

*Sri Lanka J.S.S. 1986 9 (1 & 2)*

## **AN ASSESSMENT OF THE ACADEMIC ABILITIES OF STUDENTS STUDYING AT JUNIOR SECONDARY LEVEL IN SRI LANKA**

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### **Introduction**

The purpose of secondary education is to produce a citizen capable of contributing to the general development of society and his individual growth as well. A good citizen apart from his professional knowledge and skill should be well informed and possess healthy attitudes and general intellectual skills.

“We assume that the good citizen is an informed citizen; that he has at his command a background of knowledge and information needed to consider social problems and issues intelligently.”<sup>1</sup>

In addition to a reserve of knowledge and information, certain other intellectual abilities are desired in a student who is completing secondary education. For instance the ability to comprehend a given communication; ability to transfer or apply previous learning in a new situation; ability to breakdown or analyse a given communication; ability to be creative or innovative in facing new situations or problems and the ability to make sound judgements and evaluations are some of the desirable outcomes expected of secondary education. Therefore a person living in modern complex society which is shrinking fast aided by technological development and mass communication should possess the intellectual abilities mentioned above, if he is to function as an effective member of that society.

Evaluation held at the secondary stage of education should attempt to promote and measure the intellectual abilities possessed by an individual. However most of the evaluation procedures employed both in schools and public examinations tend to measure mostly simple recall or memory. The students who are able to gather a vast body of knowledge and retain it in their memory are at a distinct advantage in negotiating such examinations. Examinations, while they do measure the students' ability to store knowledge, do not measure the students' ability to deal with knowledge.

In recent years there has been much deliberation on the nature of examination papers; about what is being measured by test papers, specially in the context of the two public examinations: the G.C.E. (AL) and the G.C.E. (OL). During the past few years an attempt has been made to incorporate into test papers, questions demanding or testing higher levels of mental ability. In addition to knowledge and comprehension which have been the bases of test

items, questions on more advanced forms of dealing with knowledge such as the ability to apply knowledge in new situations, ability to analyse a given communication, ability to create new ideas (synthesis) and the ability to evaluate a given a situation or material have been included in test papers.

Meanwhile public examinations have become increasingly competitive and as a consequence students, teachers, parents and the public at large maintain a close watch on these examinations. The reliability and validity of examination papers have been repeatedly questioned by those concerned about them. The Department of Examinations itself has taken several measures to improve the reliability and validity of its examinations.

Independent studies to ascertain the level of intellectual/academic abilities possessed by students completing junior secondary school education seem pertinent in the light of the above discussion. Knowledge gained from such studies could serve two purposes: ascertain firstly whether the objectives of junior secondary education have been achieved, and, secondly such studies could provide valuable information for the construction of reliable and valid examination papers which will be suitable for the particular age group. The purpose of this study, therefore, is to assess the academic/intellectual abilities possessed by students who have completed the junior secondary level of education of five years. (11 years in school) to sit the General Certificate of Education (Ordinary Level) Examination.

The G.C.E. (OL) grade forms a convenient point for a survey of this nature. A student studying in the G.C.E. (OL) grade is 15+ years in age and mature in abstract thinking. Furthermore in a cohort of students that enrol at the initial grade in the primary school, less than 50 per cent reach the G.C.E. (OL) grade, others having left school early with an incomplete primary education or incomplete junior secondary education. For those who have remained in school to reach the G.C.E. (OL) grade, this examination plays a dual function in selecting for higher education and screening for white collar jobs at the lower level in the labour market. Those who obtain qualifications for further education will then pass on to the G.C.E. (AL) grade and later join the different institutions of higher education. Those who join the labour market irrespective of whether they continue with further studies or not, will be contributing to economic production sooner or later. The G.C.E. (OL) grade therefore forms a very important juncture; a point at which the future citizens are sent along different streams or channels. Therefore it is very essential that steps are taken to assess whether the goals of education; i.e. the desired academic/intellectual skills are achieved by these students. The researchers, therefore, fervently hope that this study would help to assess the level of academic/intellectual abilities possessed by the student completing junior secondary education and thereby provide more information for the construction of test papers at this age level.

### **Objectives of Education**

In testing and evaluation, it is always appropriate to query the exact things that we are going to find out or measure. The answer to such a question defines both the objectives of testing and education or instruction. If it is agreed that the basic purpose of a test is to measure, then the question of what is being measured must be answered. Tests attempt to measure the success of the educational process or learning experience which the pupils have undergone. Then in each subject area the objectives of instruction or education and evaluation should be identical. The process of evaluation is a means by which we assess the level of achievement possessed by the individual in each of the subjects he or she has studied. Achievement could be classified in general terms and tested in a logical sequence starting from the least intellectually demanding task to the more complex forms of intellectual ability. For example: the recall of a name or a date is a simple intellectual task which is mainly a reproduction of memory. On the other hand the analysis of a problem, the solution of a problem or evaluation of some work is a more complex intellectual task which demands higher levels of mental ability.

Educational objectives have been categorised as belonging to three domains: Cognitive, Affective and Psychomotor. Educational objectives in the cognitive domain were considered by a series of conferences held in the United States between 1949 and 1953. The conclusions of these discussions were edited by B.S. Bloom and published as a *Taxonomy of Educational Objectives in the Cognitive Domain* in 1956.<sup>1</sup> According to this classification the cognitive domain consist of six major categories as follows:

1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation.

It should be noted that these categories for classifying the objectives in the cognitive domain start with relatively simple knowledge and proceed through increasingly complex levels of intellectual tasks. A person who completes a junior secondary education should have the ability to perform these intellectual tasks and a valid test should seek to measure a person's ability in several or all of these tasks.

## **Description of the major categories in the cognitive domain**

### **1. Knowledge :**

Knowledge is very often equated with facts and the ability to remember facts. Knowledge plays a vital role in teaching and testing. Teaching in a way is imparting knowledge and testing on the other hand is an assessment of the amount of knowledge retained by the pupil. A great reserve of knowledge is essential for a good education and knowledge forms the base for higher intellectual tasks.

Testing in knowledge involve the recall of a wide range of material from specific facts to complete theories. But all that is required is the bringing to mind of the appropriate information. Knowledge represents the lowest level of learning outcomes in the cognitive domain.

### **2. Comprehension :**

Factual knowledge encourages rote learning or memorising. Knowledge without understanding is of little use. The ability to understand a given communication is of fundamental importance in modern society. Communication of knowledge may take many forms such as mathematical symbols, diagrams, maps and pictures or the written form. Comprehension is the ability to understand a given communication or is defined as the ability to grasp the meaning of material. This ability may be shown by translating material from one form to another (words to symbols, words to numbers, etc.), by interpreting material (explaining or summarising), and by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond simple remembering of material and represent the lowest level of understanding.

### **3. Application :**

Application differs from comprehension in that it represents another step in the hierarchy of mental skills and abilities. It implies the ability of the person not merely to understand, but also the ability to recognise whether or not the principle is applicable in any given case. In general it implies the ability on the part of a person to select the appropriate abstract tools in order to solve a problem, make a prediction or explain some phenomena. This may include the application of such things as rules, methods, concepts, principles, laws and theories. Learning outcomes in this area require a higher level of understanding than those under comprehension.

**4. Analysis :**

Analysis refers to the ability to break down material into its component parts so that its organisational structure may be understood. This may include the identification of the parts, analysis of the relationship between parts and recognition of the organizational principles involved. Learning outcomes under analysis represent a higher intellectual task than comprehension and application because analysis requires an understanding of both the content and the structural form of the material.

**5. Synthesis :**

Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication (theme of a speech), a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress on creative behaviour with major emphasis on the formulation of new patterns or structures.

**6. Evaluation :**

Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. The judgements are based on definite criteria. These may be internal criteria (organisation) or external criteria (relevance to the purpose) and the student may determine the criteria or they may be given to him. Learning outcomes in this area are the highest in the cognitive domain because they contain elements of all of the other categories, plus conscious value judgements based on clearly defined criteria.

**Methodology and the analysis of the test**

**Objectives :**

The objectives could be listed as follows:

1. The construction of a multiple choice test to measure academic abilities of the students at General Certificate of Education (Ordinary Level) grade.
2. Assessing the general level of attainment among G.C.E. (OL) students in the five academic/intellectual abilities: comprehension, application, analysis, synthesis and evaluation.
3. Ascertaining whether attainment differ according to type of school and socio-economic background and sex of students.

**The Sample :**

In order to realize the objectives stated above an appropriate sample had to be selected. The size of the sample decided for this purpose was 1000 students. They belong to 30 schools of varying types from 5 education districts: Colombo, Gampaha, Kurunegala, Kalutara and Ratnapura.

The sample had to be a stratified random sample. First several types of schools were identified as listed below:

- |   |                                     |   |   |
|---|-------------------------------------|---|---|
| A | Urban popular schools               | } | With-in the Municipality<br>of Colombo. |
| B | Urban middle level schools.         |   |   |
| C | Urban non affluent schools          |   |   |
| D | Suburban schools                    |   |   |
| E | Popular schools in the outstations. |   |   |
| F | Rural Schools                       |   |   |
| G | Private schools and Pirivena.       |   |   |

Urban popular schools are the schools most sought after in the Municipality of Colombo. The competition for entry into these schools is very fierce. They enjoy the pride of place in the hierarchy of schools in the whole country. The category named urban middle level schools consists of the next most popular schools within the city of Colombo. Urban non affluent schools are schools patronised by the lower socio-economic strata among dwellers in the city of Colombo.

The category named suburban schools are schools situated in the outskirts of the city of Colombo. The popular schools in the outstations is a category consisting of Central schools and former Colleges of the denominational era located in the urban centres outside Colombo. These schools enjoy a great deal of prestige and popularity in the respective areas. The rural schools are the village schools, most of them being rural Maha Vidyalayas.

From the seven types of schools thirty schools were selected at random. Then from each school a class or a cluster of grade 10 students (G.C.E.: OL - 11th year) was drawn at random. Thus thirty classes or clusters of students sitting the G.C.E. (OL) for the first attempt in 1986 were drawn into the sample.

The intention at the very outset was to draw 1000 students to the sample and administer the test towards the end of the third term of 1986 when the students were in the proper mood to take a test. However there was a 13.2 per cent loss or drop-out from the sample due to two intervening reasons beyond the control of the researchers. Firstly in most schools as the syllabi had been completed a considerable number of students were not attending school. Secondly the onset

of a period of wet weather reduced attendance in certain schools. Nevertheless the test was administered to 868 students from the 30 schools selected and the composition of the sample according to the type of school is given below:

**TABLE 1**  
Composition of the sample according to the type of school.

<i>Type of school</i>	<i>No. of schools</i>	<i>No. of students.</i>	<i>Percentage.</i>
A Colombo Popular	4	97	11.2
B Colombo Middle	3	88	10.1
C Colombo Non affluent	3	73	8.4
D Suburban	6	197	22.7
E Outstation Popular	6	229	26.4
F Rural	6	115	13.2
G Private & Pirivena	2	69	8.0
Total	30	868	100.0

The seven types of schools represent different learning environments within the school system of Sri Lanka, which is being patronised by the State. Also, the seven types of schools between and within them are a representation of wide differences in the socio-economic status, religion, cultural environment of the family and geographical location of the student body. This sample therefore has taken into consideration all possible stratifications in order to justify itself as a representative sample. However according to the medium of education, the sample is entirely Sinhala medium.

A breakdown of the sample according to sex reveals that 406 or 52 percent of the sample are males. The number of females in the sample are 381, amounting to 48 percent. Regarding 81 students, data pertaining to sex were not available.

### **The academic ability test**

The academic ability test constructed specially for this study attempts to measure only five areas of the cognitive domain: comprehension, application, analysis, synthesis and evaluation. Knowledge has been left out for several reasons. Knowledge forms a common component of all types of tests: teacher made and public examinations as well. Also, knowledge means memorisation of facts and if knowledge is to be included students have to be given a specific syllabus. Furthermore knowledge is the lowest level among categories in the cognitive domain which is only a reproduction of memory. The five areas included in the test are all higher intellectual tasks which require more ability than just reproducing pure memory. In all items the subject matter has been provided (therefore not calling back memory) and the student has to perform

certain intellectual tasks; comprehend, apply, analyse, synthesise or evaluate as demanded by the particular item.

The test consists of 25 items with five items from each of the categories. The breakdown of the items according to the categories is given below:

#### **Comprehension - 5 items**

1. ability to translate an idea given in a passage into different words.
2. ability to translate an idea given in a poem into different words.
3. ability to interpret data.
4. ability to translate a landscape feature from one symbolic form to another.
5. ability to extrapolate by interpreting consequences.

#### **Application - 5 items**

6. ability to apply the relationship between landscape and crop pattern in a different situation.
7. 8. ability to apply the meaning implied by an idiom in a new situation.
9. use of grammar in a sentence.
10. ability to apply a natural phenomenon in solving a problem.

#### **Analysis - 5 items**

11. analysis of relationship.
12. 13. ability to recognise logical fallacies in reasoning
14. 15. ability to analyse facts and recognize relationships.

#### **Synthesis - 5 items**

16. selection of relevant facts to prove a given hypothesis.
17. selection of an outline of a story for a given theme.
18. ability to find a solution to a problem.
19. ability to recognise a set of abstract relationships
20. ability to find a solution to a given problem.

#### **Evaluation - 5 items**

21. evaluation of a poem using given criteria.
22. evaluation of a person on given characteristics.
23. evaluation of a location by making use of given criteria.
24. evaluation of a person using given criteria.
25. evaluation of several locations suitable for industries.

### **Administration and scoring of the test**

The test was administered to the sample without prior notice during October - November 1986. The duration of the test was approximately one hour. Scoring was done on the basis of awarding 1 mark for each correct response and zero for each incorrect response. The 25 items therefore carry a maximum of 25 marks with 5 marks for each of the five categories. The test when administered to the sample of 868 students had a grand mean of 11.43 and a standard deviation of 3.34.

### **Item analysis**

The number of subjects used for the item analysis was 822 with 222 of them in each of the upper and lower groups (27%) and 378 belonging to the middle group.

The facility index and the discrimination index for each item is given in Table 2. A perusal of Table 2 reveals that 13 items out of twenty five are acceptable without any revision; their facility index, discrimination index and distraction of responses to other alternatives being satisfactory. Seven items need minor revisions, in that these items have been either too facilitating or poor disorientators. Five items need major revisions because they have very low discriminatory power while being difficult for all groups. In some of these items the distractors have drawn more responses than the correct answer from all groups. These five items need revision before proceeding further.

TABLE 2

Facility Index and Discrimination Index for each item.

Item No.	Facility Index	Discrimination Index	Revision	
1	.41	.31		Comprehension
2	.40	.41		
3	.40	.25	--	
4	.55	.51		
5	.38	.34	--	
6	.47	.38		Application
7	.75	.37	--	
8	.46	.31		
9	.38	.27		
10	.15	.20	**	
11	.40	.38		Analysis
12	.46	.43		
13	.71	.4	--	
14	.50	.04	**	
15	.20	.12	**	
16	.65	.44	--	Synthesis
17	.69	.46		
18	.21	.25	--	
19	.32	.14	**	
20	.23	.32	**	
21	.55	.48		Evaluation
22	.72	.25	--	
23	.59	.47		
24	.58	.50		
25	.35	.40		

Items that need major revisions have been marked\*\* (five) and those that need minor revisions are marked -- (seven).

Looking at the item analysis from another angle it is seen that the five items under evaluation have been the most satisfactory, followed by items under comprehension and application. A large number of items that require either a major or minor revisions have been from synthesis and analysis.

**Reliability :**

The reliability of the test as calculated by formula  $KR_{20}$  for internal consistency is .53.

$$\begin{aligned} -KR_{20} &= \frac{K}{K-1} \left\{ \frac{S^2 \sum PQ}{S^2} \right\} \\ &= \frac{25}{25-1} \left\{ \frac{(3.34)^2 - 5.5193}{(3.34)^2} \right\} \\ &= \underline{\underline{.53}} \end{aligned}$$

$\sum PQ$  values have been calculated from Facility Index for each item as given in Table 2.

**Presentation of data**

The test was administered to a sample of 868 students from 30 schools. These students coming from seven types of schools were sitting the G.C.E. (OL) examination for their first attempt in December 1986 in the Sinhala medium. The data will be treated under three headings as follows:

1. The nature of the distribution of scores.
2. Achievement according to the type of school
3. Achievement according to sex.

The original intention of the researchers was to use two way analysis of variance for tests of significance. But the nature of the data; the observations being not independent when the five categories: comprehension, application, analysis, synthesis and evaluation are taken, prevented them from using two way analysis of variance. Instead, one way analysis of variance will be used where ever possible, supplemented by tests of significance between independent means; a rather laborious statistical procedure.

**The nature of the distribution of scores:**

In a study of this nature it is relevant to ascertain whether the distribution approximates the normal distribution. The chi-square test for "goodness of fit" is applied below to ascertain whether the distribution is normal or not.

TABLE 3

Chi-square test for "goodness of fit"

Scores	Z for upper limit	F <sub>o</sub>	F <sub>e</sub>	Chi-square
22-24	3.92	1	1.1	.009
19-21	3.02	15	14.4	.025
16-18	2.12	93	84.4	.876
13-15	1.22	210	231.7	2.032
10-12	.32	284	268.6	.882
7-9	- .58	206	197.6	.357
4-6	- 1.48	53	60.8	1.000
1-3	- 2.37	6	9.4	1.229
TOTAL		868		6.413

Chi-square = 6.41 < 14.06 for df 7 at .05 level:  
not significant.

The chi-square test for "goodness of fit" reveals that the observed or obtained distribution does not differ significantly from the normal distribution. Nevertheless the distribution has a slight positive skewness as evident from the positions of the measures of central tendency: mode (11.00) median (11.29) and mean ((11.43) in that order, and the degree of skewness which is .13.

The overall position as revealed by the mean (11.43) and standard deviation (3.34). indicate that while the performance is somewhat below the mid way mark (12.5 or one half of 25, the maximum obtainable, the distribution of scores is fairly widespread. The range of individual scores is from 3 to 22.

Having examined the nature of the distribution of scores according to the performance in the test as a whole, it is pertinent to ascertain their performance in the five areas of academic abilities: Comprehension, application, analysis, synthesis and evaluation. Table 4. below, gives the distribution of scores according to performance in the five areas stated above, with measures of central tendency and degree of skewness.

An examination of the degree of skewness and the relative position of the three measures of central tendency: mean, median and mode as given in Table 4, reveals that the distribution of scores for the five abilities take 3 different shapes. Comprehension and synthesis are slightly positively skewed while the distribution of scores for evaluation is negatively skewed. Application and analysis theoretically do not reveal any skewness in that their values are Zero.

TABLE 4

Distribution of scores according to performance in the five abilities:  
Comprehension, application, analysis, synthesis and evaluation.

Ability	Scores						Central Tendency			Std. Dev.	Degree of Skewness
	0	1	2	3	4	5	Mean	Median	Mode		
Comprehension	78	199	282	201	81	27	2.11	2.05	2	1.20	.15
Application	46	180	301	248	84	9	2.19	2.19	2	1.11	.00
Analysis	38	163	299	269	86	13	2.28	2.28	2	1.06	.00
Synthesis	57	202	309	211	81	8	2.09	2.06	2	1.05	.09
Evaluation	43	122	191	236	208	68	2.75	2.83	3	1.34	-.18

N = 868

The performance of the students in four abilities: comprehension, application, analysis and synthesis have been below the half way mark, i.e. less than 2.5 out of a maximum of 5. The lowest performance has been in synthesis. On the other hand performance in evaluation is the best and stands above the half way mark of 2.5. This may be explained in terms of the relative facility of items under evaluation. (See table 2).

#### Achievement according to type of school:

The type of school is an important variable that brings about differences in achievement. Hence it is important to ascertain whether the type of school leads to differences in academic abilities of students. In this case six types of schools: Colombo Popular, Colombo Middle Level, Colombo Non-affluent, Suburban, Outstation Popular and Rural were considered for analysis and the results as determined by one way analysis of variance are given in Table 5, below:

TABLE 5

F value for significance of difference among 6 types of schools on the performance in the test as a whole.

Source	df	SS	S <sup>2</sup>	F ratio
Among type of school	5	1052	210.4	21.6
Within	793	7723	9.74	
Total	798	8775	—	

The obtained F ratio of 21.6 exceeds the critical value of 3.06 for 5 and 793 degrees of freedom in the numerator and the denominator respectively at .01 confidence level. This in other words means that there is a significant difference in the performance of students in the six types of schools. Table 6 below gives the means and standard deviations for the six types of schools:

TABLE 6

Means and Standard Deviations for the six types of schools

Type of school	N	$\bar{X}$	SD	Highest-Lowest $\bar{X}$
Colombo Popular	97	13.95	3.41	16.57 10.81
Colombo Middle Level	88	11.66	3.17	14.43 10.56
Colombo Non affluent	73	9.52	2.6	10.18 8.7
Suburban	197	11.97	3.29	13.35 10.6
Outstation Popular	229	11.32	3.08	12.73 10.5
Rural	115	10.42	2.8	11.18 9.74

From Table 6 it is seen that the students in Colombo Popular schools have fared better and their mean of 13.95 is higher than the means of all the other types of schools with the differences between means being significant at .01 confidence level. (See Table 7) at the other end, the students in the Colombo Non Affluent schools have performed poorly and their mean of 9.52 differs significantly from the other five types of schools. The standard deviation of the distribution too is low. The students in the Rural Schools also have a low mean of 10.42 which place them above the Colombo Non Affluent schools, but below the other four types of schools. The mean of the Rural schools is significantly different from all five types of schools. The students in the other three types of schools: Colombo Middle level, Suburban, and Outstation Popular have means ranging between 11.97 and 11.32, thus indicating a mediocre performance. The Outstation Popular and Suburban school means do not differ significantly from that of the Colombo Middle Level schools. Table 7, below, gives the matrix of Z scores for difference between means among different types of schools

TABLE 7

Matrix of Z Scores for difference between independent means among different types of schools.

	CP	CML	CNA	SUB	OP	R
Colombo Popular	...	4.74	9.63	4.71	6.58	8.21
Colombo Middle Level	-4.74	...	4.65	0.76	0.87	2.88
Colombo Non Affluent	-9.63	-4.65	...	-6.45	-4.86	-2.25
Suburban	-4.71	0.76	6.45	...	2.09	4.31
Outstation Popular	-6.58	0.87	4.86	-2.09	...	2.72
Rural	-8.21	-2.88	2.25	-4.31	-2.72	...

Z > 2.58 Significant at 0.01 level

Z > 1.96 Significant at 0.05 level

From the analysis of variance and Z tests for significance between means, it has been clearly established that differences or disparities exist among the different types of schools. However it should also be noted that striking differences in achievement prevail between schools within each type. A perusal of the last column in Table 6 clearly establishes the existence of such noteworthy differences between schools in each category of schools.

Having observed that students in different types of schools perform at different levels when the test is considered as a whole, it will be useful to examine the nature of their performance when scores are grouped under each of the abilities or categories of the cognitive domain. Table 8, below, gives the means and standard deviations for the five categories according to type of school:

TABLE 8

Means and Standard Deviations for Comprehension, Application, Analysis, Synthesis and Evaluation, according to type of school.

Type of school		Comperhen- sion	Applica- tion	Analy- sis	Synthe- sis	Evalua- tion
Colombo Popular	$\bar{X}$	2.63	2.54	2.73	2.69	3.36
	S	1.28	1.23	0.87	1.11	1.32
Colombo Middle Level	$\bar{X}$	2.05	2.14	2.34	2.13	3.01
	S	1.19	0.95	1.14	1.07	1.26
Colombo Non Affluent	$\bar{X}$	1.53	1.82	1.96	1.96	2.25
	S	0.98	1.05	1.04	1.15	1.33
Suburban	$\bar{X}$	2.17	2.47	2.32	2.18	2.83
	S	1.23	1.2	1.03	0.66	1.33
Outstation Popular	$\bar{X}$	2.05	2.06	2.32	2.10	2.78
	S	1.2	1.03	1.05	1.08	1.22
Rural	$\bar{X}$	2.09	2.12	2.07	1.66	2.43
	S	1.02	0.98	1.06	1.06	1.17

According to Table 8, the students in the Colombo Popular schools have scored the highest marks in all five categories of the cognitive domain. The students in the Colombo non affluent schools have scored the lowest in all categories, except synthesis, where students in Rural Schools have lagged behind them. The other types of schools fall in between these two extremes, the rank order changing here and there. Nevertheless, a noteworthy difference is observed between students in Outstation Popular schools and Rural schools in that in two categories: comprehension and application, the former falls behind the latter.

The findings of this study therefore confirm the existence of differences in academic abilities among students from different types of schools.

#### Achievement according to sex

In studies concerned with achievement it is important to ascertain whether differences exist between the sexes. The overall test of significance for difference between independent means reveals that the difference is not significant. Table 9 below presents the data:

TABLE 9.

Test of significance for difference between means:  
Males and Females

	$N$	$\bar{X}$	$S$
Male	406	11.47	3.63
Female	381	11.69	3.03
$Z = \frac{11.47 - 11.69}{0.24} = -0.92$			

The obtained Z value of  $-0.92$  is less than 1.98, the critical value at 0.05 level, and as such there is no significant difference in the achievement of males and females.

Table 10 below gives a breakdown of achievement between males and females under the five categories of the cognitive domain.

TABLE 10

Achievement in the five categories; a breakdown according to sex.

		Compr.	Appli:	Analysis:	Synth:	Evalu:
Males	$\bar{X}$	2.18	2.27	2.15	2.13	2.73
	$S$	1.27	1.17	1.06	1.18	1.27
Females	$\bar{X}$	2.06	2.13	2.45	2.15	2.88
	$S$	1.18	1.04	1.04	1.0	1.31
Z =		- 1.37	- 1.79	+ 4.1	+ 0.25	+ 1.63

According to Table 10, the differences are not significant, except for analysis, where girls have scored significantly higher marks than boys.

### Analysis of the revised test and a comparison of data

The twelve items of the academic abilities test that needed revision as stated in Table 2 were revised. The revised test was administered to a sample of 480 G.C.E. (OL) students (11th year) during the last two weeks of January 1987. This sample was drawn from 12 schools representing different types of schools and socio-economic environments as the original sample. The upper and lower groups of the sample used for the item analysis consisted of 130 students. The middle group had 220 students. Table 11 below, gives the data of the item analysis. From the table it is seen that the revised items have improved

considerably both in item facility and discriminatory power. The facility indices for the items in the revised test now vary only between 0.35 and 0.65, whereas in the original test this was between 0.15 and 0.75. Similarly several items (notably items 4, 15 and 19) now have higher discriminatory indices above 0.28.

The reliability of the test as calculated by formula  $KR_{20}$  for internal consistency is as follows:

$$KR_{20} = \frac{25}{24} \left\{ \frac{(3.8)^2 - 6.0056}{(3.8)^2} \right\} = 0.6$$

The reliability coefficient of 0.6 for revised test is a considerable improvement on the previous figure of 0.53.

The distribution of scores for the revised test, as in the original test, approximates the normal distribution. Table 12, below, gives the Chi-square test for "goodness of fit" of the distribution, which is not significant even at 0.05 level.

TABLE 11

Item analysis data: a comparison of the original test and the revised test

Item No	Original Test	Revised Test		
	Fac. In	Disc In.	Fac. In	Disc. In
1	0.41	0.31	0.44	0.35
2	0.40	0.41	0.45	0.44
3	0.40	0.25	0.45	0.40*
4	0.55	0.51	0.55	0.52
5	0.38	0.34	0.40	0.42*
6	0.47	0.38	0.48	0.41
7	0.75	0.37	0.62	0.41*
8	0.46	0.31	0.48	0.36
9	0.38	0.27	0.40	0.30
10	0.15	0.20	0.40	0.32*
11	0.40	0.38	0.42	0.39
12	0.46	0.43	0.47	0.45
13	0.71	0.40	0.56	0.42*
14	0.50	0.04	0.52	0.28*
15	0.20	0.12	0.35	0.30*
16	0.65	0.44	0.60	0.45*
17	0.69	0.46	0.65	0.48
18	0.21	0.25	0.35	0.31*
19	0.32	0.14	0.45	0.34*
20	0.23	0.32	0.42	0.38*
21	0.55	0.48	0.54	0.48
22	0.72	0.25	0.62	0.34*
23	0.59	0.47	0.58	0.48
24	0.58	0.50	0.56	0.51
25	0.35	0.40	0.38	0.42

(\* Revised items)

TABLE 12

Chi-square test for "goodness of fit"

Scores	Z upper limit	F <sub>o</sub>	F <sub>e</sub>	Chi-square
22-24	3.31	01	2.5	0.9
19-21	2.52	12	17.2	1.75
16-18	1.73	72	63.3	1.19
13-15	0.94	122	128.1	0.29
10-12	0.15	152	144.3	0.41
7-9	- 0.64	90	88.7	0.02
4-6	- 1.43	28	30.3	0.17
1-3	- 2.22	03	5.6	1.21
Total	—	480	480	5.95

Chi-square = 5.95 < 14.06 for df = 7 at .05 level.

The values for mean, median and mode, in that order, are 11.94, 11.84 and 11.00, which indicate that the distribution is slightly positively skewed as the distribution for the original test.

In Table 13 is given the comparison of scores for achievement in the original and revised tests.

**TABLE 13**  
Comparison of scores: original and revised tests

Category	Original Test		Revised Test	
	$\bar{X}$	S.D	$\bar{X}$	SD
Comprehension	2.11	1.2	2.27	1.4
Application	2.19	1.11	2.34	1.3
Analysis	2.28	1.06	2.33	1.12
Synthesis	2.09	1.05	2.34	1.2
Evaluation	2.75	1.34	2.66	1.3
Whole Test	11.43	3.34	11.94	3.8
N	868		480	

A perusal of Table 13 reveals that the mean of the revised test has gone up by 0.51. The standard deviation has increased by 0.46 which suggest that the distribution of scores is greater than in the earlier set of scores. The means for the three areas: comprehension, application and synthesis have increased considerably. This increase could be attributed to the improvement in the facility indices of the items, including the revised ones. However, the mean for the items in evaluation, shows a slight decrease.

The data also reveals differences in achievement among different types of schools. But no formal analysis was attempted due to the fewer number of schools in each type. Sex differences were not significant. Nevertheless the females had a slightly higher mean than the males.

### Conclusions and Implications

The cognitive abilities test was administered twice: the original version in November 1986 and the revised version in January-February 1987. On both occasions the test for "goodness of fit" revealed that the distribution of scores did not differ significantly from a normal distribution. In the original test the obtained chi-square value of 6.41 from a sample of 868 students, and in the revised test the chi-square value of 5.95 from a sample of 480 students, did not

exceed the critical value of 14.06 for 7 degrees of freedom at 5 per cent level. Hence the distribution of scores in academic abilities could be assumed as a normal distribution.

The mean, median and mode in the original test and revised test converted to percentages, as given below, reveal that the achievement on both occasions stand below the half way mark.

<i>Test</i>	<i>Mean</i>	<i>Median</i>	<i>Mode</i>
Original	45.72	45.16	44.0
Revised	47.76	45.36	44.0

Hence, it is seen that even though the distribution of scores takes the shape of a normal distribution, achievement has been low to a considerable extent. Nevertheless, the range of individual scores is between 12 and 88.

In examining achievement in the five categories: comprehension, application, analysis, synthesis and evaluation, it is revealed that the highest achievement is in evaluation (2.71) followed by analysis (2.31), application (2.27), synthesis (2.22) and comprehension (2.91), in that order. High achievement in evaluation could be explained in terms of the relative facility of test items under that category.

Achievement in the academic abilities test (means of 45.7 and 47.7), when compared to other tests of similar characteristics, though slightly lower does not deviate remarkably. For example, Rupasinghe, (1978)<sup>5</sup> in a survey of achievement of Social Studies Concepts among 2400 G.C.E. (OL) student from different types of schools observed a mean of 49.31 and a standard deviation of 18.68. Again Rupasinghe (1982) in a study involving 400 grade 9 students from different types of schools found that their achievement in several school tests held at the district/circuit level had a mean of 49.17 with a standard deviation of 18.9. Similar researches at the master's level in the University of Colombo by Weerawardane<sup>7</sup> (Democratic Political Concepts), Ranasinghe, (1985)<sup>4</sup> (Population Concepts), Jayaratne, (1983)<sup>3</sup> (Economic Concepts) observed means ranging between 42 and 52 for G.C.E. (OL) grades.

The academic abilities test on both administrations revealed that highly significant differences occur in achievement between different types of schools. This finding is consistent with the findings of all studies cited above. The differences in achievement among different types of schools to a considerable extent indicate the differences in the socio-economic status of the student population.

Finally, sex, on this occasion as in many studies concluded previously, was found to be a variable that does not contribute to differences in achievement.

The present study has two important implications to be considered for policy making at both the national level and the school level. The findings revealed remarkable differences among the different types of schools which in other words implicate social class disparities. Therefore while measures are being taken to bridge the gap between different types of schools, parallel steps should be taken to improve the socio-economic status of the student body. Compensatory educational programmes should be launched to help the students from culturally deprived homes. These programmes rather than being ad hoc ones, should be planned and phased programmes. The programmes should be both immediate short term and long term ones, specially to help the students from poor homes.

At the class room level steps should be taken to develop the higher cognitive abilities of students. At present teaching is mainly a function of pouring in knowledge which serves to pass examinations. Therefore, in addition to imparting a sound knowledge, a strong attempt should be made to develop the higher order cognitive abilities of students during the process of teaching. In this respect along with the teachers, the curriculum developers have in their hands a vital role to play. Teaching at the classroom level is entirely dominated and guided by the nature of the curriculum and the targets set by it. Therefore any improvement or change in teaching at the school and classroom level has to be laid down by the curriculum itself.

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