© Journal of the Indian Academy of Applied Psychology
July 2023, Vol. 49, No. 2, 202 - 210

Verbal Reasoning Abilities predict Academic Achievement among School-Going Adolescents: Evidences from Indian population

Debdulal Dutta Roy
Indian Statistical Instituete, Kolkata

Sumona Datta
Government General Degree College, Singur

Murshida Khatoon
GITAM School of Humanities and Social Science, Vishakapatnam

Verbal reasoning and its contribution to measuring students' success in the academic realm is an emerging area of research in school psychology. Students need to understand and reason using concepts that they acquire in the classroom to learn well and perform well during various academic assessments. The present study aimed at predicting academic achievement with verbal reasoning abilities namely, similarities-based reasoning, synthesis, syllogistic reasoning, data sufficiency, and coding. A verbal reasoning test battery and an academic achievement test were administered to a sample of 2083 adolescent students. Logistic regression analysis was fitted on the data. Success in academic achievement was treated as the outcome variable, whereas the five verbal reasoning abilities were the predictor variables. Results showed that the logistic model fitted to the data correctly, classifying 77.9% of the cases. Also, all five verbal reasoning abilities were found to be significant predictors of success in academic achievement with synthesizing ability being better than the other abilities. The significance of various domains of verbal reasoning in the prediction of academic achievement was established through this study.

Keywords: Verbal Reasoning, Academic Achievement, Adolescents, Prediction, Logistic Regression

Reasoning is concerned with inferences that are drawn from a theory, a principle, a rule, a heuristic, or a model, to the individual either infer new conclusions or evaluate proposed conclusions from what is already known. (Johnson-Laird and Byrne, 1993). Reasoning involves going beyond the information given (Bruner, Goodnow, & Austin, 1956) to a more structured and precise understanding. In reasoning, we move from what is already known to infer a new conclusion or to evaluate a proposed conclusion. Kamphaus (2001) defined reasoning as "that which follows a reasonable inference and or natural consequence, deducible or defensible on the grounds of consistency; reasonably believed or done. Samarapungavan (2009) defined reasoning as the set of mental processes used to derive inferences or conclusions from premises. According to him, reasoning helps to generate new knowledge and to organize existing knowledge, rendering it more usable for future mental work.

Verbal reasoning refers to understanding and reasoning using concepts framed in words. Verbal reasoning comprises the ability to analyze and evaluate written material and reason with the information obtained, for example analyzing relationships among parts of sentences or recognizing relationships among words and concepts. It is not just a simple reflection of fluency or vocabulary recognition. It is a cognitive system that entails a set of interrelated but distinct cognitive operations and several dimensions which form the basis of individual differences along these lines (Burton, Welsh, Kostin & van Essen, 2009).

The chances of a student successfully navigating through the school system depend heavily on the student's abilities to (1) understand what others convey, (2) communicate their thoughts (3) solve problems posed by various

academic curricula and social interactions within the school. All of these situations demand some form of verbal reasoning ability. Therefore, verbal reasoning abilities are critical for success. How well students reason is an excellent predictor of how they will do in school. Verbal reasoning assessments are distinguishable from assessments of other verbal skills, such as writing, listening, and speaking, or achievement in literature. Students require to employ verbal reasoning abilities to look at relevant details of a problem, formulate plans, apply general rules and principles to solve problems and evaluate alternate actions and their consequences.

The vital language skills measured in verbal reasoning assessments seem to be correlated with other language-centric skills and achievements (Donlon, 1984, p. 21; ETS, 2002, p. 15) such as patiently listening to arguments in a debate to conjure counter-arguments, expressing ideas in writing, and comprehending historical and literary articles.

However, the current teaching pedagogy in most schools, unfortunately, tends to emphasize content knowledge, and students are not sufficiently encouraged to develop analytical and critical thinking skills.

One way of enhancing verbal reasoning skills in the classroom setting is through introducing dialogue in the classroom or eliciting responses from students. But it is often seen that students are reluctant to respond in class as they feel that giving a wrong answer would be to lose face in the presence of peers as well as the teacher. Also, students often lack the courage to discuss ideas in class (Cheosokul, 2002).

Theoretical underpinnings of verbal reasoning

The theoretical explanations of verbal reasoning can be traced back to the 'metatheoretical framework' proposed by Sternberg (1980). Sternberg proposed that reasoning, problem-solving, and intelligence is closely interrelated and interdependent. The reasoning may involve conceptual representation initiated by sensory input, shifts in conceptual representations, or transformation of the same into a behavioral outcome. He also opined that these processes are contingent upon different functions such as planning actions, execution of the plans, learning skills for the execution, retaining the acquired knowledge, and application of the skills in comparable problem-solving situations.

Polk (1992) contradicts the three-part 'transduction paradigm' of reasoning, i.e., encoding the problem, employing reasoning processes to arrive at solutions, and decoding the solution. He contended that verbal reasoning represents an inferior kind of reasoning process to which individuals, lacking the complexities of superior reasoning abilities, resort, and is based heavily on repetitive linguistic modes for encoding problems.

Recent studies on verbal reasoning

Recent studies have either investigated the link between verbal reasoning and other cognitive skills or have drawn upon the theoretical aspects of verbal reasoning for explaining related cognitive phenomena. In a recent report by Low (2015) on children's theory of mind, predicting others' response (i.e., mindreading) is ascribed not only to observatory responses but also to verbal reasoning abilities, that is to say, children use observation skills as well as draw upon their general knowledge and wisdom to arrive at a prediction about others' behavior.

On a more pragmatic and contemporary note, a study by Rodriguez, Silva, Souza, Souza, and Brito (2016) reported the detrimental effects of rising global temperatures on students' numerical and verbal reasoning. This study rightfully points out the necessity of a comfortable physical environment for optimum performance on cognitive tasks thus deciding academic outcomes.

The cognitive complexities inherent in classroom learning were highlighted in a recent study by Gomez-Veiga, Chaves, Duque, and Madruga (2018). This study revealed that learning in school occurs sequentially, relying heavily on reasoning and metacognitive abilities. Also, out of all other cognitive competencies, reasoning abilities were found to be of utmost importance in determining the level of academic achievement.

Indian studies on verbal reasoning have focussed on issues like gender difference (Sarsani, 2008; Kanimozhi & Ganesan, 2017); its role in predicting mathematical aptitude (Kanimozhi & Ganesan, 2017; Pyari, Mishra & Dua, 2016); and its role in assessing the difference between students in the arts and sciences in terms of verbal reasoning abilities (Barmola, 2013).

Academic Achievement and Reasoning

Academic achievement is regarded as the successful completion of an academic goal or attaining a benchmark of academic performance. Simpson and Weiner (1989) contended that achievement test intends to measure systematic education and training in school occupation towards a conventionally accepted pattern of skills or knowledge. Achievement tests are used in diverse contexts to measure the degree to which examinees can demonstrate the acquisition of knowledge or skills deemed to be important. The contexts range from teacher-made achievement testing in elementary and secondary school settings to high-stakes testing for college admission, and licensure to practice a profession or certification. Teacher-made tests assess the attainment of specified knowledge or skills (Cizek,2004).

Reasoning skills are essential to students since they need to be able to discern and make valid and correct decisions on issues and problems concerning their academic and living environments. Several studies have emphasized the importance of reasoning in learning and academic achievement. Moore and Bruder (1996) stated that reasoning skills help students think clearly and logically, as answers to issues and problems usually entailed making careful distinctions in arguments, and solutions to these issues also required logical and critical thinking.

Powers and Dwyer (2003) pointed out that one of the most important factors on which success in college depended was the ability to reason well in the symbol systems used to communicate knowledge. According to them, reasoning tests correlate with academic success because reasoning abilities are very often required in school learning, whether for understanding a story, inferring the meaning of an unfamiliar word, detecting patterns and regularities in information, going beyond the information given to form more general rules or principles, or applying mathematical concepts to solve a problem. They added that, in these ways and hundreds of others, successful learning requires reasoning strategies. Mishra (2013), based on his findings, claimed that abstract reasoning, analogical reasoning, and deductive reasoning are reliable predictors of performance in high school science courses. Thus, of all cognitive abilities, the reasoning is perhaps the most general and central to academic learning and achievement.

To add to the literature on verbal reasoning and its role in academic achievement, the authors conducted a study with a newly developed test of verbal reasoning abilities. The aim was to include a variety of tasks requiring deductive and inductive reasoning in this test of verbal reasoning, to get a more comprehensive picture as to which reasoning abilities have an upper hand in predicting academic success among adolescents. Such an approach was expected to provide a deeper understanding about the differential contribution of verbal reasoning domains in academic performance.

Method

Participants

2083 students from 18 different schools participated in the study out of which 52 % were boys and 48% were girls. Schools were selected from different rural and sub-urban areas of West Bengal. All schools were under the West Bengal Board of Secondary Education. The medium of instruction in most of the schools was Bengali. Students of Grades IX and X participated in the study. Most of the students (62%) were from grade IX. A majority of students (as high as 91.41%) were from the Hindu community compared to other communities. Around 54% of the students belonged to the non-general (SC, ST, and OBC) community. Parents of the students differed by educational qualification. A large number of mothers were illiterate (around 93.5%) in comparison to fathers (around 30.7%).

Measures

Verbal reasoning measure

Verbal reasoning Test battery. The 47-item verbal reasoning test battery (Dutta Roy, 2015) consists of five subtests measuring five verbal reasoning abilities, namely similarities-based reasoning, synthesis, syllogistic reasoning, knowledge sufficiency, and symbolic representation. The subtests are briefly described below:

i. *Similarities subtest (10 items):* This subtest assesses the ability that allows classifying events or objects based on the proximity among them. The proximity can be perceived based on the resemblance among the events/objects. The reliability coefficient for this subtest is 0.84.

ii. *Anagrams subtest (11 items):* This subtest assesses the ability to manipulate relations among objects/events and combine them to form an interrelated meaningful whole is 0.88.

iii. *Syllogistic reasoning subtest (6 items):* This subtest assesses the ability to deduce inference regarding the relationship between objects or events, based on two or more premises. The reliability coefficient for this subtest is 0.28.

iv. *Data sufficiency subtest (8 items):* This subtest assesses the ability to reason whether a given set of knowledge is sufficient enough to justify a certain proposition. The reliability coefficient for this subtest is 0.51.

v. *Coding subtest (12 items):* This subtest assesses the ability to code numerals and alphabets based on some assumed relationship among them. The reliability coefficient for this subtest is 0.81.

Academic achievement measure

Academic achievement test. The Academic achievement test (Author, 2015) consists of 45 items assessing achievement in the language (English and Bengali) and science subjects (Maths and Science). The maximum score on this test is 60. The test has a reliability coefficient of 0.81. The test also has good criterion validity as the test scores were found to be significantly correlated with school examination scores.

Procedure

The verbal reasoning test battery was administered along with an academic achievement test. The instructions were given for each subtest separately in the questionnaire. They were further explained in lucid language, sometimes in the local dialect, so that the students could understand the task properly before starting it. Examples were also demonstrated and explained on the blackboard. On average, the participants took around 90 minutes to complete the whole test.

Statistical Analysis

The present data were analyzed using logistic regression. Academic achievement was the binary outcome variable considered and the five reasoning abilities were the predictor variables. The total score on academic achievement test obtained by each student was converted into percentages and then divided into two groups-pass and fail based on 40% criteria, i.e., students who got 40% or more on the academic achievement test were categorized as 'passed' (and coded as 1) and those getting below 40% were categorized as 'failed' (and coded as 0). 40% criteria were chosen as most schools and educational boards use 40% marks as the cut-off value to represent success in academic performance.

Results

Table 1 shows the mean and SD of the scores obtained by the students who passed the academic achievement test and who failed concerning the different reasoning abilities.

Logistic Regression analysis

Let us denote the probability that Y(outcome)=1 (i.e., passing the academic achievement test) by p and the probability that Y=0 (i.e., failing the academic achievement test) by 1- p and the predictor variables, namely similarities, anagrams, syllogistic reasoning, data sufficiency and coding by ,, , and respectively. From table 2, the following model can be written

ln (= -4.33+ 0.13* +0.34* +0.11*, +0.21* +0.18*

Table 1. Descriptive statistics of the five verbal reasoning abilities of 2083 students.

Outcome of Academic Achievement test	No. of cases	Similarities (10 items)		Anagrams (11 items)		Syllogistic reasoning (6 items)		Data sufficiency (8 items)		Coding (12 items)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pass	1149	5.41	2.74	8.72	2.14	1.79	1.17	3.07	1.58	6.34	2.91
Fail	934	3.02	2.61	4.55	3.51	1.19	1.17	1.59	1.46	3.10	2.71
Summary	2083	4.34	2.94	6.85	3.51	1.53	1.21	2.41	1.70	4.89	3.25

Table 2. Results of logistic regression of academic achievement test (pass/fail) of 2083 students.

Predictor variable	Estimated regression coefficient (B)	S.E.	Wald-test statistic value	df	p-value	Exp (B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Similarities	.13	.02	31.86	1	.001	1.14	1.09	1.19
Anagrams	.34	.03	187.15	1	.001	1.41	1.34	1.48
Syllogistic reasoning	.11	.05	4.33	1	.04	1.11	1.01	1.23
Data sufficiency	.21	.04	25.03	1	.001	1.24	1.14	1.34
Coding	.18	.02	59.34	1	.001	1.19	1.14	1.25
Constant	-4.33	.23	357.50	1	.001	.013		

According to the model, the log of the odds of a student passing on the academic achievement test is positively related to all five verbal reasoning abilities as indicated by the B-values (unstandardized regression coefficients) in table 2. In other words, the higher the score on the five reasoning abilities, the greater the probability of passing on the academic achievement test. The regression coefficient is highest for anagrams followed by data sufficiency whereas it is lowest for syllogistic reasoning.

The Wald test values indicate whether a particular predictor is a statistically significant predictor in the model. In the present case, since the Wald test values are all significant at 0.05 level, all the verbal reasoning abilities can be considered to be significant predictors in the model that is predicting the probability of passing the academic achievement test.

The column with the heading 'EXP(B)' gives the odds ratio for each of the predictor variables. The odds ratio means the change in the odds of the outcome due to a unit change in a particular predictor variable holding all other predictors constant. Since the odds ratio for all five predictors is over 1, it indicates that an individual getting a high score on these subtests is more likely to pass the academic achievement test. The odds ratio is greatest for anagrams (Exp(B)=1.41) and lowest for syllogistic reasoning (Exp(B)=1.11).

The improvement of the logistic model over the intercept-only model can be assessed by looking at the difference between the 'overall percentage' of cases correctly predicted by the intercept-only model (Table 3) and the logistic model (Table 4). The overall percentage of correctly predicted cases increased from 55.1 to 77.9 after the model is fitted with the data. This suggests that the model performs quite satisfactorily.

Figure 1 gives the classification plot. Conceptually it is similar to the classification table. Such a plot shows that where the event occurred (success was achieved, as indicated by '1' in the graph) the predicted probability was also high and that where the event did not occur (success was not achieved, indicated

Table 3. Classification table with only the constant included in the model

Observed			Predicted		
			Achievement category		Percentage Correct
			0	1	
Step 0	Achievement Category	0	0	934	.0
		1	0	1145	100.0
	Overall Percentage				55.1

Table 4. Classification table with the predictors included in the model

Observed			Predicted		
			Achievement category		Percentage Correct
			0	1	
Step 1	Achievement category	0	653	281	69.9
	Overall Percentage	1	178	967	84.5
					77.9

by '0' in the graph) the predicted probability was also low. Thus, if the model is good at predicting the outcome for individual cases, we should find a bunching of the observations towards the left and right ends of the graph. Figure 1 shows that majority of the students who were predicted to pass the academic achievement did pass (967 students as seen in table 4) with only a few numbers of cases (178 students) being misclassified. Similarly, for the failure group, 69.9% of the cases (i.e., 653 students) were correctly classified based on the predicted probabilities. Figure 1 shows the frequency of categorizations for different predicted probabilities and whether they fell in the 'passed' (i.e., 1) or 'failed' (i.e., 0) categorizations.

The Hosmer-Lemeshow test of goodness-of-fit generated an insignificant chi-square value of 12.83 (p-value being 0.12) (see Table 5). Thus, the null hypothesis that predicted values based on the estimated logistic model is not significantly different from the observed data is retained, indicating that the model is a good fit for the obtained data.

The Nagelkerke R^2 was estimated to be 0.517. Thus 51.7% of the variance in the observed data of academic achievement tests can be accounted for by the five predictor variables. However, as pointed out earlier, this R^2 is pseudo and is not very well defined for logistic regression. Hence this estimate need not be overemphasized.

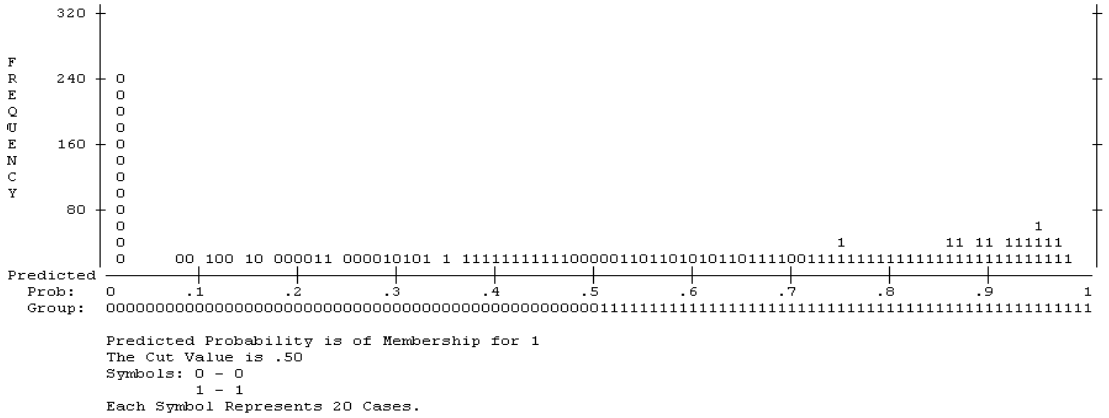

Figure 1. Classification plot for observed groups and predicted probabilities

Table 5. Output of Hosmer and Lemeshow Test and R^2

Step	Chi-square	df	Sig.	Nagelkerke R Square
1	12.83	8	.12	.517

Another way to examine the fit of the model is by plotting the ROC curve. It plots pairs of sensitivity and 1-specificity on a scatter plot which gives the ROC curve. Sensitivity refers to the proportion of correctly classified events and specificity refers to correctly classified non-events. The overall measure of model fit is assessed by the area under the curve (AUC). Larger the AUC, the larger the predictability of the model. In the present case, the ROC curve for anagrams has the largest AUC viz., 0.84 indicating that a model with anagrams as a predictor can better predict academic achievement compared to a model with syllogistic reasoning as a predictor as the latter has the least AUC value of 0.64.

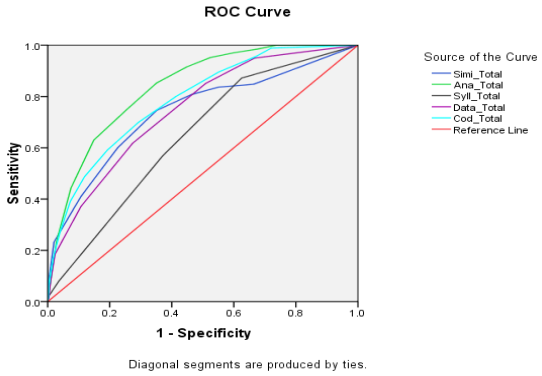

Fig. 2. ROC curve

Table 6. Area Under the Curve

Variable(s)	Area
Similarities	.260
Anagrams	.164
Syllogistic reasoning	.36
Data Sufficiency	.25
Coding	.21

Discussion

The results indicate that academic achievement can be predicted to quite an extent based on verbal reasoning abilities. The ability to synthesize (as revealed from the anagrams subtest) was found to contribute the most (B value=0.34) in predicting success in the academic achievement test. On the other hand, syllogistic reasoning was found to contribute the least in predicting success in the academic achievement test with B value=0.105. A possible reason behind this may be that syllogistic reasoning is a form of deductive reasoning which is thought to develop at a later stage in life, whereas inductive reasoning develops earlier in life (Goswami, 1996). So, it may be inferred that the syllogistic reasoning ability may not have been well developed in this group of adolescent students. Okoro & Oyanga (2014) found that the syllogistic reasoning ability of M.Ed. students does not significantly influence their performance in the Psychology of learning and that certain aspects of reasoning correlate more highly with academic achievement than others. The present finding is somewhat in line with the findings of Okoro & Oyanga (2014) in that syllogistic reasoning was indeed found to have made comparatively less contribution in predicting success in academic achievement. Another support for the findings of this study is found in the study by Powers and Dwyer (2003). They noted that reasoning tests correlate with academic success because according to them, reasoning abilities are very often required in school learning. Also, the claim made by Tella, Adika & Toyobo (2008) that pupils' reasoning ability is a sine qua non to the evaluation of their performance in learning and is an indicator or potential predictor of their future performance, provides support to the present findings.

As observed, all other verbal reasoning abilities, namely, similarities-based reasoning, knowledge sufficiency, and symbolic representation were comparatively better than syllogistic reasoning in predicting success in academic achievement but not as good as the ability to synthesize. Students need the ability to manipulate relations among objects/events and combine them to form an interrelated meaningful whole. It requires planning ability and reasoning of serial positioning as one has to plan and reason which event comes first and which follows next to form a meaningful whole.

On the other hand, syllogistic reasoning is a form of higher-order reasoning, that reportedly develops during adolescence (Inhelder & Piaget, 1958). However, Epstein (1978) reported that only 37% of all adolescents attain this cognitive level. Also, research has shown that not all persons in all cultures reach the stage of formal operations, and most people do not use formal operations in all aspects of their lives (Arnett, 2013). This may be a possible reason why the ability to synthesize has the upper hand in predicting success in academic achievement compared to other reasoning abilities, syllogistic reasoning, in particular.

To sum up, it may be said, verbal reasoning abilities play a role in predicting academic performance. However, other factors, such as non-verbal reasoning abilities can be included in the model to examine whether these further enhance the usefulness of the model and improves its ability to better predict outcomes on the academic achievement test.

Implications of verbal reasoning studies in school

It is quite clear to educators and school counsellors that one design does not fit all. Hence, to map a student for all his/her cognitive strengths and weaknesses, it is essential to adopt a multidimensional approach. This realization is reflected in the recent revisions of contemporary intelligence tests, such as the inclusion of the 'word reasoning' subtest in the Wechsler Adult Intelligence Scale IV (WAIS-IV) (Wechsler, 2008a) which essentially assesses verbal reasoning ability. However, more sophisticated reasoning abilities such as syllogistic, deductive, and inductive reasoning are undermined in the overall assessment of a student's prowess on the academic front. Research on verbal reasoning has pointed out its role in differentiating rational thinkers from non-rational ones thereby predicting their success or failures in school. Thus, verbal reasoning assessments can be used as an essential link between students' cognitive competencies and their academic performance which can help diagnose learning difficulties and therefore formulate customized educational interventions.

Having noted that verbal reasoning holds a distinctive position in the cognitive system, its interplay with other cognitive resources is not to be overlooked as none of the cognitive phenomena function in isolation from the others. For meaningful learning in school, students must learn to integrate perceptual and reasoning abilities along with other higher-order cognitive functions such as working memory functions and executive functions. This can be achieved only when educators and educational bodies are well aware of the intricacies of these cognitive systems and are well equipped to inculcate the requisite skills in students through school curricula carefully designed to help all students reach their highest potential.

Conclusion

The present study provided an overview of verbal reasoning research literature that attempted to look at what role verbal reasoning abilities play in predicting success in academic achievement. The present study aimed to test this prediction through a logistic regression model. Success on an academic achievement test was predicted by five different verbal reasoning abilities as assessed by a verbal reasoning test battery. The results showed that the model was a good fit for the observed data. The fitted model correctly predicted 77.9% of the cases. All five verbal reasoning abilities were found to be positively related to academic achievement and significantly predicted success in academic achievement. The study provided grounds for making verbal reasoning assessments an essential part of the discussion on school curricula design and diagnosis of learning difficulties.

References

Arnett, J.J. (2013). Adolescence and Emerging Adulthood: A Cultural Approach (5th ed.). New York: Pearson Education Inc. p. 91.

Author, (2015). Differential validity of computer programming abilities. Project Report: Psychology Research Unit, Indian Statistical Institute, Kolkata.

Barmola, K. C. (2013). Aptitude and academic performance of adolescents. *International Journal of Research in Social Sciences, 3*(4), 372-382.

Bruner, J. S., Goodnow, J. J., & Austin, G. (1956). A study of thinking. Oxford, England: Wiley.

Burton, N. W., Welsh, C., Kostin, I., & van Essen, T. (2009). Toward a definition of verbal reasoning in higher education. ETS Research Report Series, 2009(2), i-41.

Cheosokul, A. (2002). Education in Thailand,

Retrieved from; http://www.definethis.org/word/Education_in_Thailand.html, on 23 December 2010.

Donlon, T. F. (Ed.). (1984). The College Board technical handbook for the Scholastic Aptitude Test and Achievement Tests. New York: The College Board

ETS. (2002). Language courseware score interpretation guide. Princeton, NJ: Author.

Epstein. H, (1978). Growth spurts during brain development: Implications for educational policy and practice. In J.S. Chall & A.F. Mirsky (Eds.) Education and the Brain. pp. 343-370. Chicago: University of Chicago Press.

Gómez-Veiga, I., Vila Chaves, J. O., Duque, G., & García Madruga, J. A. (2018). A New Look to a Classic Issue: Reasoning and Academic Achievement at Secondary School. *Frontiers in psychology, 9,* 400.

Goswami, U. (1996). Analogical reasoning and cognitive development. In H. Reese(Ed.), Advances in Child Development and Behaviour. (Vol. 26, pp:91-138). New York Academic Press.

Inhelder, B., & Piaget, J. (1958). The Growth of Logical Thinking from Childhood to Adolescence. New York. Basic Books.

Johnson-Laird,P.N. & Byrne, R.M.J.(1993). Precis of Deduction. *The Behavioural and Brain Sciences, Vol. 16*(2); pp: 323-333

Kamphaus,R.W.(2001). Clinical Assessment of child and adolescent intelligence(2nd Ed.) Boston: Allyn and Bacon

Kanimozhi, P., & Ganesan, P. (2017). Reasoning ability among higher secondary students. *International Journal of Research-Granthaalayah, 5*(6), 471-475.

Low, J. (2015). Two-Systems View of Children's Theory-of-Mind Understanding. Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable, and linkable resource, 1-14.

Mishra, S. (2013). Reasoning ability in science of secondary school students in relation to some personal variables. *Journal of Humanities and Social Science, 10*(6), 08 – 13.

Moore, B., & Bruder, K. (1996). Philosophy: The power of ideas (3rd ed.). U. S. A.: Mayfield Publishing.

Okoro. C.C., & Oyanga, U.D. (2014). Syllogistic reasoning ability and academic performance of master's degree students in a South-South Nigerian university. *International Journal of Educational Research and Information Science, 1*(4), pp. 38-42

Polk, T. A. (1992). Verbal reasoning (No. CMU-CS-92-178). Carnegie-Mellon University, Pittsburgh, PA, Department of Computer Science.

Powers, D. E., & Dwyer, C. A. (May 2003). Toward specifying a construct of reasoning. Research Memorandum. Research Publications Office, Educational Testing Service, Princeton, NJ08541. Retrieved on 22nd December, 2013, from http://www.ets.org/Media/Research/pdf/RM-03-01-Powers.pdf

Pyari, P., Mishra, K., & Dua, B. (2016). A Study of Impact of Aptitude in Mathematics as Stream Selection at Higher Secondary Level. *Issues and Ideas in Education, 4*(2), pp. 141–149

Rodrigues, R., Silva, L., Souza, E., Souza, A., & Brito, F. (2016). Performance evaluation in teaching environments on climate change. In Occupational Safety and Hygiene IV (pp. 81-84). CRC Press.

Samarapungavan, A. (2009). Reasoning. Retrieved on 29th May, 2014, from http://www.education.com/reference/article/reasoning/

Sarsani, M. R. (2008). A Study of the Reasoning Abilities of Ninth Standard Students with Respect to Their Gender and Type of the Institution. *Journal on Educational Psychology, 1*(3), 44-54.

Simpson, J. A. & Weiner E. S. C. (1989). The Oxford English Dictionary (2nd ed.) vol. 1. Oxford: Clarendon Press.

Sternberg, R. J. (1980). Reasoning, Problem Solving, and Intelligence (No. RR-3-80). Yale University, New Haven Ct, Department Of Psychology.

Tella, A., Tella, A., Adika, L. O., & Toyobo, M. O. (2008). Relationship among demographic variables and pupils' reasoning ability. Electronic Journal of Research in Educational Psychology, 6(3), 709– 728.

Wechsler, D. (2008a). Wechsler Adult Intelligence Scale–Fourth Edition. San Antonio, TX: Pearson Assessment.

Debdulal Dutta Roy, Ph.D., Head & Associate Professor, Psychology Research Unit, 7th Floor, PJA Building, Indian Statistical Institute, 203, B.T. Road, Kolkata-700108. India

Sumona Datta, Ph.D. (Corresponding Author), Assistant Professor, Department of Psychology, Government General Degree College, Singur, Hooghly-712409. India Email id: sumonadatta.psych@gmail.com. ORCID ID: 0000-0002-9831-9508

Murshida Khatoon, Assistant Professor, Department of Applied Psychology, GITAM School of Humanities and Social Science, GITAM (Deemed to be) University, Vishakapatnam, India. Email id: mkhatoon@gitam.edu. ORCID ID: 0000-0002-4115-1361