHER RESEARCH

The aim of this study was to investigate the effects of instructional methods (mastery learning and conventional) as well as learning environment organizations (cooperative, competitive, or individualistic) on both the achievement levels of students as well as on their attitudes toward mathematics.

The study was carried out as carefully as school environments allow, with as much control over procedures demanded by the methodology as possible. The instruments used in the study were developed with care. The findings indicate not only the positive impact of mastery learning in terms of mathematics achievement levels, but also in terms of attitudes toward mathematics after the completion of instruction. Mastery learning students scored significantly higher in every comparison than students under conventional instruction in terms of their summative test scores (Table 4). In terms of their attitudes toward mathematics, the mastery learning students as a whole scored significantly higher than students under conventional instruction.

The findings of the study also indicate the statistically significant effects of learning environment organizations (LEO) on not only achievement levels but also in terms of attitudes toward mathematics. The study shows that in terms of achievement levels, there is no significant difference between cooperative or competitive arrangements (ML+CpLEO and C+CpLEO combined versus ML+CmLEO and C+CmLEO combined), regardless of instructional methodology. Both types of peer interaction enable students to reach significantly higher levels of learning in comparison to conditions where peer interaction is not allowed (individualistic learning environment organizations; Table 4). Under mastery learning, kind of learning environment organization does not have a significant effect on student achievement levels, although the trend in achievement is cooperative, competitive and individualistic respectively. All students achieve high levels of learning under mastery learning conditions, whatever LEO is used. Under conventional instruction, cooperative arrangements lead to significantly higher levels of learning in comparison to individualistic arrangements, the trend in achievement being again cooperative, competitive, and individualistic respectively.

In terms of attitudes toward mathematics, there is a significant difference favoring the cooperative learning environment organizations in comparison to individualistic ones when students in the mastery learning and conventional classes are taken together. The trend of most positive attitudes under cooperative, competitive and individualistic environments (in that order) seem to hold, although there are no significant differences between the competitive and individualistic, and the cooperative and competitive arrangements.

When each instructional methodology is taken separately, under conventional instruction the above stated trend is present with no significant differences among the three classes in attitudes. However when attitudes are concerned, the story is different under mastery learning conditions. Under mastery learning, students under competitive arrangements have significantly less positive attitudes toward mathematics in comparison to students under cooperative arrangements.

This indicates that in terms of attitudes toward mathematics, the competitive mastery learning environment is more negative than the competitive conventional learning environment since the mastery learning students in the competitive LEO who reached significantly higher levels of learning than their counterparts under conventional instruction, were not significantly different from them in terms of their attitudes toward mathematics (Tables 9 and 10).

Competition under mastery learning conditions seems to have a dampening influence on the relationship between achievement and attitudes this is aligned with the theory behind mastery learning because under these methodology students all try to reach high levels of learning rather than competing for scarce rewards and outcomes. Competition does not have a logical ground under mastery learning.

It is once more substantiated through both the comparisons of mastery learning and conventional instruction as well as the correlations between achievement and attitudes, that if students reach high levels of learning, they develop more positive attitudes toward their subject area, in this case mathematics (Table 11).

The only methodological change one could think of making is increasing the group work hours for the control classes to match the mastery learning classes. It must be remembered that under mastery learning conditions, group work took place for one hour after the completion of the formative test as a corrective procedure and for another hour after the parallel form of the formative, totaling to two hours for each learning task. For the control classes, group work was implemented only for one hour after the completion of the learning task since students under control conditions were not required to reach the criterion level or to take the parallel form of the formative test after each learning task. Although two hours in a row of group work for the control classes would equalize the number of hours to the mastery learning conditions, this would still lead to other problems.

In that case, the mastery learning students would have the two hours dispersed, one after the formative and one after its parallel form, while the control classes would have them massed together. This too might lead to differential inputs, but it is worth trying in another project. If the results are still similar, this would strengthen the points made here even more.

CONCLUSIONS AND IMPLICATIONS

What this research has shown is that mastery learning is a very effective instructional methodology to increase achievement levels of students, once again. When students learn well, their attitudes toward learning become more positive in comparison to students who have not reached high levels of learning.

What is encouraging in this study is that different types of learning environment organizations have differential effects not only on achievement levels but also on attitudes toward what one has learned. This research has shown clearly that cooperative learning environments are most enhancive of not only achievement levels, but also in the development of more positive attitudes toward learning. In terms of achievement levels, competitive environments seem better than individualistic ones.

Students like to be in touch with their peers, even if this means competition; and they seem to prefer peer interaction in learning to isolated learning experiences. Secondly, in terms of more positive attitudes for learning, again cooperative organizations lead to highest results. This is followed by competitive organizations under conventional instruction, but not under mastery learning. Under mastery learning, if a competitive learning environment organization is made, students score significantly lower in attitudes toward their learning in comparison to cooperative arrangements. This is because competition for scarce goods is antithetical to the mastery learning theory. All students are urged to reach high levels of learning, and this is expected from all students. To create an artificial competitive environment probably creates cognitive dissonance because it is not functional.

Motivation for learning is important for positive learning outcomes as well as for measured achievement levels. When students come to our classes, they bring with them learning histories in which we as individual teachers, most likely, did not have an input. Our students do not only bring with them different levels of prerequisite learning's but also different levels of affect for what they will be learning. If we leave their final learning at the mercy of these entry characteristics, a test given the first day before the course will have almost isomorphic results with their achievement levels on the last day. The ones who had 'it' on the first day will be the ones who in the future will also have 'it', not too different from what the present situation is all over the world.

The above described circumstances will tend to be the case ad infinitum, unless of course, we *want* to change the situation. This research clearly shows that effective instructional methodologies coupled with cooperative peer interactions not only have an impact on achievement but also on positive attitudes toward one's learning.

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