A STUDY OF THE REASONING ABILITIES OF NINTH STANDARD STUDENTS WITH RESPECT TO THEIR GENDER AND TYPE OF THE INSTITUTION

By

MAHENDER REDDY SARSANI*

ABSTRACT

Reasoning and learning are closely related, both being the methods of solving problems, learning usually results from the process of reasoning. All inventions, discoveries, art, literature and advances in culture and civilization are based on thinking, reasoning and problem solving capacity of human beings. A sound reasoning leads to better adjustment of the child with the environment; and it also controls his total behaviour. The present research is proposed to measure the reasoning abilities of the students with a developed tool by the researcher called 'Battery of Reasoning Test' (BRT). The test was divided into four parts and consists of 80 items. The reliability of the test was 0.86. A 'survey' approach was adopted to test the reasoning abilities of the students studying in Hyderabad, capital city of Andhra Pradesh, India. The pilot study was conducted on a sample of 100 students from five schools. A sample of 400 students was selected from twenty schools for the final study which comprises 200 boys and 200 girls from the private and government schools. The study revealed that boys performed better than girls in reasoning ability. It was also found that private school students have better reasoning abilities than government school students. In the further detailed analysis, it was found that the boys studying in private schools are performing better than their counter parts that are girls of private schools, boys of government schools and girls of government schools on BRT test. The lowest mean score on BRT was found among the girls studying in government schools. Therefore proper care should be taken to develop reasoning power of girls and particularly students studying in government schools.

INTRODUCTION

Man is a rational animal. His rationality consists in his ability to think and reason for successful living. All the pioneer workers of every field have got these abilities at the highest level. All inventions, discoveries, art, literature and advances in culture and civilization are based on thinking, reasoning and problem solving capacity of human beings. (Kulshreshtha, 1997). Reasoning is also an implicit act and involves problem solving behaviour. Reasoning and problem solving are not different from thinking. They may be regarded as the highest forms of thinking. In simple way one can say that the most orderly process of thinking is reasoning or problem solving (p.182). Garrett (1968) defined that reasoning is step-wise thinking with a purpose or goal in mind. According to Gates (1947), reasoning is the term applied to highly purposeful controlled selective thinking.

To prepare for the future, children and young adults need a good range of problem solving, communication and partial skills and opportunities to try these out confidently. They need skills for accessing information, as well as experience in reasoning by analogy. Learning activities which encourage them to imagine are essential, as are those in which they can get really absorbed (Fryer, 1996).

Tests of mental ability have had their greatest usefulness in schools, where they have been utilised for purpose of educational and vocational guidance, as well as in the diagnosis of learning difficulties in the case of particular individual. Non-verbal group tests have been found valuable in efforts to determine aptitude and promise in shop work, mechanical drawing, architectural drafting, and occupations of a mechanical or quasi-mechanical nature all of which make demands upon those psychological activities which enter into problems involving geometric perceptions and reasoning with the concrete rather than with the abstract. 'Sound reasoning

leads to better adjustment of the child with the environment. It also controls his total behaviour' (Bhatia and Bhatia, 1998). Thus we can say that sound reasoning leads to a sound and better life.

Reasoning plays a significant role in one's adjustment to one's environment. Not only it controls one's cognitive activities, but also the total behaviour and personality is influenced by the proper or improper development of one's reasoning ability (Mangal, 1998). It is essentially a cognitive ability and is like thinking in many aspects. Therefore proper care should be taken to develop reasoning powers of children.

Reasoning- its meaning and definition

In the wider sense of the term, higher intellectual activity or process is termed as reasoning. Piaget and his colleagues defined the use of formal operational reasoning as the ending stage in the process of intellectual development. The great American Philosopher John Dewey (1933) has formalised reasoning as a five step process: 1. Awareness of a problems (and motive to solve it), 2. Collection of facts needed to solve it, 3. Formulation of hypotheses or possible solutions, 4. Evaluation of these hypotheses against the facts collected, and 5. Verification or actually trying out a solution which seems valid.

In the activity of reasoning, a man makes new judgments and decisions on the basis of his old judgments and decisions. With the help of reason or logic he tries to examine the existing situation and on the basis of the experiences acquired and arrived at, he / she tries to reach certain conclusions. According to Angell (1964), reasoning means 'the kind of mental activity in which an individual is trying to arrive at a conclusion on the basis of reasons'. Reasoning is the word used to describe the mental recognition of cause-and-effect relationships. It may be the prediction of an event from an observed cause or the inference of a cause from an observed event (Skinner, 1968).

Reasoning is best defined as problem solving in the form of symbolic activity. It is the organisation of all relevant experiences or relationships with reference to a particular problem or situation. In reasoning, we manipulate symbols, instead, muscular activity is reduced to a minimum. Many things that go on in the process of learning at the perception action level are duplicated at the symbolic level. Reasoning consists, making a new judgement on the basis of judgement or judgements already formed and are commonly defined as 'perceiving relations among judgements' or see agreement or disagreement among judgements already made' (Bhatia, 1968). It helps the person to fit a problem or situation into familiar social, cultural or psychological patterns so that his decisions and actions have continuity and are understood by others (Theodorson and Theodorson, 1969).

Reasoning is much like trial-and-error behaviour: but instead of motor exploration, it is mental exploration. It thus saves time and effort. Reasoning is, therefore, a highly purposeful, controlled, selective, thinking process, the material of which is predominantly factual reproduction of past experience. Reasoning and learning are closely related, both being methods of solving problems, learning usually resulting from the process of reasoning (Mathur, 1997). Thus, while there are many things in common between trial and error learning and reasoning, there are enough new aspects to justify us in making a study of reasoning for its own sake.

Reasoning does not occur unless a difficulty, or question has risen, for which there is no ready answer. It involves trial and error and also insight. Therefore, reasoning is a variety of learning. After reasoning, the organism is left with new patterns of response in the face of situations where he / she had none before, or where he / she had a different one before. But in reasoning, as contrasted with trial and error learning, one's past experiences play a much greater role. Previous experiences are recalled and organised into patterns that did not exist before. However, an increasingly sophisticated knowledge base supports increasingly sophisticated forms of reasoning. There is thus an important synergy between good knowledge and good reasoning (Lohman, 2005). As Munn (1967) explained that "Reasoning is combining past experiences in order to solve a problem, which cannot be solved by

mere reproduction of earlier solutions." Too much cannot be said for the importance of past experience in reasoning. Past experience furnishes the vast majority of the material with which we think.

Reasoning is a form of thinking in which concepts are reorganised in such a way that a new understanding of meaning emerges from previously established knowledge. No one can think in a vacuum! One has to think about something. And if one has not a ready stock of information on many subjects, he lacks the essential materials with which to think (Guilford, 1965). Billinge's (1934) experiment found that knowledge of facts is therefore an essential factor for reasoning, but it is not sufficient in itself to produce reasoning. Ability to reason must also be present.

Reasoning is a certain way of solving intellectual problems. In general, an individual given with a problem and in a given background of beliefs and principles of 'better' reasoning will be reasoning which (a) is quicker and more direct in reaching a solution, (b) yielding a complete solution of the initial problems as the individual's background and time allowed, and (c) yields a solution as rigorously, well supported by reasons as the problems, the individual's background and if time permits 'Reasoning' is 'worse' just so far as the process is fumbling, goes off on tangents, wastes time on inessential questions, ends up with a less satisfactory answer than could have been achieved or arrives at a solution which is 'based' on irrelevant 'reasons' thrown together with unnecessary and careless haste or taken to be better supported than it is.

Types of Reasoning

Carroll (1993) suggests that the general reasoning factor can be decomposed into three sub factors: 1. Sequential reasoning (requires deductive or logical reasoning) tasks are often (but not always) verbal, 2. Inductive reasoning (requires identification of a pattern or rule in a stimulus set) tasks are often (but not always) figural / non-verbal, and 3. Quantitative reasoning (requires either inductive or deductive reasoning on quantitative concepts), setting aside task content, then, the critical reasoning processes are sequential (or deductive) and inferential.

1. Verbal Reasoning tests: The verbal reasoning test, as its name implies, is a measure of ability to understand concepts framed in words. It aims at the evaluation of the student's ability to abstract or generalize and to think constructively, rather than a simple fluency or vocabulary recognition. The analogies form of test item is peculiarly appropriate for the measurement of reasoning ability. The particular type of analogies item devised for this test is especially useful because it provides: 1. a highly reliable item; 2. a very versatile item; and 3. a measure of reasoning that is relatively complex without being tricky or esoteric (Bennett, Seashore and Wesman, 1959).

2. Non-verbal Reasoning tests: These tests are related with words, figures, digits and letters. The knowledge of words, their meanings and usage, is not required. However, the power of logical reasoning, quickness of thinking and the ability to differentiate or find correlation's between given objects or figures or patterns will be tested. These tests use diagrams, figures and designs to evaluate mental ability rather than academic knowledge. In each instance, the student must discover the principle or principles governing the change of the figures and give evidence of his understanding by designating the diagram which should logically follow (Wesman, A.G. and Seashore, H.G, 1945).

Reasoning may be classified into following two types such as deductive and inductive reasoning.

1. Deductive reasoning: In deductive reasoning the individual applies a general principle to a particular fact. Therefore it is said to be deductive reasoning when a particular problem has been solved on the basis of certain principles. In order to solve the problem we look at our past experience and try to lay down theories. Thus, with the help of this principle we are able to solve a problem.

Example:A. 'Everything in this world disappear'..... (General principle).

(1) 'Table is a thing, therefore it will also disappear' ... . (Particular fact).

(2) 'Box is a thing, therefore it will also disappear' .... (Particular fact).

2. Inductive reasoning: Inductive reasoning consists of deriving a general principle from particular observed facts. This system of reasoning is just a reverse of deduction way of reasoning. In the inductive way of reasoning we do not start with principle. On the other hand we collect the data and observe them with the help of the experiments, we try to verify the theory to reach a particular principle.

e.g. 'A' school has got classes,

'B' school has also classes,

'C' school is also having classes.

Therefore "all the schools have classes".

Review of the studies on reasoning

Singh (1971) has developed and standardised a Battery of Verbal Numerical and Abstract Reasoning Test (VNART) which consists of Verbal Reasoning Test (VRT), Numerical Reasoning Test (NRT) and Abstract Reasoning Test (ART). The subsets included in the battery were word classification, word analogy, number series, arithmetic problems, figure analogy and figure series. The coefficient of split-half reliability for the VRT, NRT, ART and VNART corrected by Spearman-Brown formula were found to be 0.82, 0.92, 0.91 and 0.94 respectively.

Manian and Feroze (1973) reported on a verbal reasoning test in Tamil for high school students which has two parts. The first part consists of eclectic reasoning, mathematical, arithmetic, syllogistic reasoning and abstract reasoning tests. The second part comprised of scientific reasoning test, indirect test, and synthetic test. The split-half reliability of the total scores was found to be 0.74 and validity coefficient was 0.60 against school marks.

Bhatt (1981) constructed a 60 items verbal reasoning test in Gujarati and standardized on the lines of the DAT. The reliability coefficient established by split-half was 0.93. Similarly Shah (1981) and Banker (1981) have independently constructed and standardised a verbal test of reasoning for the school children in Saurashtra. The reliabilities of their tests were 0.89 and 0.94 respectively.

Patel (1969) and Banker (1981) found that boys and girls significantly differed on verbal reasoning and abstract reasoning. Manian and Feroze (1973), Bhatt (1981), and Shah (1981) found that boys were found to be better in reasoning ability than girls. Shemesh and Lazarowitz (1985) findings showed that the boys surpassed girls in the VTGT performance in grades 7 through 11; although the percentage of formal reasoning increased with age; and half of the students in the total sample were in the concrete operational reasoning stage. The VTGT measured conservation and volume displacement, proportional reasoning, control of variables, combinatorial analysis, probabilistic reasoning, and correlational reasoning. Anand (1995) studied that no significant difference was found between the boys and girls in DAT abstract reasoning. Ramesh (2006) concluded that boys and girls do not significantly differ in their non-verbal reasoning abilities and Rajkumar (2006) found the same results on verbal reasoning test.

Anand (1995) found that boys and girls studying in private schools are better in DAT abstract reasoning than the boys and girls studying in Government schools. Ramesh (2006) found that private school students performed better than the government school students in verbal reasoning and Rajkumar (2006) reported a similar result in the non-verbal test of reasoning.

Need of the present study

The students may have good abstract reasoning ability but due to lack of expression they may fail to present their abilities. It is the primary obligation of the school to help the learners not only to gain ideas but also help them to express the ideas in understandable language. The loaded courses of study at the secondary stage leave little time for the development and expressing abstract reasoning abilities of the learners.

Reasoning tests have important uses in many applied fields, particularly education. When administered to children, the main uses of such tests are: (a) to provide an estimate of students' general cognitive development that usefully supplements measures of achievement and teacher observations, (b) to provide an alternative frame of reference for interpreting academic achievement, and (c) to guide efforts to adapt instruction. Each of these

use is discussed in considerable detail elsewhere (Lohman & Hagen, 2001a, b; 2002).

The verbal reasoning test may be expected to predict with reasonable accuracy success in fields where complex verbal relationships and concepts are important. Academic success in most fields would certainly come under that classification. In judgments as to whether or not a student is likely "college material", the Verbal Reasoning test score deserves considerable weight, Vocationally, the test also indicates something of the occupational level to which the student may appropriately aspire; since there is a positive relationship in many occupations between the level of responsibility of a job and the complexity of verbally phrased ideas to be comprehended (Bennett, Seashore and Wesman, 1959).

Now a day's students are facing many competitive and entrance examinations for admissions or employment and for career development, for example, Professional and Vocational entrance examinations, UGC- research awards, Bank and Railway Recruitment Boards, etc,. In all these exams students have to face the reasoning test which consists of 1. Series of completion 2. Classification 3. Analogies, 4. Spotting the Odd one out, 5. Pattern completion, 6. Spotting hidden figures, 7. Finding a similar pattern and 8. Some practical work situations.

It is therefore necessary to develop reasoning power in children. Only then it shall be possible for the children to have a proper perspective of the problem. Hence, the present investigation is made to attempt to study the existing methods and practices adopted by the schools which promote or hide the reasoning abilities among its students with the following objectives.

The main objectives of the study are:

1. To construct a 'Battery of Reasoning Test (BRT)' to measure the reasoning abilities of ninth standard students.
2. To find out whether there is any significant gender differences in reasoning ability.
3. To find out whether there is any significant differences between private and government school students in reasoning ability.
4. To find out whether there is any significant influence of the type of the educational institution on students' reasoning ability

The hypotheses formulated for the study are:

1. Boys and girls do not differ significantly in reasoning abilities.
2. Private and government school students do not differ significantly in reasoning abilities.
3. There is no influence of the type of educational institution on students' reasoning ability.

Methodology

Research Method used in the study

The investigator has selected a suitable research method called 'survey' for the present study. The survey approach to educational problems is one of the most commonly used approaches. The method of research which concerns itself with the present phenomena in terms of conditions, practice, belief, processes, relationships or trends. It involves interpretation, comparison and generalization which are all directed towards a proper understanding and solution of significant educational problems. It brings into focus the attention towards existing educational problems and also suggests way of meeting them. Worthwhile survey studies collect three types of information such as: (i) of what exists, (ii) of what we want and (iii) of how to get there.

Sample

For the pilot study 100 pupils from standard IX, from five schools were selected by a random sampling method. For the final study 400 pupils were selected from twenty schools, from Hyderabad, capital city of Andhra Pradesh (India) by a process of stratified sampling technique for selection of schools and systematic sampling technique for the selection of students. The sample comprises of 200 private school students (100 boys and 100 girls) and 200 government school students (100 boys and 100 girls). Out of these in each school an equal sample of ten girls and ten boys were selected from each of the 20 schools.

Development of the Battery of Reasoning Test (BRT)

A test construction is not an easy task. A lot of literature and

test constructions on reasoning were perused by the investigator. The battery was constructed after having discussions with the staff of the Department of Education and Psychology, subject teachers of schools, experts in the field and resource persons. All the precautions were taken to minimize the common errors that normally occur in a test. While preparing the tool, the investigator has referred the test items on reasoning from different sources such as: 1. Differential Aptitude Test (DAT), 2. Intelligence Tests, 3. Scholastic Aptitude Test (SAT), 4. State Bank Probationary Officers and Clerks Examinations (P.O. Examinations and Clerical), 5. Graduate Management Admission Tests (GMAT), 6. Indian Institute of Technology (IIT) Examinations, 7. Other competitive examination books available in the field.

The investigator constructed a reasoning test consisting of four parts i.e. PART A, PART B, PART C and PART D. The items selected for the above parts are 40, 32, 22 and 56 respectively. The four sub-tests (parts) with a total of 150 items of multiple choice and recall types were analysed and rated subjectively into 'most difficult', 'easy' and 'very easy' groups. Each subset was cyclostyled in a booklet model, and with appropriate instructions and examples to be worked out. Separate answer sheets were supplied by the investigator. Thus a battery of tests which was named as 'Battery of Reasoning Tests (BRT)' was finalized. Part-wise description about the BRT tool is explained below.

Part A: This test is a measure of students' ability to reason with numbers, to manipulate numerical relationships and to deal intelligently with quantitative materials. In this part the investigator included some of the fundamental mathematical reasoning items, real numbers, fractions, complex fractions, additions, subtractions, multiplications, divisions, decimals, square roots, averages, percentages, ratio and proportions, and number series.

Part B: The investigator selected some of the items from arithmetic problems which lead to reasoning. As Guilford (1965) defined 'problem reasoning' is the best measure of this ability for arithmetic reasoning, test composed of the following items: eg). If a man's salary is Rs.50 a week and he spends Rs. 38 a week, how long will it take him to save Rs. 300?

Any item that poses a problem requiring some trial and error in its solution seems to bring this ability into action. Many types of test items became sufficiently difficult for the examinee involved this ability to some extent. It is one of the most important abilities measured by intelligence tests. It is also an important subject in many schools besides arithmetic. In this Part B, almost all type of arithmetic problems were included. Although some problems in the test are in a mathematical setting; the major emphasis is on solving problems based on 'real life' situations.

Part C: This part covers the geometrical figures and properties of many sided figures, circles, angles, squares, rectangles, lines, areas, volume and so on. The emphasis is given to ability to apply fundamental mathematical knowledge to new situations.

Part D: This test (abstract reasoning) is intended as a non-verbal measure of the student's reasoning ability. The series presented in each problem requires the perception of an operating principle in the changing diagrams. In each instance, the student must discover the principle or principles governing the change of the figures and give evidence of his understanding by designating the diagram which should logically follow. The questions can be of the following three types 1. Analogies 2. Series and 3. Classification.

Data collection Procedure

The investigator selected schools which had class rooms with good light and ventilation for administering the test with the help of Headmaster or teachers. Students being tested had to be seated sufficiently far apart so that to avoid copying. The researcher explained briefly why the tests are being administered and emphasized the personal value of the tests for each student, so that the pupils will not only accept them but also put forth their best efforts.

Special instructions were given orally to the group. Students were asked to read the directions given in the booklet and the researcher read it again loudly. Each

candidate was given one book along with separate answer sheets for Battery of Reasoning Test (BRT).

Then the reasoning test was scored with the use of a scoring key. These scores were used for statistical analysis. Various statistical methods have been adopted in the analysis. The mean of standard deviation and standard errors for Reasoning were calculated. Analysis of various method was adopted to observe the relationship between the institutions. For comparison purposes percentiles were calculated and the Ogives drawn. Further the critical ratios were also calculated to see whether there were significant differences between the groups.

Pilot Study

A pilot study was undertaken to verify the applicability of the items. The preliminary draft was administered to 100 pupils (both boys and girls) of standard IX. The time allotted for the administration of the test was determined on the basis of observation of pre-pilot study. The investigator observed every time the number of answer sheets returned. Then the average time was taken, which was fixed for both preliminary and final drafts. Finally a standard time limit for pilot study, i.e., 2 hours 10 minutes was fixed for the administration of the whole test (Part-A and Part-B 80 minutes, and Part-C and Part-D 50 minutes).

For the convenience of pupil and to hold their interest and to avoid monotony, the test was divided into two sessions under the guidelines of DAT Tests (See Bennett, Seashore and Wesman (1959). They are, 1. When using the separate booklet edition the tests should be arranged in a sequence which will hold interest and avoid monotony. Tests containing words and numbers should be alternated or paired with test having pictures or diagrams. 2. Two session testing: some schools may prefer to set two whole morning for testing a class. It is suggested that a brief relaxation period can be scheduled after the second test when this plan is used. So the investigator administered that Part-A and Part-B in one session and Part-C and Part-D in other session, during the school hours.

Item Analysis: After the administration of preliminary test, from the scoring key, individual scores were obtained for 100 pupils. Then the pupils were ranked in the ascending order on the basis of scores obtained by them in the test. For the item analysis the investigator considered those who performed very well on the total test (the high group) and those performed most poorly (the low group), following the Dairs method, 27 percent scripts from upper and lower ranges of ability were taken for analysis. Then on the basis of carefully drawn out tally chart, Davis indices for difficulty, and discriminative values were calculated for every item in a sub-test. On the basis of the above said process by eliminating the items of poor discriminative index, 80 items were retained for final study, whose difficulty levels lie between 0.3 and 0.7 (and above) and discriminative indices lie between 0.2 to 0.5 (and above). Twenty two (22) were retained in Part-A, 18 in Part-B, 15 in Part-C and 25 in Part-D. The time limit was fixed at 80 minutes. Each item carried one mark. The marks lie between 0 and 80.

Reliability and Validity of the test

In the construction of the present BRT, a Split-half method of calculating reliability was adopted. The test was divided into four parts (A, B, C and D). Each part of the test was divided into two categories such as odd and even numbers for the purpose to calculate the coefficient. The coefficient of split-half reliability for the Part-A, Part-B, Part-C and Part-D corrected by the Spearman-Brown Formula were found to be 0.73, 0.74, 0.78 and 0.86 respectively. The reliability coefficient of the whole test (BRT) was 0.94. The index of the reliability (0.97) for the test indicates the maximum correlation in which the given test is capable of yielding in its present form (Garrett, 1981).

Validity is a relative term. A test valid for a particular purpose or in a particular situation is not generally valid (Garrett, 1981). Validity is that the quality of a data-gathering instrument or procedure that enables it to determine what it was designed to determine (Best, 1983). In other words, validity refers to the ability of a test to measure what it was supposed to measure. Validity is also referred to as 'the extent to which the procedure actually accomplishes, what it seeks to accomplish or measure what it seek to measure' (Fox, 1969). Judgments of face validity are very useful in helping an author to decide

whether his test items are relevant to some specific situation (eg. the military) or to specialized occupational experiences (p.355). The Battery of Reasoning Test (BRT) were given to senior experts like lecturers and senior school teachers in the field of Psychology to give their judgment about each item in the tool and its validity. They made some suggestions and it was carried out. Hence it can be considered that the tool has validity.

Results

The frequency distribution of Battery of Reasoning Test (BRT) scores descriptive statistics for the test scores are given in Table -1. The mean, median and mode of the scores were found to be 35.1, 34.9, and 34.5 respectively. The standard deviation of the BRT is 13.5. The maximum score obtained by the sample in this test was 70, while the minimum score obtained was 5, giving a range of 65.

In order to determine the 0.95 and 0.99 confidence interval limits of the population means, the SE_M was calculated. The SE_M was found to be 0.68. So it may be said that the 0.95 and 0.99 confidence interval limits of the true value of this sample mean are 33.8 and 36.4; and 33.4 and 36.9 respectively. A standard frequency polygon (Figure.1) has been drawn from the data given in the Table 1. The coefficient of Skewness is 0.04, which indicates that the distribution is slightly positively skewed. In this distribution Kurtosis is 0.283, which is greater than 0.263, denote that the sample distribution is Platykurtic.

Scores	f	Cum. f	Smoothed frequency	Descriptive Statistics
01 - 10	17	17		Mean = 35.1
11 - 20	61	78		Median = 34.9
21 - 30	80	158		Mode = 34.5
31 - 40	95	253		SD = 13.5
41 - 50	71	324		Minimum = 05
51 - 60	61	385		Maximum = 70
61 - 70	15	400		Range = 65
				Skewness = 0.04
				Kurtosis = 0.283
				SE_M = 0.68

Table 1. The frequency distribution of Battery of Reasoning Test (BRT)

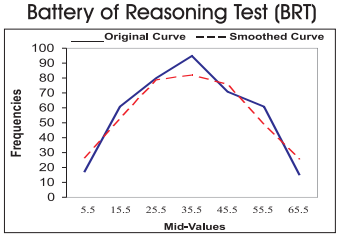

Figure 1. Original and Smoothed frequency Polygon on data given in Table 1.

In the case of the sub sample of boys the mean and standard deviation are found to be 41.4 and 13.2 respectively. As regards the sub sample of girls, the mean and standard deviation are found to be only 31.2 and 15.9 respectively. In order to determine whether the difference in reasoning test between boys and girls is significant or not, the null hypothesis that there is no such difference exists and the observed differences has arisen only due to fluctuations has been set up. The t-value was found to be 7.0 and it is significant at 0.001 level (see Table 2). Hence, the null hypothesis is rejected and interpreted that boys of this sample have more reasoning ability than girls.

In the case of the sub-sample of private school students' mean and standard deviation are found to be 44.6 and 12.9 respectively (see Table 3). Regarding the sub sample of government school students mean score and standard deviation are found to be 28.1 and 13.4 respectively. The calculated t-value is 12.6 which denote significant difference between mean scores of private and government schools at 0.001 level. Hence, the null hypothesis is rejected and it can be concluded that students studying in private schools are having higher reasoning power than the students studying in government schools.

Variable	Category	N	Mean	SD	t-ratio
Gender	Boys	200	41.4	13.2	7.0***
	Girls	200	31.2	15.9	

*** Significant at 0.001 level t-value at 0.001 level is 3.29

Table 2. Mean scores, SDs and t-ratio of students' reasoning abilities in relation to their gender

Variable	Category	N	Mean	SD	t-ratio
Type of school	Private schools	200	44.6	12.9	12.6***
	Government schools	200	28.1	13.4	

*** Significant at 0.001 level t-value at 0.001 level is 3.29

Table 3. Mean scores, SDs and t-ratio of students' reasoning abilities in relation to the type of school

The Table 4 shows the mean scores and SD for the BRT on four groups A, B, C and D from different type of schools. The highest score is obtained by the private school boys with the mean 47.9 and the lowest score (22.0) is obtained by the government school girls. There seem to be differences in the mean scores among the groups. Hence, Analysis of Variance (ANOVA) was applied to see the mean differences among the four groups called, Private school boys (A), Private school Girls (B), Government school boys (C) and Government school girls (D). The F-ratio for these four groups is 88.0 ($p<0.001$), which is highly significant at 0.001 level. The mean differences between the four groups are presented in the last column with an asterisk mark (*).

The result reveals that the four groups show marked difference and is significant. Hence, null hypothesis that there is no influence of educational institution upon the level of reasoning is rejected. It can be interpreted that private school students (either boys or girls) are performing better than students (either boys and girls) studying in government schools in their reasoning ability.

Variable	Category	N	Mean	SD	F-ratio	Mean differences
Type of School with gender	Private school boys (A)	100	47.9	10.0	88.0***	B C D
	Private school girls (B)	100	40.3	13.5		A * * *
	Government school boys (C)	100	34.9	12.2		B * *
	Government school girls (D)	100	22.0	10.3		C *

* Significant mean differences between groups
*** Significant at 0.001 level
Table values of F (3, 396) at 0.05 level is 3.86
Table values of F(3, 396) at 0.01 level is 6.71

Table 4. Mean scores, SDs and t-ratio / F-ratios of students' reasoning abilities in relation to the type of school with gender

Conclusions and discussion

The Battery of Reasoning Test (BRT) was constructed with 80 items to measure the reasoning abilities of the IX standard students. The reliability coefficient of the whole test is 0.94 which is high. The study results revealed that the boys performed better than girls in reasoning ability test. The difference between the private and government school students' mean reasoning abilities is significant and is in favour of private school students. In the further detailed analysis, it is found that boys studying in private schools are performing better than their counter parts that are girls of private schools, boys of government schools and girls of government schools. The lowest performance was found among the girls studying in government schools. Therefore proper care should be taken to develop reasoning powers of girls and particularly students studying in government schools.

The beginning of reasoning or logical thinking starts when we confront with a problem before the children, which has been framed on the intellectual lines. The power of reasoning has been properly developed, when the education has been correlated with the problems of the daily life. In order to draw reference in regard to problem one should follow certain rules related to psychology of education. The teacher should teach the students in such a way that they are able to think themselves, to improve their reasoning power. The power of logical thinking and reasoning can be acquired through practice, thus enlarging one's grasp of the mechanics of reasoning (Winch, 1922).

It is the moral commitment of the school to help learners not only to gain ideas but also to express them in understandable language. Too often loaded courses of study in our schools leave little time for reasoning abilities. Proper evaluation of students' performance in the class is an important job of a teacher. Hence, the teacher must take care in framing question paper with new thoughts and ideas.

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ABOUT THE AUTHORS

* Associate Professor of Education, University College of Education, Kakatiya University.

Dr. Mahender Reddy Sarsani is an Associate Professor of Education and he was the Principal and Head, University College of Education (Dept. of Education), Director, Centre for Adult, Continuing Education and Extension Activities and Chairperson and Board of Studies in Education (PG and UG) Kakatiya University, Warangal (AP). He received his PhD degree from Institute of Education, University of London, UK, in the area of Educational Psychology. He was awarded Commonwealth Academic Scholarship by the Commonwealth Scholarship Commission in the UK, London (1995-98). He may be contacted at drmrsarsani@yahoo.co.in