CHAPTER - IV

ANALYSIS AND INTERPRETATION

4.1 Introduction:

The purpose behind the present investigation has been explicated in terms of two objectives, viz.,

(i) To develop the strategy for mastery learning in fifth grade geometry, and

(ii) To validate the developed strategy.

The first objective has already been achieved as discussed in chapter III. The achievement of the second objective is being discussed in this chapter. For this we analyse the data obtained as a result of experimentation. The data collected was obtained in two forms: (a) in the form of achievement scores in different tests, and (b) in the form of answers to the questionnaire given to the pupils of experimental group in final tryout. This is further analysed and interpreted to validate the developed strategy. Since the data obtained is in two forms, the validation is done in two parts. First part is based on the data obtained in the form of achievement scores in different tests, and the second part is based on the questionnaire given to the pupils of experimental group in the final tryout.

4.2 Validation of the strategy based on the data obtained in the form of achievement scores:

In this article the analysis and interpretation is divided into three parts. In the first part statistical analysis and interpretation of the data obtained in the form of achievement scores on formative and summative test is done. In the second part relation between achievement scores and I.Q. level is found out and in the third part the graphical interpretation of the data obtained is done. The details are as under.

4.2.1 Statistical analysis and interpretation of achievement scores on formative and summative tests:

The experiment was conducted in two schools. First, as an initial tryout in the school Convent of Jesus and Mary and then as a final tryout in the school The Baroda High School. Two groups, the experimental group (group A) and the control group (group B) were considered for both the tryouts. As explained in Chapter III the whole course content of the fifth grade geometry was divided into three units: Unit-1, Unit-2 and Unit-3.

For the experimental group in the initial tryout, two formative tests, Test-1 and Test-2, based on the content of unit-1 were conducted and then again two tests,

Test-1 and Test-2, based on the combined content of unit 2 and unit 3 were conducted. Then the same summative test, based on the combined content of all the units, (that is, based on the full course content of the fifth grade geometry) was conducted for both the groups - the experimental group-A as well as the control group B. The achievement scores for all these tests are given in the appendix.

For the experimental group in the final tryout, two formative tests, Test-1 and Test-2, were conducted for each of the units unit-1, unit-2 and unit-3 - based on the content of the respective unit. Of course, since content of unit-3 and unit-2 depends on previous units, the tests were held first for unit-1, then for unit-2 and finally for unit-3. Also one more test based on the combined ~~ee~~ contents of unit 2 and unit 3 was held. Finally the same summative test, based on the whole course content of the fifth grade geometry was conducted for the experimental as well as the control group. The achievement scores for all these tests are given in the appendix.

In both the tryouts, as each test was of different marks, the raw score for each test (given in the appendix) is converted into percentages and then the data is sorted out in the decreasing order of achievement score for the purpose of conveniency in comparative study.

In the following tables percentiles, mean and standard deviation of scores of scholastic achievement of pupils in the initial and final tryouts are given. They are analysed and interpreted by taking help of measures of statistics such as percentiles, mean, standard deviation, coefficient of correlation, standard error of measurement and the significance of difference between the two means (t-value) and these statistics are used for comparision.

We first consider the scholastic achievement scores of the pupils at the Initial Tryout.

It can be observed from the table 4.2.1 (a) that the pupils under the experiment have achieved higher percentages in the second formative test of unit 1 as well as in the second formative test of combined units unit 2 and unit 3 than the percentages they achieved in the first formative tests for the same units. These positive changes in the formative test results may be due to the remedials given after every first test in these units. As remedials were also the elements of the strategy, it could be said that the strategy worked well during the initial tryout.

Also, from the same table 4.2.1 (a) it can be said that in the experimental group (group-A) 70 percent of

Table 4.2.1 (a): Scholastic achievement of pupils at the Initial Tryout (in percent of marks)

Per-centi-les	Formative Test Scores: Experimental group (group-A)				Summative Test Score	
	Unit-1		Combined Units: Unit-2 and Unit-3		Experimental group (group-A)	Control group (group-B)
	Test-1	Test-2	Test-1	Test-2		
P_{90}	94	100	95	100	96.66	69.17
P_{80}	88	97.5	92.5	100	91.66	65
P_{70}	84	95	90	95	88.33	61.66
P_{60}	80	95	85	95	86.66	56.66
P_{50}	76	92.5	85	90	84.17	48.33
P_{40}	74	87.5	75	85	81.66	45
$P_{36.36}$ (Mastery level)	72	82.5	75	80	80	43.33
P_{30}	70	80	71.25	80	73.33	41.66
P_{20}	64	70	65	67.50	66.66	40
P_{10}	50	61.25	51.25	60	62.50	35.83
$P_{0.73}$ (Pass level)	42.40	48.50	29.50	44.50	36	31.33
P_0	40	47.50	27.50	37.50	30	30
Mean →	75.53	84.73	77	84.18	79.20	51.27
S. D. →	15.07	15.11	17.77	15.59	15.04	12.62
t →					* 13.76	

* at .05 t = 1.98
at .01 t = 2.63

the pupils have achieved minimum 80 percent of marks before going to the next unit. Moreover, if the summative test result of this experimental group-A is considered then one can see that 63.64 percent of pupils have achieved minimum of 80 percent of marks. Comparing this result of group-A with the predetermined criteria fixed by the investigator for mastery learning, it can be said that in initial tryout 63.64 percent of pupils have attained the desired mastery level in the fifth-grade Geometry (observe the mastery level row in the table). Rest of the pupils, that is 36.36 percent of the pupils could not attain the mastery level; even then their scholastic achievement is not at all frustrating. It can be seen from the same table 4.2.1 (a) that out of these non achievers of mastery level, 26.26 percent of pupils have shown their scholastic achievement score between 62.50 percent and 80 percent, and only 10 percent of pupils had scholastic achievement below 62.50 percent.

In other words it can be seen that at the end of the initial tryout in the school Convent of Jesus and Mary, after completion of three units of Geometry course, that is, after the completion of the whole Geometry course of the fifth standard 63.64 percent of the pupils of group-A have attained mastery level.

Table 4.2.1 (b): Percentile and percentages comparision of achievement levels of the pupils in the Summative Test for the two groups - Initial Tryout.

Achievement level	Percentiles of pupils achieving the respective achievement level		% of the pupils achieving the respective achievement level	
	Experimental group (group-A)	Control group (group-B)	Experimental group (group-A)	Control group (group-B)
Mastery level (i.e., Acht. score ≥80%)	$P_{36.36}$	P_{100}	63.64 %	0.0 %
Distinction (i.e., Acht. score ≥70%)	$P_{25.45}$	$P_{90.90}$	74.55 %	9.10 %
First Class (i.e., Acht. score ≥60%)	$P_{8.73}$	$P_{67.27}$	91.27 %	32.73 %
Second Class (i.e., Acht. score ≥50 %)	$P_{6.36}$	$P_{54.55}$	93.64 %	45.45 %
Pass class (i.e., Acht. score ≥35 %)	$P_{0.73}$	$P_{3.64}$	99.27 %	96.36 %
Failure (i.e., Acht. score <35%)	-	-	0.73 %	3.64 %

Further, for the better analysis of those who could not achieve mastery level a glance at the Table 4.2.1 (b) could be much helpful. It is clear from this table that for the experimental group 63.64 percent of pupils have achieved mastery level scoring above 80 percent and additionally 10.91 percent of pupils have scored between 70 percent and 80 percent, 16.72 percent of pupils have scored between 60 percent and 70 percent, 2.37 percent of pupils have scored between 50 percent and 60 percent and only 6.36 percent of pupils are in the poor pupils group; (assuming that those scoring below 50 percent are poor).

Compared to this, it can be said from the observation of Tables 4.2.1 (a) and 4.2.1 (b) that none has achieved mastery level (refer Appendix) in the control group B which was taught by conventional method by regular school teacher. Also, only 9.10 percent of pupils score between 70 percent and 80 percent additional 23.63 percent of pupils score between 60 percent and 70 percent, and another 12.72 percent of pupils score between 50 percent and 60 percent. This means a significantly big lot of 54.55 percent of pupils of the control group fall into the category of poor pupils (assuming those score below 50 percent are poor). Thus, comparing the scholastic

achievement scores of both the groups over the whole geometry course, from the percentiles of scholastic achievement in the summative tests (i.e., tests for units 1,2 and 3 covering whole course) it can be said that (refer Table 4.2.1 (b)) while 63.64 percent of pupils of Experimental group-A have achieved mastery, none of the Control group-B could achieve mastery; also from among the non achievers of mastery level, while only 8.73 percent of pupils of group A score below 60 percent, the figure for control group B scoring below 60 percent is as high as 67.27 percent of pupils. Again, while 54.55 percent of pupils of Control group B have shown the scholastic achievement below 50 percent, the score which can reasonably be considered as of poor standard, the figure for the Experimental group A pupils falling into this category of poor scorers is as low as just 6.36 percent.

Thus there is a vast difference between the achievement scores of the group A and the group B which were matched groups on the variable intelligence but were taught by different teachers using different methods of teaching Geometry. The experimental group (group-A) was taught by the investigator using the developed strategy for mastery learning in the fifth grade geometry while the control group (group B) was taught by another teacher using the conventional method. It can justifiably be

interpreted that this very significant difference between the scholastic achievement of the two groups is due to the use of the developed mastery learning strategy implemented on group A.

Also from the values of mean and standard deviation of scholastic achievement of both groups (refer Table 4.2.1 (a), bottom rows) it can be said that the developed strategy of Mastery learning has worked very well. The values of standard deviations of the achievement scores, in the formative as well as summative tests, for both the groups show that the scores are homogeneous more or less of the same degree. However the values of mean of the Formative test scores show that for the unit-1 as well as for the combined unit-2 and unit-3 the mean value of scores is higher for Test-2 than for Test-1 - indicating the positive effect of remedials given to the Experimental group each time after the first test. This was a part of the strategy and it can be seen that these remedials turn out to be an effective factor of the strategy even at the final tryout. Not only that, the means themselves are as high as 84.73 and 84.18 for Test-2 of unit 1 and of the combined unit-2 and unit-3 respectively - indicating that the overall strategy of Mastery learning has also worked well for achieving higher scores. Again, the values of mean of the summative

test scores for Experimental group and the control group are respectively 79.20 and 51.27 (refer the same Table 4.2.1 (a) again). This clearly shows that the achievement of the Experimental group-A is significantly higher than the achievement of the control group B. In view of the fact that both the groups were matched groups and the indication that both the groups are homogeneous more or less of the same degree, this significantly higher achievement of the experimental group over the control group B at the summative test based on the whole course of the fifth grade geometry can be interpreted as the confirmation of the already drawn conclusion that the strategy of mastery learning developed by the investigator is indeed very effective for increasing students achievement level.

We now consider the scholastic achievement scores of pupils at the final tryout.

It can be observed from the table 4.2.1 (c) that the pupils of the experimental group-A have achieved higher percentages of scores in the second formative test of each unit than the percentages they achieved in the first formative test for the same unit. These positive changes in the formative test sresults may be interpreted as due to the remedials given after every first test in these units. Moreover, comparing tables 4.2.1(a) and 4.2.1 (c) it can also be seen that these scores at the

Table 4.2.1(c): Scholastic achievement of pupils at the Final Tryout.

Percentiles	Formative Test Scores: Experimental group (group-A)							Summative Test score	
	Unit-1		Unit-2		Unit - 3		Combined Units: Unit-2 & Unit-3	Experimental group (group-A)	Control group (group-B)
	Test 1	Test 2	Test 1	Test 2	Test 1	Test 2	Test-1		
P_{90}	99.75	100	95.80	100	100	100	97.5	96.49	82.33
P_{80}	95	100	86	100	100	100	95	92.66	76.66
P_{70}	85	97.50	77.40	93.33	90	100	90	90	70.17
P_{60}	82.50	95	76	93.33	90	100	90	86	65.99
P_{50}	80	95	68	91.67	85	100	87.50	82.50	59.17
P_{40}	75	92.50	62	80	75	100	85	80	51.66
$P_{31.37}$ (Mastery level)	70	90	58	80	70	90	80	80	4
P_{30}	70	90	58	80	66.50	90	80	78.83	49.83
P_{20}	62.50	85.50	52.80	61.33	60	70	78	75.33	46
P_{10}	57.75	80	46.20	46.66	55	60	70	68.50	41.66
P_{0}	35	45	34	20	20	20	25	50	23
Mean→	76.91	90.83	68.59	80.19	77.16	87.45	83.77	82.09	58.95
S.D.→	16.40	10.91	17.16	22.17	21.22	20.75	14.09	10.51	15.77
t→								* 9.54	

* at .05 t = 1.99

at .01 t = 2.63

Table 4.2.1(d): Percentile and percentages comparision of achievement levels of the pupils in the Summative Test - for the experimental group-A of both the tryouts and the control group-B of the final tryout.

Achievement level	Percentiles of the pupils achieving the respective achievement level			% of the pupils achieving the respective achievement level.		
	Experimental group (group-A) Initial Tryout	Experimental group (group-A) Final Tryout	Control group (group-B) Final Tryout	Experimental group (group-A) Initial Tryout	Experimental group (group-A) Final Tryout	Control group (group-B) Final Tryout
Mastery level (ie.Ach. score $\geqslant$80%)	$P_{36.36}$	$P_{31.37}$	$P_{88.37}$	63.64 %	68.63 %	11.63 %
Distinction (ie.Ach. score $\geqslant$70%)	$P_{25.45}$	$P_{11.76}$	$P_{69.77}$	74.55 %	88.24 %	30.23 %
First Class (ie.Acht. score $\geqslant$60%)	$P_{8.73}$	$P_{3.14}$	$P_{51.16}$	91.27 %	96.86 %	48.84 %
Second Class (ie.Ach. score $\geqslant$50%)	$P_{6.36}$	P_{o}	$P_{30.23}$	93.64 %	100 %	69.77 %
Pass class (ie.Ach. score $\geqslant$35%)	$P_{0.73}$	-	$P_{6.28}$	99.27 %	-	93.72 %
Failure (ie.Ach. score $<$35%)	-	-	-	0.73 %	00 %	6.28 %

second formative test of each unit at the final tryout are also better than the respective scores at the second formative test of the corresponding units at the initial tryout. More or less the same is true also for the first formative test scores of initial and final tryout. Not only this, for the summative test scores also, for the experimental group-A of initial tryout and final tryout, it can be seen from the table 4.2.1 (d) that there is an improvement in the achievement level of the pupils of final tryout than the pupils of the initial tryout. In fact, compared to initial tryout, in the final tryout an increase in mastery level achievers is by 8.70 percent, an increase in distinction level achievers is by 13.69 percent, an increase in first class level achievers is by 5.58 percent and an increase in second class level achievers is by 6.36 percent ; again while 6.36 percent of students achieve a score of less than 50 percent in the initial tryout, no one scores less than 50 percent in the final tryout. These positive changes in the formative as well as summative test results in the final tryout as compared to initial tryout may be interpreted as due to the impact of the refinement of mastery learning strategy at the final tryout in view of the better insight into the instructional process and also into the interplay of various variables of the mastery learning strategy obtained at the initial

tryout. Since to give remedials for each unit after the first test were also elements of the mastery learning strategy, it can be said that these elements did help to make the mastery learning strategy more effective.

Next, it may be observed from the table 4.2.1 (c) that in the experimental group-A at least 70 percent of pupils have achieved mastery level (minimum of 80 percent of marks) in the second test of every unit, that is, before going to the next unit. It may be noted here that it is also an element of the mastery learning strategy that before proceeding to the next unit it must be seen that a very big majority of pupils have achieved mastery in the current unit; and as such, but for the strong limitation of the time constraint the investigator would have preferred to raise this 70 percent to about 90 percent.

Let us now see the percentage scores of experimental group-A and the control group-B at the final tryout in the summative test. It can be said from the table 4.2.1 (c) that in the experimental group-A 68.63 percent of pupils have attained minimum of 80 percent of marks. This means at the final field tryout in the Baroda High School, 68.63 percent of pupils of experimental group-A have attained the desired mastery level in the fifth grade Geometry (observe the mastery level row in the table 4.2.1(c)). The rest 31.37 percent of pupils of this group,

eventhough have not achieved mastery, show the good achievement scores during the experiment. It can be seen from the same table 4.2.1(c) that out of these non achievers of mastery level, 21.37 percent of pupils have shown their scholastic achievement score between 68.50 percent and 80 percent and the rest 10 percent of pupils had scholastic achievement between 50 percent and 68.50 percent.

More precisely it can be seen that at the end of the final field tryout in The Baroda High School after the completion of three units of Geometry course, that is, after the completion of the whole Geometry course of the fifth standard 68.63 percent of pupils of group A have attained mastery level. Further, from the table 4.2.1 (d) it can be seen that out of the non-achievers of mastery level in the experimental group at this final tryout 19.61 percent of pupils have scored between 70 percent and 80 percent, another 8.62 percent of pupils have scored between 60 percent and 70 percent and the rest 3.14 percent of pupils have scored between 50 percent and 60 percent. It is important to note here that no student of the experimental group at the final tryout falls into the category of poor students group (assuming that those scoring below 50 percent of marks at the summative test are poor).

Compared to this, it can be said from the observation of tables 4.2.1 (c) and 4.2.1 (d)that only 11.63 percent of pupils have achieved mastery level (refer Appendix for raw and sorted data) in the control group-B which was taught by conventional method (mainly lecture method, prevailing everywhere even today!) by regular teacher. Also, only 18.60 percent of pupils have scored between 70 percent and 80 percent, another 18.61 percent of pupils have scored between 60 percent and 70 percent and yet another 20.93 percent of pupils have scored between 50 percent and 60 percent. This means a big lot of 30.23 percent of pupils fall into the category of poor students group scoring below 50 percent of marks. Thus, comparing spread out of percentile achievement scores of both the groups in the summative test based on the whole Geometry course it can be said that while 68.63 percent of pupils of experimental group-A have achieved mastery, just 11.63 percent of pupils of control group-B could achieve mastery; also, from among the non-achievers of mastery level, while only 3.14 percent of pupils of experimental group-A score below 60 percent, the figure for control group-B scoring below 60 percent is as high as 51.16 percent of pupils. Again, while 30.23 percent of pupils of control group B have shown the scholastic achievement score below 50 percent, the score of poor standard, in the experimental group-A no student falls into this category.

Thus, like initial tryout in the final tryout also, there is a vast difference between the achievement scores of the group-A and the group-B (in fact, some what more at the final tryout - as observed earlier). Since the two groups were matched groups on the variable intelligence but were taught by different teachers using different methods of teaching, this significant difference between the achievement level of the two groups can be interpreted as due to the use of developed mastery learning strategy implemented on group A. In otherwords, mastery learning strategy developed and used by the investigator during the experiment on group-A has worked well and showed better results as compared to conventional method used for teaching group B.

Considering the values of mean and standard deviations of achievement scores in different tests in different units of group-A (refer table 4.2.1 (c)) it can be noticed that the mean value has shown an increment in every second test of each unit which means that pupils' achievement score has increased in every second test. In fact, to be more precise, for unit-1 the mean value increased from 76.91 (in Test-1) to 90.83 (in Test-2) and the standard deviation decreased from 16.40 to 10.91. This implies that at the end of second test in unit 1 the homogenity has been increased and more pupils showed higher

achievement as compared to first test of unit-1. This may be interpreted as due to the remedials accommodated in the strategy after the first test of unit one.

Observing the mean and standard deviations of achievement scores of the first and second tests of unit-2 and unit-3 it is seen that eventhough for unit-2 the mean value has increased from 68.59 to 80.19 and for unit-3 it has increased from 77.16 to 87.45; the value of standard deviations show that the homogenity of the group is not maintained. However, it may be observed here that this could be due to few extreme values. (For example, for Test-2 of unit-2, 50 percent of students score above 90 percent which is good but mean being 80.19 due to another 10 percent scoring below 46.66 percent, the S.D.value is more; similarly for Test-2 of unit-3, 50 percent of students score 100 percent of marks but mean is 87.45 due to another 10 percent scoring below 60 percent again giving the S.D.value more). Even then, the investigator provided remedials for both these units after the respective second test was over. But as the time limit given by the school did not permit the investigator to conduct third test separately for unit 2 and unit 3, the investigator conducted one test on unit 2 and unit 3 combined. The mean value of scores for this formative test turns out to be 83.77 and the value of standard deviation is 14.09

- showing that homogenity is maintained and the mean value is above the mastery level of 80 percent.

Comparing now the values of mean and standard deviation of achievement scores at the summative test based on full Geometry course, it can be seen that mean value for experimental group-A is 82.09 which is above the mastery level of 80 percent, while the mean value for control group-B is as low as 58.95. Even for experimental group itself, this mean value of summative test scores at the final tryout is more than that at the initial tryout. Again, the value of standard deviation for the experimental group-A is 10.51 while for the control group B it is 15.77. This indicates that experimental group is more homogeneous than the control group. It may also be seen that the experimental group-A at this final tryout is more homogeneous than at the initial tryout.

Thus the values of mean and standard deviations of achievement scores of formative as well as summative tests indicate that the mastery learning strategy has worked very well and helps more students to achieve much higher level.

It may justifiably be concluded from the percentile analysis as well as from the analysis of the values of means and standard deviations, that as the two groups

were matched for variable intelligence the higher achievement of the experimental group over the control group in terms of number of achievers and individual achievements at the formative as well as summative stage is due to the strategy of mastery learning developed and implemented by the investigator is indeed very effective in increasing students' achievement level.

The t-value between the experimental and the control groups is also highly significant at .01 level in the initial as well as final tryouts as is seen from the tables 4.2.1(a) and 4.2.1(c).

4.2.2 Relation between intelligence and achievement:

Before conducting this experiment for developing the strategy of mastery learning in fifth grade Geometry, Intelligence test developed by Dr. G. B. Shah was conducted for the experimental and the control groups to measure the I.Q. of pupils of both the groups at the initial as well as final tryouts. Also, at the end of the experiment the same summative test was given to both the groups of the pupils at the initial and the final tryouts. Based on percentage scores of each pupil in this summative test and the I.Q. scores, the value of correlation coefficient for these variables was found out; both at the initial tryout as well as the final

tryout. To find the correlation coefficient 'r' the following formula was used:

$$r = \frac{\sum (XY) - N.M_x.M_y}{\sqrt{\sum X^2 - N.M_x^2}.\sqrt{\sum y^2 - N.M_y^2}}$$

In this formula X and Y are the obtained scores, M_x and M_y are the means of the X and Y series respectively and N is the number of the cases. $\sum X^2$ and $\sum Y^2$ are the sums of squared X and Y. Generally there is a fairly good agreement among the workers with psychological and educational tests regarding the different ranges of values of r and the corresponding interpretation as regards to the relation between the variables which is shown below.

range of values of r	corresponding interpretation
0.00 to $\pm$ 0.20	Indifferent or negligible relationship
$\pm$ 0.20 to $\pm$ 0.40	Low correlation or slight relationship
$\pm$ 0.40 to $\pm$ 0.70	Substantial or marked relationship
$\pm$ 0.70 to $\pm$ 1.00	High or very high relationship

Several research attempts are made to correlate achievement of a learner - through instructional systems for teaching various subjects like Mathematics, English etc. - and learner's characteristics like intelligence,

risk taking behaviour etc. Some of the researches indicate positive and significant relation between the achievement of a learner and the learner's intelligence, while in some researches it is found that there is no significant positive correlation between the achievement and intelligence. This has already been discussed in article 1.5 of chapter II.

In the present study the investigator gets the value of r for the experimental and the control groups of both the tryouts as shown in the following table 4.2.2(a).

Table 4.2.2 (a) : Values of r for different groups at different tryouts.

Tryout	Value of correlation r	
	Experimental group-A	Control group-B
Initial	0.634	0.805
Final	0.446	0.620

The table clearly tells that at the initial tryout the achievement of the control group B is positively and highly related with intelligence while for the experimental group-A eventhough the relationship is positive, it is substantial and not high. This implies that this minimization of the relationship between the achievement of pupils and their intelligence could be due to the effectiveness of the strategy for mastery learning. However, in view

of the fact that even with this minimization there is still substantial relationship between the achievement and the intelligence; the investigator felt the need for the refinement of the mastery learning strategy. This was done and its effect can be seen at the final tryout. The value of r at the final tryout for the experiment group-A is significantly reduced to 0.446 - very nearer to 0.40. The value of r for the control group B at this final tryout is as high as 0.620. Thus, it can be seen that though the scholastic achievement of both the groups are positively and substantially related to the variable intelligence, the dependence of the achievement on the intelligence is much more in the case of the control group than in the case of the experimental group. This is clear because though r = .446 and r = .620 both lie in the range 0.40 to 0.70, the value .446 of r for experimental group is very near to lower limit of the range while the value .620 of r for the control group B is very near to the upper limit of the range.

Thus it can be seen that the strategy used during the experiment could considerably reduce the influence of the variable intelligence on the scholastic achievement, eventhough not to much greater extent. The binding of time limit might be the main reason for this less minimization of the effect of individual differences of the

intelligence on the achievement. Inspite of the time limitation, on the whole it may be concerned that intelligence does intervene in the process of mastery learning eventhough the strategy for mastery learning could minimize the influence of intelligence on the scholastic achievement to some extent.

4.2.3 Graphical interpretation of the data obtained in the form of scholastic achievement scores:

From the scores of summative test in the initial and final tryouts following tables are formulated showing the frequencies of pupils in different intervals of achievement scores. Based on this, graphs of histogram and frequency polygon are plotted which clearly shows that developed strategy for mastery learning has greater effect on scholastic achievements of the pupils than that of conventional method.

A. Analysis based on Histograms:

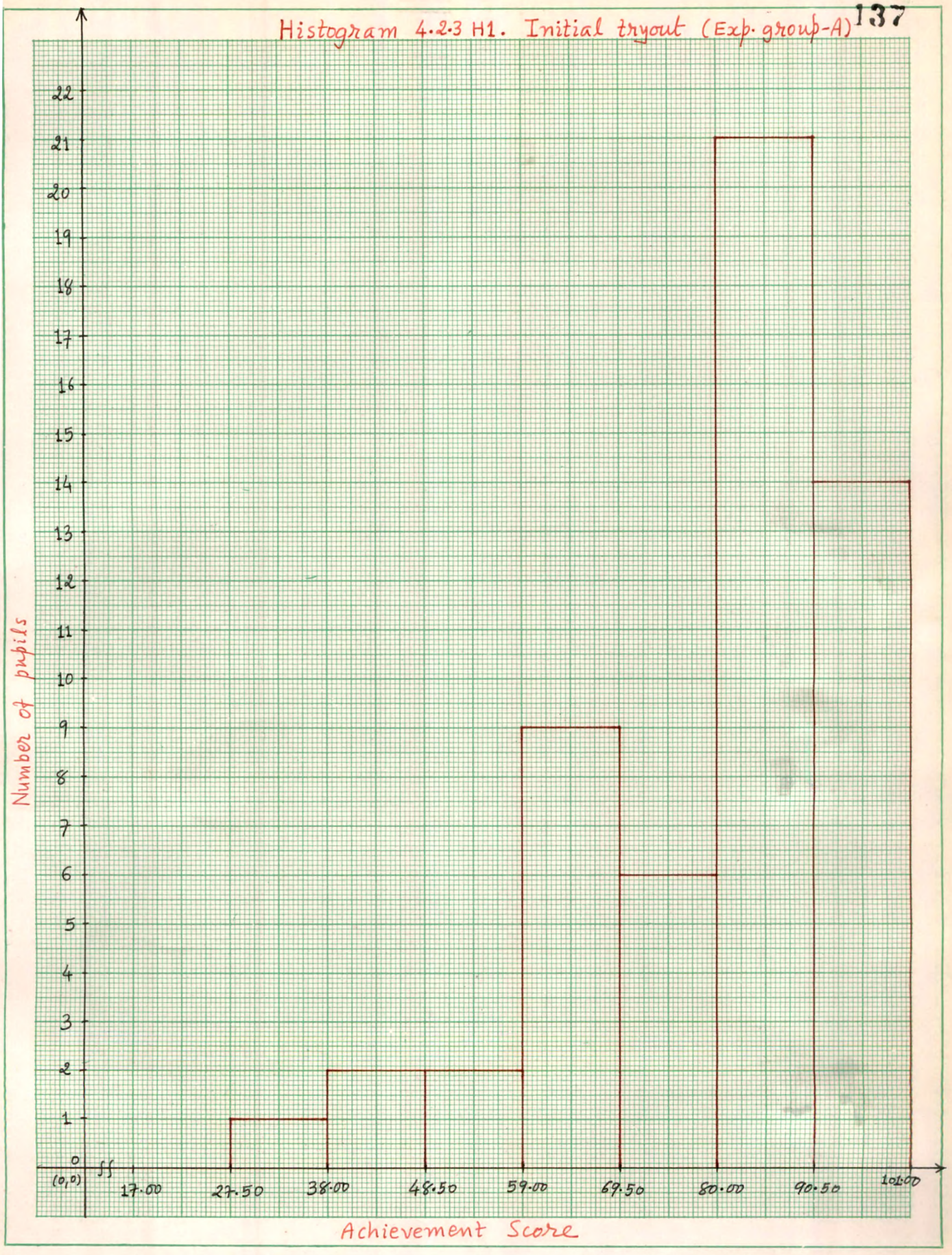
Table 4.2.3 (a): Frequency distribution of pupils of the experimental and the control groups in the initial tryout.

Class intervals of Achievement Scores in the summative test	Frequency of pupils	
	Experimental group-A	Control group-B
90.50 - 100	14	0
80.00 - 89.50	21	0
69.50 - 79.00	6	5
59.00 - 68.50	9	13
48.50 - 58.00	2	11
38.00 - 47.50	2	18
27.50 - 37.00	1	8

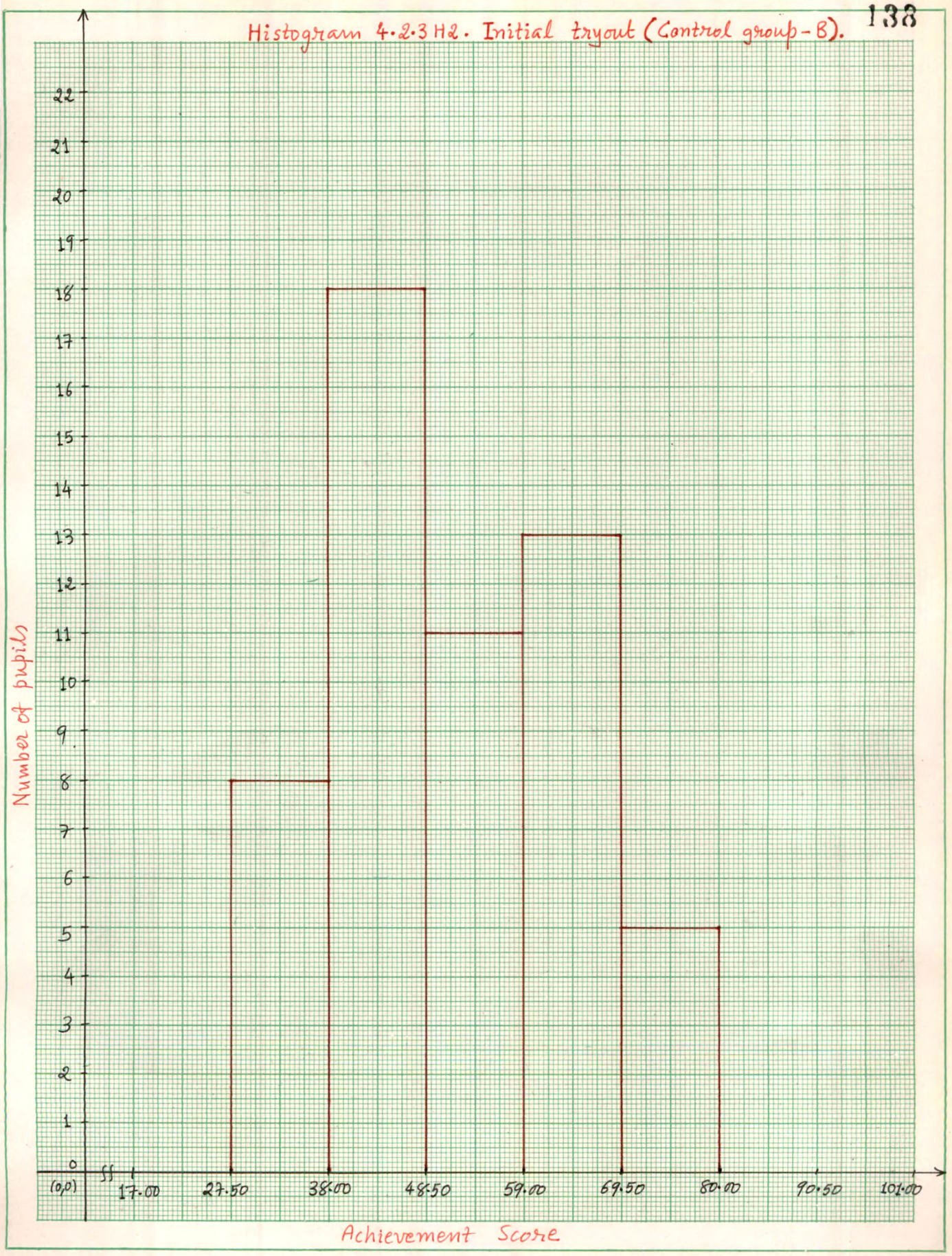
A.1 Initial tryout:

The histograms 4.2.3 H1 and 4.2.3 H2 for the experimental and the control groups at the initial tryout show the graphic form of 'distribution of scholastic achievement of these groups at the summative test in the initial tryout. It is evident from these histograms that the pupils of the experimental group are highly piled up at the High end of the scale while the pupils of the control group are almost distributed symmetrically around the mean.

Histogram 4.2.3 H1. Initial tryout (Exp. group-A)



Histogram 4·2·3 H2. Initial tryout (Control group-B).



It can be seen that large number of pupils of experimental group-A score atleast 80 percent of marks in the summative test while in the control group-B a few individuals score moderately high (but less than 80 percent), few quite low and the vast majority falling somewhere near the middle of the scale. In fact, no pupil of group B could achieve mastery level of 80 percent in the summative test while for group A 14 pupils have achieved above 90 percent and another 21 pupils have achieved between 80 percent and 90 percent implying that almost two third of the pupils could achieve mastery over the Geometry course. Again, only 5 pupils score below 58.50 percent of marks in the experimental group-A, while for the control group B the figure is as high as 37 pupils. A glance as a whole on both the histograms makes it clear that while most pupils of the experimental group-A fall to the right side (higher achievement side) of middle class interval (i.e. the interval 59.00 - 68.50), for the control group-B most students fall to the left side (lower achievement side) of it.

The two groups were matched groups and the summative test given to both the groups was the same; but while the experimental group-A was taught by the investigator using developed strategy of mastery learning, the control group B was taught by a school

teacher using conventional method. Therefore this large difference in the scholastic achievement of the two groups, observed from the histograms above, can be interpreted as the positive effect of the mastery learning strategy developed and adopted by the investigator.

A.2 Final tryout:

Table 4.2.3 (b): Frequency distribution of pupils of the experimental and the control groups in the final tryout.

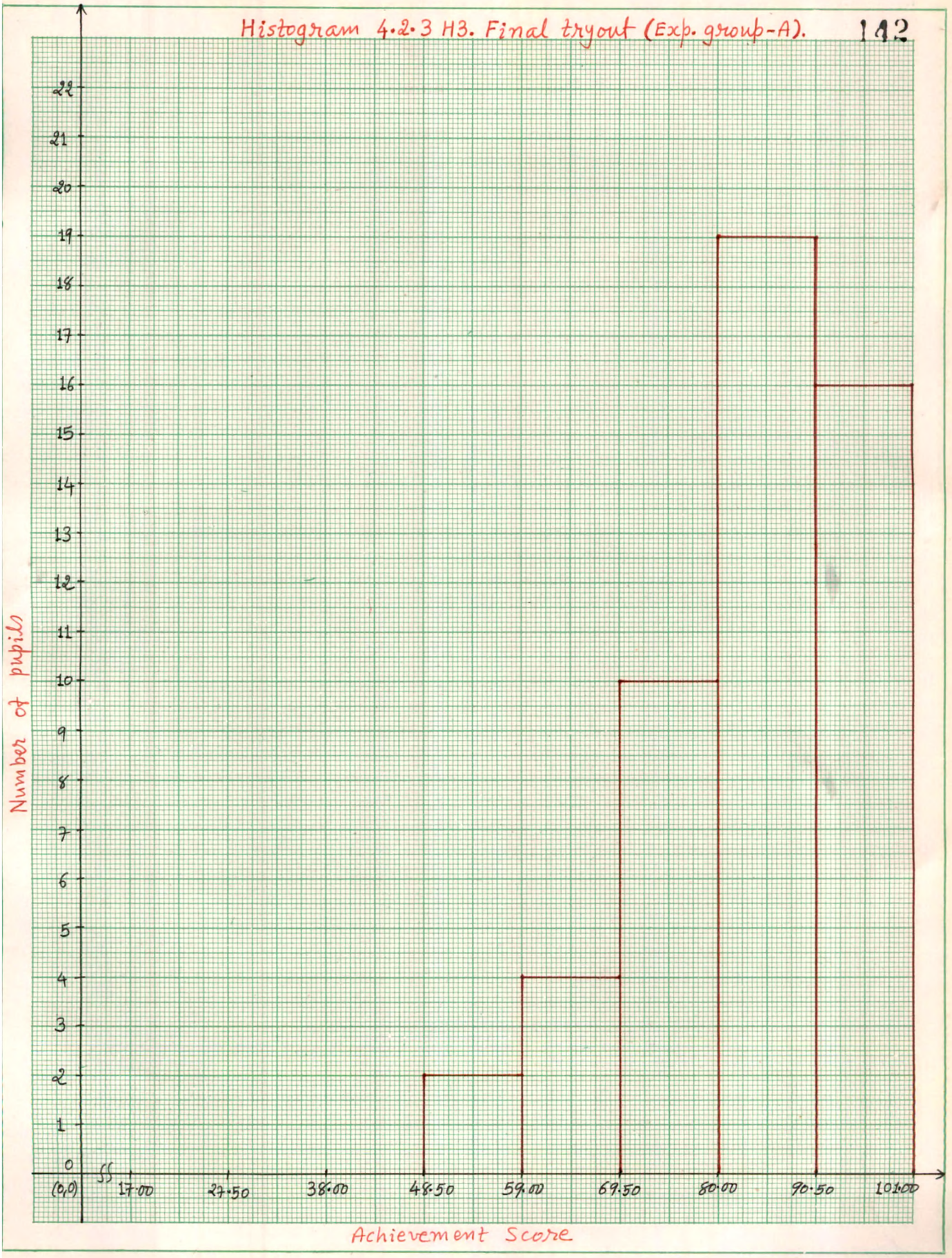
Class intervals of Achievement Scores in the summative test	Frequency of pupils			
	Experimental group-A		Control group B	
	in number out of 51	in percentage	in number out of 43	in percentage
90.50 - 100	16	31.37	0	0
80.00 - 89.50	19	37.26	5	11.63
69.50 - 79.00	10	19.61	8	18.60
59.00 - 68.50	4	7.84	8	18.60
48.50 - 58.00	2	3.92	12	27.91
38.00 - 47.50	0	0	6	13.95
27.50 - 37.00	0	0	3	6.98
17.00 - 26.50	0	0	1	2.33

As the experimental and the control groups differ in size (Total number of pupils in the experimental group-A is, 51 and in the control group-B it is 43) the distribution of pupils of both the groups is expressed in terms of percentage of frequencies of pupils; so that the frequencies can be directly compared from interval to interval. However for drawing Histograms we use frequencies of pupils in number and while drawing frequency polygons we use frequencies of pupils in percentage.

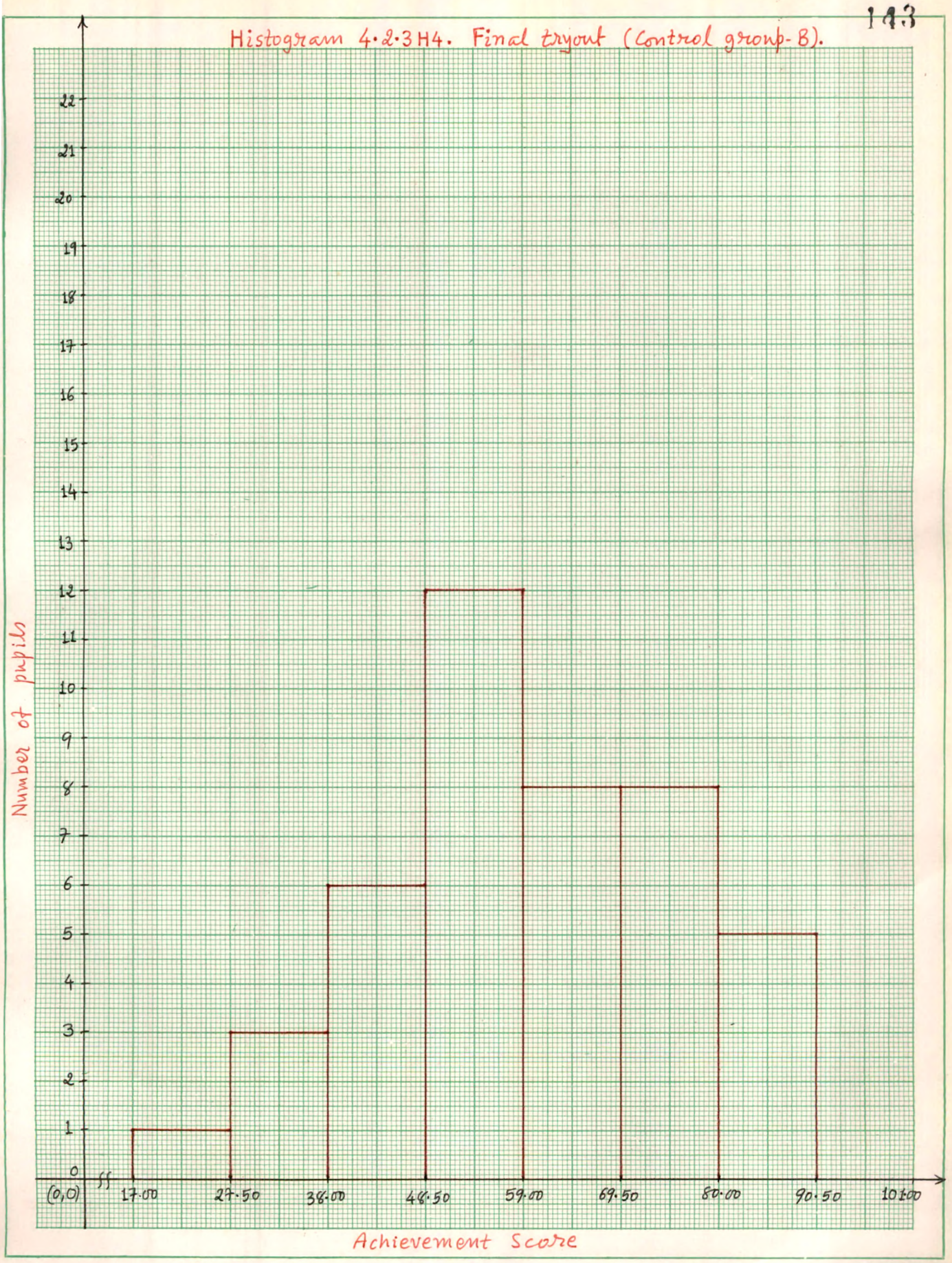
The histograms 4.2.3 H3 and 4.2.3 H4 for the experimental and the control groups at the final tryout show the graphic form of distribution of scholastic achievement of these groups at the summative test in the final tryout. As in the case of initial tryout, it is evident once again from these histograms that the pupils of the experimental group are highly piled up at the high end of the scale while those of the control group are almost distributed symmetrically around the mean. In fact a careful observation will show that the performance of the experimental group at the final tryout is better than at the initial tryout.

It can be seen from the histograms that more than two third (68.63 ,percent) of the students of the experimental group-A score at least 80 percent of marks

Histogram 4.2.3 H3. Final tryout (Exp. group-A).



Histogram 4·2·3 H4. Final tryout (Control group-B).



while in the control group just about one ninth (11.63 percent) of students achieve this level. And while as many as 45 out of 51 students score more than or equal to 69 percent of marks in the experimental group-A, the figure for the control group is just 13 out of 43. Again while just 2 out of 51 students score below 58.50 percent of marks in the experimental group-A, the figure of such performance for the control group-B is as high as 22 out of 43. The histograms clearly show that while most of the pupils of the experimental group-A fall to the right (i.e. higher achievement side) of the middle part of the class intervals, for the control group most students fall to the left (i.e. lower achievement side) of this middle part.

As the summative test given to both these matched groups was same but the methods by which they were taught were quite different, it could be said that this large difference in the scholastic achievement could be due to the impact of methods used for teaching these groups. The experimental group was taught by the investigator using developed strategy for mastery learning in fifth grade geometry while the control group was taught by a school teacher using conventional method. Thus histo-grams too show that mastery learning strategy worked very well.

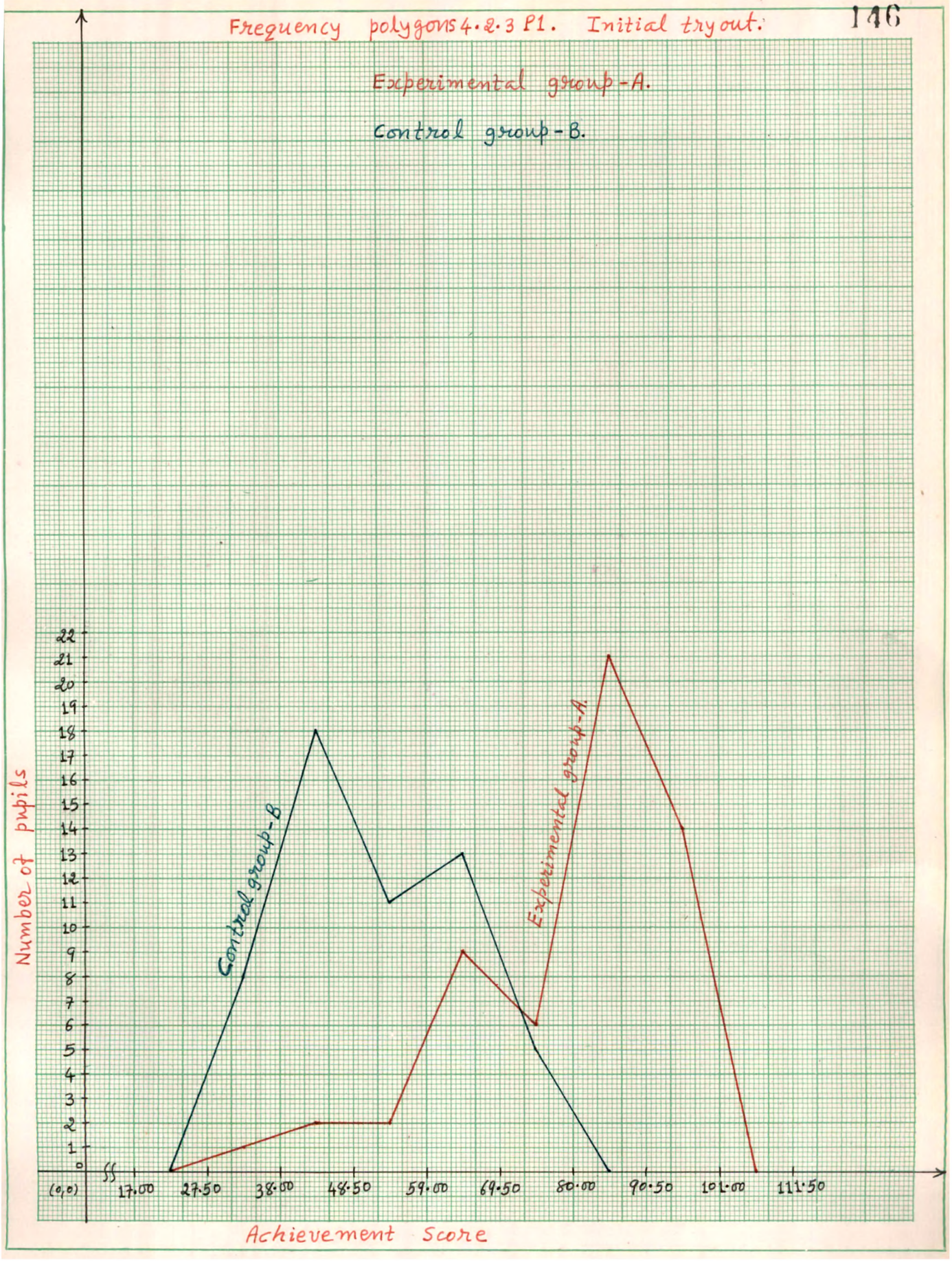
B. Analysis based on frequency polygons:

B.1 Initial tryout:

At the initial tryout both the groups are of the same size and hence frequency polygons 4.2.3 P1 are drawn based on the table 4.2.3 (a) representing the distribution of pupils of both the graphs in terms of frequencies in different classes of achievement scores. The frequency polygons are drawn on the same frame of reference so that relative achievement of the two groups can immediately be compared.

It can be seen from the frequency polygons 4.2.3 P1 that ,for the control group the frequency polygon resembles the normal distribution curve with low peak, while for the experimental group it is a high peaked polygon with high peak at the higher achievement score side. Clearly the mean score for control group is much lower than that of experimental group. Important to notice is that while for the control group the major part of the area under curve lies upto the score of about 64 percent, for the experimental group the much larger part of the area under the curve lies beyond this score of about 64 percent. In otherwords, only few score high percentage of marks for the control group, while for the experimental group only few score low percentage of marks.

Frequency polygons 4·2·3 P1. Initial tryout.



In fact, area under the curve for control group beyond the score of 80 percent of marks is very negligible implying that almost no one scores beyond 80 percent of marks in the control group, while for the experimental group such area is seen to be more than 60 percent of total area implying that more than 60 percent of students of experimental group score beyond 80 percent of marks.

The frequency polygons thus give a very good intuitive picture of the difference between the achievement levels of the two groups. Since the two groups were matched and were given the same summative test, this difference in scholastic achievement levels between the two groups can be interpreted as due to the different methods used for teaching the two groups. As the experimental group was taught by the investigator using developed mastery learning strategies while the control group was taught by another school teacher using conventional method, it may be concluded that the developed mastery learning strategy is superior and effective as compared to the conventional method.

8.2 Final tryout:

As the experimental and the control groups differ in size at the final tryout, as mentioned earlier the distribution of pupils of both the groups is

expressed in terms of percentage frequencies (Refer table 4.2.3 (b)). Therefore the frequencies can directly be compared from interval to interval and the frequency polygons representing the distribution of pupils of these two groups can be plotted on the same frame of reference. The frequency polygons 4.2.3 P2 based on the table 4.2.3(b) represent these distribution of pupils in terms of percentage frequencies. These polygons provide an immediate comparision of relative achievement of the experimental and the control groups, which can not be given by frequency polygons plotted from original frequencies.

It can easily be seen from these frequency polygons 4.2.3 P2 that the frequency polygon of the experimental group-A does not fit into the graph of a normal distribution curve of scholastic achievement; in fact, it is very nearer to the graph of a high peaked left skewed curve of scholastic achievement, if smoothened. Both the points are important to notice: it is high peaked and left skewed. Noticing that achievement scores are along x-axis and they increase as we move from left to right, the left skewness means concentration of students is more towards the high achievement score side. In fact, it can clearly be seen here that area under the curve upto the score of 59 percent is almost negligible and upto the score of 69.5 percent is very small, implying

Frequency Polygons 4·2·3 P2. Final tryout.

Experimental group - A.

Control group - B.

that most of the pupils score above 69.5 percent. Again noticing that y-axis represents percentage frequencies of distribution of pupils and it increases as we go further up, the high peak at the score of about 85 percent implies that a big lot of pupils have scored 85 percent marks, also it shows that the mean achievement score is also very high.

As compared to this, a look at the frequency polygon of the control group-B show that it fits very much into the graph of a normal probability curve with low peak, if smoothened. Also, the peak is located at the score of about 52 percent only. It clearly shows that the mean achievement score is very low, area under the curve beyond the score of 80 percent is very small and also the area under the curve upto the score of 38 percent is also very small. This means most students fall between 38 percent and 80 percent. A close look will further make it clear that almost half the area under the curve is covered upto the score of 50 percent.

Thus, the frequency polygons depict an intuitively very clear picture of the significantly large difference between the achievement levels of the two groups - in regard to the number of high level score achievers as well as the level of high score itself; as also the mean achievement score. As both the groups were matched

and were given the same summative test, the larger difference in the scholastic achievement levels between the two groups, as seen from the frequency polygons, imply the impact of different methods used for teaching both the groups. The experimental group was taught by the investigator using mastery learning strategy and the control group was taught by other teacher of the same school using conventional method. Hence the higher achievement of pupils of experimental group indicates the effectiveness and superiority of developed mastery learning strategy over the conventional method.

B.3 Experimental groups of the initial and final tryouts:

Since the size of the experimental groups at the initial and the final tryouts differ, as in the case of final tryout here too the distribution of pupils of both the groups is expressed in terms of percentage frequencies in the following table 4.2.3 (c).

Table 4.2.3 (c): Frequency distribution of pupils of the experimental groups in the initial and the final tryouts.

Class intervals of Achievement Scores in the summative test	Percentage frequency of pupils	
	Initial tryout	Final tryout
90.50 - 100	25.45	31.37
80.00 - 89.50	38.18	37.26
69.50 - 79.00	10.91	19.61
59.00 - 68.50	16.36	7.84
48.50 - 58.00	3.64	3.92
38.00 - 47.50	3.64	0.0
27.50 - 37.00	1.82	0.0

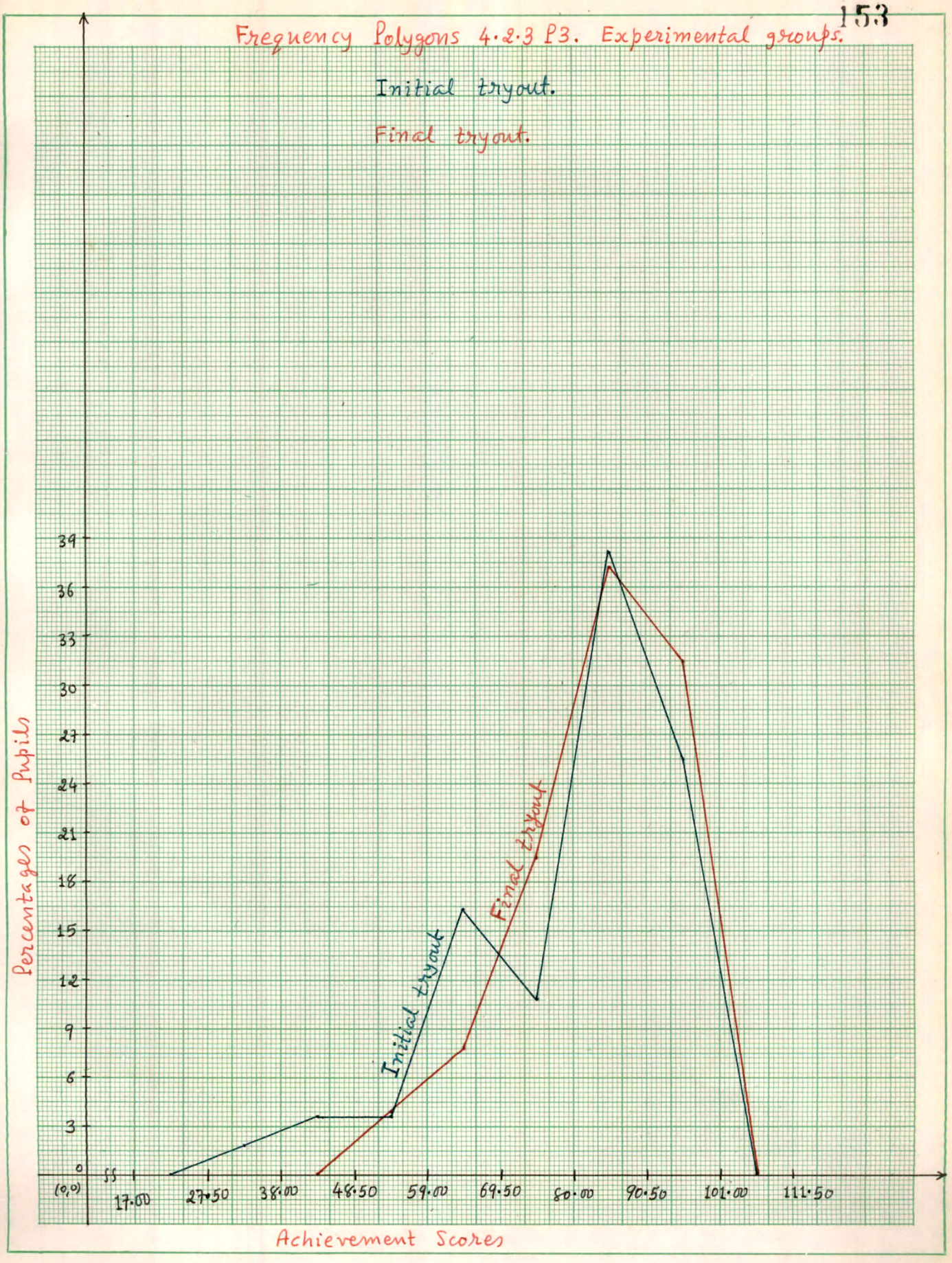
The frequency polygons 4.2.3 P3 representing the percentage frequencies of the pupils of the experimental groups at the initial and the final tryouts are drawn on the same frame of reference based on the above table 4.2.3 (c). This provides an immediate comparision in a very clear and intuitive way of relative achievement of pupils of the experimental group at the initial and the final tryouts.

Three points are clear from the observation of these frequency polygons. First, it can be seen that in the initial tryout a few pupils of the experimental

Freqeuncy Polygons 4·2·3 P3. Experimental groups.

Initial tryout.

Final tryout.



group do have lower scholastic achievement score, as can be seen from the area under the curve for the initial tryout upto the score of 50 percent or so, while in the final tryout lower scores in the experimental group are almost eliminated as can be seen from the similar area covered under the curve for final tryout. Second, the left skewness of the curve in the initial tryout is affected by a small left peak caused by an abrupt decrease in the percentage frequency of pupils in the class interval 69.50 - 79.00 of achievement score, while this does not happen in the final tryout. This shows that in the final tryout concentration of pupils in a certain medium achievement score interval was successfully eliminated. One can see comparing the area under both the curves upto the score of 69.5 percent or 75 percent of marks that such smaller peaks in the graph on the low or medium achievement score side imply that the curve is not left skew as desired and that means that area under the curve in the class interval corresponding to the peak is more implying the concentration of bulk of students in that class interval of achievement score; in the final tryout the graph has no such peaks implying no concentration of pupils in a particular medium or low achievement score class interval. Third, it can be seen that in the final tryout the area under the curve beyond the score of 75 percent or 80 percent of marks is more as compared to

to the similar area under the curve for initial tryout; this shows that the number of pupils scoring high percentages of marks as well as their scores themselves are more in the final tryout as compared to the initial tryout.

This better outcome at the final tryout as compared to the initial tryout may be interpreted as due to the impact of the refinement of the mastery learning strategy at the final tryout in view of the better insight into the instructional process and also into the interplay of various variables of the mastery learning strategy obtained at the initial tryout. The refined mastery learning strategy thus turns out to be quite effective in increasing students' achievement level.

4.3 Validation of the strategy based on the questionnaire given to the pupils of the experimental group-A in the final tryout:

After the completion of the experiment, a questionnaire was given to each pupil of the experimental group-A of the final tryout (refer appendix for the questionnaire). The objective of giving the questionnaire was to know the extent to which the pupils appreciated the strategy as a whole and the components of strategy such as the game, the discussions, the model preparations;

as well as to know the effect of certain outside factors such as private tuitions, parents' or friends' help etc. on the achievement of pupils.

In the questionnaire no direct questions such as 'Do you like the way in which Geometry was taught to you?' were included thinking that there may be more chances for getting an affirmative answer to such questions as the investigator and the pupils taught by the investigator had developed nearness and liking for each other during the experiment. Such extremely good raport may tempt the pupils to give favourable answers to such direct questions to please the investigator which may not help much in further analysis. Therefore the investigator has tried to gather more information for the developed strategy by asking indirect questions in the questionnaire so that the pupils may not become aware of what exactly the investigator had in mind.

Also, the questionnaire was given to the pupils without informing them about it in advance and the duly responded questionnairs were collected in the same period.

The following table 4.3.1 shows the percentages of students responding favourably to different querries in the questionnaire.

Table 4.3.1: Percentages of students responding favourably to different querries of the questionnaire.

favourable responses / Querries	Percentages of students
Going for private tuitions	23.81
Doing home work mostly alone	66.67
Liking all the concepts and chapters of Geometry course	73.81
Equally liking all the three components:the game, the discussion and the models preparation	28.57
Liking the preparation of models most	57.14
Liking the discussion most	28.57
Liking the game most	42.86

It can be seen from the table that only 23.81 percent of pupils of group-A were going for private mathematics tuitions; and just 36 percent of these pupils going for tuitions could achieve mastery. On the other hand, out of the rest 77.19 percent of pupils of this group-A who were not going for any private mathematics tuitions, as many as 72 percent of pupils have achieved the mastery. Further, it is

seen that 66.67 percent of the pupils of the group-A did their home work alone and out of them as many as 71.43 percent have achieved the mastery; while from the rest 33.33 percent of students taking others' help for doing homework about 57 percent of them could achieve mastery.

These results show that the outside factor of private tuitions had the least effect on the scholastic achievement scores of the pupils in Geometry. Similarly, the influence of the outside help from parents, teacher, brother, sister, friends etc. is also very less on the achievement scores of the pupils. This means the developed strategy for the mastery learning worked well and had much greater impact on the achievement of pupils in Geometry as compared to the outside factors like private tuitions, other persons' help in doing homework etc.

The table reveals that 73.81 percent of pupils liked all the concepts and chapters of the Geometry. This means the developed strategy for the mastery learning could induce - in as many as 73.81 percentages of pupils the liking for the whole of the Geometry course. This is indeed very significant because normally every student does get some dislike for one or the other concept or portion of the course in Geometry. From among the rest 26.19 percent of pupils, some didn't like types of angles,

some didn't like parallel lines etc. It is found that in these cases, the pupils didn't achieve mastery in the respective units the content of which they didn't like.

As for the three components of the mastery learning, namely the models preparation,the discussions and the game, it can be seen from the data given in the table that 28.57 percent of pupils liked all the three of them most; 57.14 percent of pupils liked preparing geometrical models most, 28.57 percent of pupils liked the discussions most and 42.86 percent of pupils liked the game most. This means the component of preparing the Geometrical models was liked the most by majority of the pupils. Discussion is the component liked by very few pupils. This means learning by doing or learning by task performance activity is very much appreciated by the pupils. Also, the fact that 42.86 percent of pupils liked the game component most implies that the investigator has quite successfully developed an innovative game as an effective component of the mastery learning strategy for the Fifth Grade Geometry. Such innovative and interesting games seem to be appreciated by the large number of pupils.

It may be concluded that for the effective teaching of geometry for this age group of pupils (age group 10 to 11), activities such as learning by doing,

interesting games,etc. must be included as components of mastery learning strategy as they could be more fruitful.

4.4 Analysis of lower achievers:

In the final tryout all the pupils of the experimental group-A achieved a score of 65 percent of marks or more in the summative criterion test of geometry course except two pupils. One of these two scored 53.33 percent of marks and the other scored 50 percent of marks. To know the reasons for their lower achievement, the investigator studied these two cases.

In the case of the lower achiever who scored 50 percent of marks, it was found that the pupil was very talkative and mischieveous. He used to harass other pupils by sheding ink on their uniform or by snatching their books and pens from them. The investigator also found that there were many mistakes in his class notes, in his homework and the work book. The pupil was instructed by the class teacher to sit on the last bench. The investigator, in the process of knowing why he made so many mistakes in the class work, surprisingly found that the pupil could not read properly the writtings on the blackboard due to some eye-sight problem. The investigator then changed his sitting arrangement and

suggested him to get his eye sight checked with the eye-specialist.

The second boy who scored 53.33 percent of marks was a very shy type boy. He used to sit on front benches but always with his thumb in his mouth. It was found that he had a feeling of insecurity and a lack of confidence. Eventhough the investigator made several efforts to improve the scholastic achievement of this pupil, the result was not fruitful because the boy never seemed to felt secured in the school.

From these case studies it may be concluded that the physical handicap, mischieveous behaviour, feeling of a sense of insecurity, home environment and factors like that also affect indirectly the scholastic achievement of pupils. In some cases, as studied above during the present experiment, the teacher needs the help of parents, psychiatrist and other teachers as well for improving their scholastic achievement level. In an experiment like this, the investigator generally faces limitations of time and other things.

4.5 Discussion and Conclusions:

The hypothesis proposed in this study is "The strategy for mastery learning will be effective in

leading most of the pupils to the mastery level". Here most of the pupils means at least 75 percent of pupils and the mastery level means the achievement level of at least 80 percent of marks. This means at least 75 percent of pupils must achieve at least 80 percent of marks in the fifth grade Geometry course. Since this has not happened, the hypothesis is not fully acceptable. But at the same time one can not reject the hypothesis because 68.63 percent of pupils did achieve the mastery level in the Geometry course. The students under the experiment were taught by the mastery learning strategy developed by the investigator for the fifth-grade Geometry course. So, the hypothesis is partially retained. The investigator strongly feels that the time constraint is the main factor due to which the target of almost all or most of the pupils attaining the mastery level is not achieved. In fact, the investigator was allotted only five weeks by the schools to teach the whole Geometry course which comprises about one third of the total syllabus of mathematics in the fifth grade! The investigator was indeed surprised to observe that in most of the schools the time allotted for teaching Geometry in the fifth grade is just four to five weeks which is infact too little. However, since the same time limit was given also to the regular teachers of the school to teach the

control group, the investigator found it rather more interesting to carry on this study and worth utilising the same time limit during the experiment; so that the results of the study can be compared with those of the control group and also, whenever needed, the same developed strategy can be applied in the practical and realistic situations prevailing in this part of the country.

As regards to the outcome and significance of this study it will be worth mentioning here that even in the highly developed countries like U.S.A., Korea etc. where the schools are well equipped and sufficient time is allotted to different topics, the studies regarding the mastery learning reveal that the percentages of students achieving the mastery level (that is, usually 80 percent or 85 percent of marks in summative criterion test) varies between 72 percent to 85 percent. This can be seen from many annotated bibliography of mastery learning research in the book by, James H. Block entitled 'Mastery learning: Theory and practice'. As compared to this, ours are under equipped schools and as mentioned above the proportional time allotted to Geometry course is very little; even then 68.63 percent of pupils could achieve mastery in this study. The investigator is confident that had there been an allocation of fairly proportional time for the Geometry course, the percentages

of students attaining the mastery could have been well over 75 or 80. This confidence comes from the fact that in this study itself 88.24 percent of pupils have scored minimum of 70 percent of marks in the summative criterion test and the fact that except for the two pupils mentioned in the article 4.4 all the pupils of the experimental group of the final tryout have scored minimum of 65 percent of marks (refer appendix).

Apart from this net outcome of the experiment in terms of percentages of students achieving mastery level, certain other intuitive subtle observations made by the investigator during the experiment are worth mentioning as they are of ultimate inherent interest. The investigator observed that since the three learning units comprising whole of the fifth-grade Geometry course were arranged sequentially, the mastery in the earlier unit facilitated the learning of the subsequent units; and hence the time spent over later units to ensure that most students achieve mastery was less than the time spent over the first unit for the same purpose. The investigator strongly feels that if these pupils of the experimental group were to be taught the subsequent Geometry course in the following year again using the mastery learning strategy then the time that may be needed may be less than usual. This means the mastery learning strategy helps in increasing the learning rate of the pupils.

Next, the investigator could see that not only all the smart and intelligent students developed greater self-confidence and greater liking for Geometry, but some of the students suffering from inferiority complex and having a feeling of defeatism and passivism were made very active by the component of model preparations and the subsequent encouragement by the investigator. In fact, they developed so much interest that during the game session they were always eager to take part by asking questions and answering questions. The investigator distinctly remembers two such cases wherein though in the summative criterion test they could not achieve mastery one of them scored about 65 percent of marks while the other scored 75 percent of marks.

Also, the investigator could see that since the mastery learning strategy provides room for the personalized attention to each student's learning problems, it adds a personal-social aspect to the learning not typical of the group-based instruction, and hence, not only that the problem of descipline in the class rarely arises but the mischieveous pupils later on start learning the subject seriously and develop a special liking for the teacher. The investigator makes this observation keeping in mind the student whose case is discussed in article 4.4.

The investigator would like to mention without fail yet another point. On the first day of the experiment the investigator had informed the pupils of the experimental group about the objectives of the experiment and had told them that almost all of them will be able to score very high percentages of marks in the Geometry after the experiment is over. The pupils who then seemed surprised and very curious, gradually went on getting so much actively involved in the learning process during the experiment that, at the time of departing at the end of the experiment, all of them felt very sad and wished very much the investigator to continue the teaching. Not only this, but the highly increasing involvement of the pupils in the learning process created such a situation that at the time of conducting the summative test for the control group, the investigator had to take the teacher of the control group again into confidence by telling the fact that it is the strategy of teaching and not the teacher that is going to be compared. Also, out of curiosity to know the change, if any, in the performance in other subjects of some students of the experimental group, when the investigator informally inquired with some teachers of the other subjects, they informed the investigator that the concerned pupils seemed to be working more later on. The investigator strongly feels, in view of these observations, that the mastery learning must have

made some pupils to realize their potential because to their own surprise they could score very high marks in geometry; which in turn might have made them to work hard in other subjects also. In view of these same observations, the investigator also feels that the mastery learning does increase the desire and ,ability of many pupils to work consistently and continuously in the task on hand.

In view of the fact that the mastery learning strategy included many components as mentioned earlier, the investigator experienced that it offered vide varieties of modes and methods of learning including the feedback/ correction procedures; and hence almost all students were assured of a method of learning, a mode of learning according to their aptitudes. Thus, the strategy increases the quality of teaching on the part of a teacher and the ability to learn on the part of a student. However, the frequency of the feedback/correction procedure. in the form of formative tests was just two in each unit, which, the investigator feels, is not sufficient. But as the time allotted to the investigator for the experiment was less, this was unavoidable.

Thus, looking to the analysis and interpretations as discussed in the articles 4.2, 4.3 and 4.4 and the general discussion as in the above paragraphs, it can be said that the mastery learning strategy developed by the

investigator has a greater impact on the scholastic achievements of pupils and is proved to be superior as compared to the conventional method for teaching Geometry course in fifth-grade.

It is also seen in the article 4.2.2 that the developed strategy did help to reduce the dependence of the achievement of pupils on their I.Q.s; in fact, there are several cases wherein pupils with low I.Q. were also able to score high percentages of marks in geometry as were scored by those having higher I.Q.s.

The graphical representation and interpretation also supports the same. It is clearly seen that the experimental group differs to greater extent in scholastic achievements from the control group. In fact the achievement distribution curves for the experimental group are quite different from the normal distribution curve, while for the control groups they are very nearer to the normal distribution curve. As the experimental and the control groups were matched, this greater difference in their achievements implies the superiority of developed strategy over the conventional method.

From the analysis of the responses to the questionnaire given at the end of the experiment it is seen that the pupils liked various components of the

strategy and welcomed the developed strategy as a whole for teaching geometry. During the experiment, the component of model preparation was liked the most by the pupils. In fact, they enjoyed to learn Geometrical concepts by the method - 'learning by doing'. The pupils also enjoyed the mathematical game developed by the investigator as there was scope for healthy competition. However, very few pupils liked the component of discussion. The investigator feels that the components involving 'learning by doing' and like 'mathematical games' should be used more frequently by the teacher to get more output in terms of scholastic achievement of pupils.

Article 4.3 reveals that majority of the few pupils going to private tuitions do not attain the mastery; while on the other hand, majority of pupils not going for any private tuitions attain the mastery in the Geometry course in the experimental group. Also, a big majority of pupils in the experimental group do not take anyone's help in doing their home-work; even then majority of them achieve high scores in different tests and attain mastery level in Geometry course. In otherwords, the outside factors such as personal tuitions or some one's help in doing home-work have the least effect on the achievement scores of the pupils in the experimental group. The investigator can say from this

that higher achievement of the pupils of the experimental group is due to the effectiveness of the developed strategy.

The investigator found during the experiment that two pupils were not showing good performance compared to others of the experimental group inspite of the investigator's special care taken for them; though of course finally they could secure 50 and 53.33 percentages of marks. However, since the mastery learning strategy provides a room for the analysis of such cases, the investigator found out that one of them had a psychological problem while the other had an eye-sight problem as well as psychological problem. The investigator felt while handling these cases that the efforts made merely by the teacher are not sufficient in such cases to achieve the mastery; in fact, in such special cases, the efforts on the part of the parents of the pupils, other family members and the other teachers as well are very much necessary to remove such pupils' complexes and to develop confidence in them.

From the overall discussion the following conclusions can be made.

1. The proposed hypothesis, namely "The strategy for mastery learning will be effective in leading most

pupils to the mastery level", is not fully acceptable but certainly it is partially retained. The time constraint is the main factor for this.

2. 68.63 percent of the pupils achieved mastery, 88.24 percent of pupils scored minimum of 70 percent of marks and all but two pupils scored minimum of 65 percent of marks. This performance is much better as compared to that of the control group. Since the two groups were matched, the strategy for the mastery learning must have influenced the better performance.

3. The values of the mean and the standard deviation for the experimental group show that the experimental group is more homogeneous and has much better mean achievement score.

4. The achievement distribution curve for the control group is much nearer to the normal distribution curve, while that for the experimental group is left skew and high peaked towards the higher achievement side. Thus the interpretation of the graphical representation of the achievement scores also proves that the developed strategy worked well.

5. The t-value obtained between the two groups is highly significant at .05 as well as at .01 level, indicating the greater influence of the developed strategy on pupils' achievement.

6. The values of corelation coefficient show that the dependence of the achievements of pupils on their I.Q.s can be reduced considerably by using the developed strategy.

7. The analysis of the responses to the questionnaire show that the outside factors like private tuitions and other person's help in homework have the least bearing on pupils' achievement - indicating greater influence of the developed strategy.

8. The analysis of the responses to the questionnaire also show that a big majority of pupils like to learn by doing and to learn through fun. This follows from the fact that they liked the models preparation and the game component very much.

9. The strategy provides a room for the care, concern and analysis of the low achievers which in turn helps to bring to the notice physical and psychological problems of pupils, if any.

10. The developed strategy takes the same time limit as is taken by the teacher of the control group

and even then it influences greately the performance of pupils.

11. The strategy forces the teacher to work very hard. If the teacher is ready to work hard then the strategy is not only feasible to be implemented but can bring unexpected exciting results.

12. The investigator feels that the strategy increases the quality of teaching on the part of a teacher and ability to learn on the part of a student; it helps to remove complexes from the mind of pupils by building up in them a greater self-confidence and it also makes pupils to realize their potential. This in turn increases their ability to work continuously.

13. The investigator strongly feels that the time of five weeks generally being allotted for geometry in schools is indeed very little as the geometry portion comprises one third of the whole of fifth-grade mathematics. If this is corrected, the strategy can bring really wonderful results.