THE RELATIONSHIP BETWEEN INTELLIGENCE, WORKING MEMORY AND ACADEMIC PERFORMANCE IN STUDENTS:

A PRELIMINARY STUDY

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Abstract:

The Present study aims to evaluate the State Board of Education (TNSBE) curriculum to what extent it utilizes and evaluates student's intelligence and working memory in their academic performance. In 2015, a survey conducted by the National Council for Education, Research and Training (NCERT) revealed that performance of students was close to the bottom in every subject. Literature suggests intelligence and working memory are reliable predictors of academic performance. It shows that outcome of training and evaluation to an extent depends on student's intelligence and working memory. Presently, we conducted a similar study on students who are studying under State Board Education Curriculum. Sixty students were selected randomly from 11th Grade of one private school and one Government aided School in Chennai and assessed with Raven's Standard Progressive Matrices for intelligence, WISC IV [India] subtests for working memory and for academic performance tenth board examination scores were taken. NIMHANS Index for Specific Learning Disability (1992) and Strength and Difficulty Questionnaire (Goodman, 1997) were used to rule out learning disability and emotional problems respectively. Results showed that the Tamil Nadu board of education's curriculum (Samacheer Kalvi) moderately utilizes and evaluates student's intelligence in their Academic performance.

Key words: Curriculum; Intelligence; Working Memory; Academic Performance.

Introduction

The objective of the present study is to evaluate to what extent intelligence and working memory are utilized and evaluated in State Board of Education Curriculum. Literature suggests strong correlation between intelligence and Academic Performance (Deary., et al, 2007) the logic being, that academic performance is dependent on individual's intelligence and academic performance is evaluated based on the curriculum of the respective Boards of Education, then to an extent intelligence is utilized and evaluated in teaching and evaluation process. With the assumption that effectiveness curriculums can be evaluated based on the correlation between Intelligence and Academic performance of students.

Intelligence, Working Memory and Academic Performance:

Watkins, et al (2007) have found high correlation between intelligence and academic performance. Academic performance was assessed by Teachers by conducting exams as per the protocol given by respective Board of education. In India, Chandra and Azimmudin (2013) has assessed 614 students with Dr. G. C. Ahuja's Group Test of Intelligence and compared with their tenth Grade scores. They found that there was a significant influence of Intelligence on board examination scores (Academic Performance). Working memory refers to responsible for temporarily storing and manipulation of information. In some studies, working memory was found as an effective predictor of academic performance in early stage of schools than later higher education (Tracy & Ross 2009). Wolfgang and Frank (2017) have found comparing to high school in childhood working memory has more influence on academic performance.

As per our assumption, a curriculum should utilize students Intelligence and working memory in their academic performance by proper modality of training and also should have proper evaluation process. Hence by finding the relationship of intelligence and working memory to academic performance, we are trying to assess the effectiveness of the curriculum like the previous studies conducted in western countries which has found strong correlation between intelligence and academic performance.

Hence the presence study aims to investigate the relationship between intelligence working memory and academic performance which helps to understand how much the curriculum utilizes and evaluates the intelligence and working memory.

Method:

Participants:

Sixty students (aging between 15 to 17 years) studying in class 11 were selected for the study. Among them 45 students were male and 15 were female. 30 students were randomly selected from a Government aided school and 30 students were selected from a private school. The medium of instruction in both the school were English.

Tools:

Raven's Standard Progressive Matrices for intelligence was used to measure the intelligence, WISC IV ^{India} subtests Digit span and letter number sequencing was used to assess the working memory and for academic performance tenth board examination scores were taken. NIMHANS Index for Specific Learning Disability (1992) comprised of tests to assess the areas of reading, comprehension, writing, spelling and arithmetic. The NIMHANS index was used to rule of the learning disability. Strength and Difficulty Questionnaire - SDQ(Goodman,1997) in which the Youth report measures for Children and Adolescents (SDQ 11-17) was used to screen emotional   problems. This tool measures five areas like emotional symptoms, conduct problem, hyperactivity, peer problem and prosocial behavior.

Study Period:

The study was conducted at one Chennai Government aided school and one private school during October 2017 to February 2018.

Procedure:

The participants were selected randomly using Random sampling technique. The intelligence test, SDQ and part of NIMHANS index writing, arithmetic was administered as a group. Working memory tests digit span & letter number sequencing and the NIMHANS index reading and comprehension part were administered individually. The participants were selected from two different school in Chennai, one was a Government aided school which comprises of students mostly from a lower socio economic status and the other school was a private school catering to middle class group. Before administration, formal permission was taken from the school authorities and informed consent was obtained from the parents as the participants were minors.

Though NIMHANS Index for Specific Learning Disability tool and Strength and Difficulty Questionnaire was used to screen the children with learning disability and emotional problems, in the scenario of the Government aided school it became difficult to screen based on it. The reason being, 20 out 30 students had difficulty in all

areas like reading, writing, spelling and arithmetic. The main reason being lack of exposure, the children mostly being the first generation learners and belonging to lower strata which discriminates them from the learning disability population. Secondly, though the students were studying in the English medium they were unable to comprehend the SDQ questions and hence they couldn't be screened for the emotional problems. Score of IQ test, working memory and Academic performance were taken irrespective of Learning Disability and Emotional problems which are confounding variables influencing academic performance. Only 52 students were taken for statistical analysis. Correlations between academic performance, working memory and Intelligence Scores are calculated using SPSS.

Results:

Analyzing the overall data (Table 1), intelligence and working memory were found to be moderately positively correlated with the total board exam scores (.40 & .32) and the subject scores Tamil (.36 & .28), English (.37 & .37), Mathematics (.35 & .26), Science (.38 & .26), Social science (.39 & .28) respectively. These correlation coefficients are significant at 0.01 level.

While looking at the Government aided school alone (Table 2), comparing to the overall, higher correlation is found between intelligence and board exam scores (.63) and the subject scores Tamil (.52), English (.62), Mathematics (.62), Science (.52), Social science (.54) respectively. These correlation coefficients are significant at 0.01 level. But the correlation between the working memory and academic performance are not found to be significant.

While looking at the private school alone (Table 3), no correlation was found between intelligence, working memory and academic performance.

Table-1. Correlation Coefficient between Board Exam Marks, Working Memory and Intelligence (overall sample)

		Total	Tamil	English	Mathematics	Science	Social Science	Working Memory	Intelligence
Total	Pearson Correlation	1	.906**	.935**	.882**	.939**	.919**	.327**	.407**
	Sig. (1-tailed)		.000	.000	.000	.000	.000	.009	.001
	N	52	52	52	52	52	52	52	52
Tamil	Pearson Correlation	.906**	1	.838**	.707**	.804**	.808**	.286*	.366**
	Sig. (1-tailed)	.000		.000	.000	.000	.000	.020	.004
	N	52	52	52	52	52	52	52	52
English	Pearson Correlation	.935**	.838**	1	.783**	.833**	.834**	.379**	.378**
	Sig. (1-tailed)	.000	.000		.000	.000	.000	.003	.003
	N	52	52	52	52	52	52	52	52
Mathematics	Pearson Correlation	.882**	.707**	.783**	1	.812**	.723**	.265*	.358**
	Sig. (1-tailed)	.000	.000	.000		.000	.000	.029	.005
	N	52	52	52	52	52	52	52	52
Science	Pearson Correlation	.939**	.804**	.833**	.812**	1	.869**	.268*	.386**
	Sig. (1-tailed)	.000	.000	.000	.000		.000	.027	.002
	N	52	52	52	52	52	52	52	52

Social Science	Pearson Correlation	.919**	.808**	.834**	.723**	.869**	1	.282*	.399**
	Sig. (1-tailed)	.000	.000	.000	.000	.000		.021	.002
	N	52	52	52	52	52	52	52	52
Working Memory	Pearson Correlation	.327**	.286*	.379**	.265*	.268*	.282*	1	.336**
	Sig. (1-tailed)	.009	.020	.003	.029	.027	.021		.007
	N	52	52	52	52	52	52	52	52
Intelligence	Pearson Correlation	.407**	.366**	.378**	.358**	.386**	.399**	.336**	1
	Sig. (1-tailed)	.001	.004	.003	.005	.002	.002	.007	
	N	52	52	52	52	52	52	52	52

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table-2. Correlation Coefficient between Board Exam Marks, Working Memory and Intelligence

(Government Aided school)

		Total	Tamil	English	Mathematics	Science	Social Science	Working Memory	Intelligence
Total	Pearson Correlation	1	.907**	.920**	.825**	.931**	.911**	.334	.631**
	Sig. (1-tailed)		.000	.000	.000	.000	.000	.064	.001
	N	22	22	22	22	22	22	22	22
Tamil	Pearson Correlation	.907**	1	.818**	.650**	.785**	.797**	.285	.529**
	Sig. (1-tailed)	.000		.000	.001	.000	.000	.099	.006
	N	22	22	22	22	22	22	22	22
English	Pearson Correlation	.920**	.818**	1	.727**	.764**	.835**	.464*	.627**
	Sig. (1-tailed)	.000	.000		.000	.000	.000	.015	.001
	N	22	22	22	22	22	22	22	22
Mathematics	Pearson Correlation	.825**	.650**	.727**	1	.779**	.589**	.311	.626**
	Sig. (1-tailed)	.000	.001	.000		.000	.002	.079	.001
	N	22	22	22	22	22	22	22	22
Science	Pearson Correlation	.931**	.785**	.764**	.779**	1	.859**	.213	.528**
	Sig. (1-tailed)	.000	.000	.000	.000		.000	.170	.006
	N	22	22	22	22	22	22	22	22
Social Science	Pearson Correlation	.911**	.797**	.835**	.589**	.859**	1	.248	.541**
	Sig. (1-tailed)	.000	.000	.000	.002	.000		.133	.005
	N	22	22	22	22	22	22	22	22
Working Memory	Pearson Correlation	.334	.285	.464*	.311	.213	.248	1	.308
	Sig. (1-tailed)	.064	.099	.015	.079	.170	.133		.081
	N	22	22	22	22	22	22	22	22
Intelligence	Pearson Correlation	.631**	.529**	.627**	.626**	.528**	.541**	.308	1
	Sig. (1-tailed)	.001	.006	.001	.001	.006	.005	.081	
	N	22	22	22	22	22	22	22	22

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table-3. Correlation Coefficient between Board Exam Marks, Working Memory and Intelligence

(Private School)

		Total	Tamil	English	Mathematics	Science	Social Science	Working Memory	Intelligence
Total	Pearson Correlation	1	.830**	.910**	.936**	.904**	.923**	-.002	.039
	Sig. (1-tailed)		.000	.000	.000	.000	.000	.496	.420
	N	29	29	29	29	29	29	29	29
Tamil	Pearson Correlation	.830**	1	.719**	.699**	.649**	.724**	-.073	.000
	Sig. (1-tailed)	.000		.000	.000	.000	.000	.353	.500
	N	29	29	29	29	29	29	29	29
English	Pearson Correlation	.910**	.719**	1	.824**	.794**	.810**	-.036	-.002
	Sig. (1-tailed)	.000	.000		.000	.000	.000	.427	.496
	N	29	29	29	29	29	29	29	29
Mathematics	Pearson Correlation	.936**	.699**	.824**	1	.827**	.827**	-.060	.034
	Sig. (1-tailed)	.000	.000	.000		.000	.000	.378	.431
	N	29	29	29	29	29	29	29	29
Science	Pearson Correlation	.904**	.649**	.794**	.827**	1	.830**	-.014	.094
	Sig. (1-tailed)	.000	.000	.000	.000		.000	.472	.314
	N	29	29	29	29	29	29	29	29

Social Science	Pearson Correlation	.923**	.724**	.810**	.827**	.830**	1	.121	.101
	Sig. (1-tailed)	.000	.000	.000	.000	.000		.266	.301
	N	29	29	29	29	29	29	29	29
Working Memory	Pearson Correlation	-.002	-.073	-.036	-.060	-.014	.121	1	.231
	Sig. (1-tailed)	.496	.353	.427	.378	.472	.266		.114
	N	29	29	29	29	29	29	29	29
Intelligence	Pearson Correlation	.039	.000	-.002	.034	.094	.101	.231	1
	Sig. (1-tailed)	.420	.500	.496	.431	.314	.301	.114	
	N	29	29	29	29	29	29	29	29

**. Correlation is significant at the 0.01 level (1-tailed).

Discussion:

In 2007 Deary et al found strong correlation (.81) between intelligence and Academic Performance. Though present study also found positive correlation between intelligence and academic performance but not strong as previous studies like Deary, et al (2007) in Europe and Chandra and Azimmudin (2013) in Lucknow, India.

As Wolfgang and Frank (2017) have found comparing to high school in childhood working memory has more influence on academic performance. Similarly, present study also found weaker correlation between working memory and academic performance than intelligence in higher classes. Therefore, it is an assumption that IQ acts as a mediator between children's working memory and their academic achievement.

Average of total Scores of students from private and Government Aided Schools are 421.33 and 348 respectively and this is a vast difference. The reason may be attributed to factors like extra coaching classes, frequent class tests, additional training to face board exams which facilitates rote memory, and providing lesser importance to extra- curricular activities, which is not the scenario in Aided School. And also the relationship between intelligence and academic performance in both schools has difference like, in Government Aided

School student's intelligence is highly correlated with academic performance at .01 level of significance but in Private school student's intelligence is not correlated with academic performance. The above said factors may aid to increase academic performance of the students in private school but not the intelligence of the students. Comparing to the private school, the Government aided school students showed poor performance on learning disability tool in all the areas of reading, comprehension, writing, spelling and arithmetic. Nearly two third of the students were having significant difficulty hence all these students cannot be accounted for learning disability but the issues like lack of early exposure, lower socio economic status, being first generation learners may be the contributing factors.

While looking at the results on the whole, the board of education's curriculum (Samacheer Kalvi) moderately utilizes and evaluates individual's intelligence. On comparing private and Government aided school, in aided school intelligence is a good predictor of academic performance than private school, where a Private school emphasis on rote memory which enables even a student in lower intelligence are able to score high marks in board exams.

Conclusion:

The education curriculum (Samachar kalvi) moderately utilizes and evaluate individual's intelligence in academic performance. Private school is more towards rote memory. Working memory is not used in school curriculum. Hence curriculum and teaching methodology should be designed to utilize intelligence and working memory.

Implication:

The present study helps in understanding the role of neuropsychology function in school curriculum. Teaching methodology could be design to encourage utilizing intelligence and working memory in schools.

Limitation:

1. The study was conducted in small sample size

2. The study didn't include other boards such as CBSE and ICIC

3. Confirming variables were not scrutinized and controlled

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