RESEARCH ARTICLE

AGE- RELATED DIFFERENCES IN REACTION TIME TASK PERFORMANCE IN SCHEDULED CASTE AND SCHEDULED TRIBES CHILDREN OF SONBHADRA DISTRICT.

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Manuscript Info	Abstract

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Background: The present study is an attempt to access the cognitive development of SC and ST children by using non-verbal test of reaction time. Reaction time is defined as the time that passes from the arousal of a sensory organ to a motor reaction. This test help in investigating SC and ST children to see the age related differences in their processing speed. Fast and quick responses show attentive mind and fast processing speed of brain.

Materials and Methods: Present study was conducted on 350 scheduled caste children and 407 scheduled tribe's children with an age group of 4 to 10 years. Study was conducted in villages of Sonbhadra district. For both auditory and visual reaction time three responses from each respondent were recorded in milliseconds (ms). Analysis was done on SPSS by applying independent sample t-test.

Observations & Result: Mean and standard deviation of VRT and ART of both SC and ST children were compared. While comparing VRT among groups it was found statistically significant in all age groups, but in ART it was found significant only in upper age group i.e 8, 9 and 10. Very prolong reaction time was given by both SC and ST children for audio and visual reaction time. Hence from our study we conclude that the cognitive development of both SC and ST is very poor.

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Introduction:-

Reaction time is the time interval between the presentation of the stimulus and appearance of a perfect voluntary response from the subject **(1).** Concept of reaction time was first described by Abu Rayhan al-Biruni**(2).** Reaction

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time in human is the measurement of nervous system in recognizing the stimulus. Once the human nervous system gets the stimulus the neurons then convey the message to the brain. The message then travels from brain to the spinal cords which then transfer it to hands and fingers. The motor neurons then guide the hand and fingers, how to react. Reaction time is usually measured in milliseconds. Efficiency of motor action can be predicted by determining the reaction time. Reaction time also helps in making prediction about the stability of attention.

Reaction time is a very important component of our cognitive system. Cognitive development means the ability to think, reason, understand and learn and it also includes memory and recall. Perceptual and sensory skills are part of our cognitive development. In other words cognitive development means the development of five senses, sight, hearing, taste, touch and smell which are further linked to physical development such as development of binocular vision and fine motor skills. The accepted figures for mean simple reaction time for college-age individuals have been about 190 ms for light stimuli and about 160ms for sound stimuli **(3,4,5,6).**

Audio-visual reaction time was investigated in scheduled tribes and scheduled caste children to see the age related differences in their processing speed. Fast reaction time is very important for any task performance and processing requirements. Reaction time is not only an indicator of good health but it can also be used to monitor an individual's condition overtime. Reaction time measures are studied extensively in the laboratory as measures of information-processing speed **(7,8).** Auditory reaction time (ART) is faster than visual reaction time (VRT) **(9,10).**Various factors affect reaction time like sex, age, physical fitness, type of stimuli, practice, distraction noise, weight, prenatal exposure of alcohol **(11,12,13,14,15)**.

Materials and Methods:-
Three hundred fifty (350) scheduled caste children and four hundred seven (407) scheduled tribe's children in age group 4 to 10 years were selected from various villages of Sonbhadra district. Villages from rural areas were purposively selected with having larger number of SC and ST population. Visits were made to the schools of selected areas and all available subjects lying in our selection criteria were taken. One stage cluster sampling method was implied for collecting data.

Reaction time was measured by using audio-visual reaction time apparatus (Model no.-RTM-608) made by MEDICAID systems. The reaction time range is 0 to 999.9999 sec. All the responses given by children were recorded in milliseconds (msec). Both for auditory and visual time reaction three responses were recorded to get more accuracy and mean of these three responses were taken. The readings were taken between 9 am - 4 pm in daylight in silent room. Instrument was kept on table & subject was made to sit comfortably on chair. Practice was taken from each subject until they have understood and performed the task as required. Subject was asked to press & immediately release the switch with the thumb of right hand as soon as he saw the glow of yellow light or hearing sound. This gave reaction time in milliseconds on time display of instrument. Each time 3 readings of VRT & ART were taken and lowest was used as final reading.

Statistical significance of various differences was analyzed by using independent sample t-test. SPSS 16.0 was used for calculating data. We have used levene's test for checking equality of variance and used the t-statistics accordingly. $P < 0.05$ was considered to be statistically significant.

Result:-
Mean and standard deviation of VRT and ART of both SC and ST children were given in Table 1 and 2. Mean of visual reaction time of both SC and ST were compared in Table 1 by using independent sample t-test and it was found statistically significant in all age groups. From the given table we can also observe that the mean of VRT of SC is lower than the ST in all age group except in age group 4, which means that they were a little faster in giving the responses.

Table.1:- Mean and standard deviation of visual reaction time of SC and ST children

Statistical Significance	t-test	Std. Error Mean	Std. Deviation	Mean	No. of children	Caste	Age	
Yes (P value 0.034)	2.149	20.859	147.492	585.82	50	Scheduled caste	**visual**	4
		17.986	134.592	526.93	56	Scheduled tribes		
Yes (P value 0.002)	-3.210	8.304	62.145	503.27	56	Scheduled caste	**visual**	5
		8.119	62.889	540.57	60	Scheduled tribes		
Yes (P value 0.006)	-2.826	11.996	76.814	475.37	41	Scheduled caste	**visual**	6
		12.389	79.330	524.10	41	Scheduled tribes		
Yes (P value 0.000)	-11.917	7.013	54.326	415.68	60	Scheduled caste	**visual**	7
		6.005	51.310	525.71	73	Scheduled tribes		
Yes (P value 0.000)	-11.298	6.742	45.225	400.49	45	Scheduled caste	**visual**	8
		8.512	60.788	525.41	51	Scheduled tribes		
Yes (P value 0.014)	-2.521	20.244	140.254	476.31	48	Scheduled caste	**visual**	9
		9.157	69.137	532.32	57	Scheduled tribes		
Yes (P value 0.011)	-2.602	12.980	91.782	504.74	50	Scheduled caste	**visual**	10
		7.522	62.479	543.77	69	Scheduled tribes		

Whereas in Table 2 mean of audio reaction time of both SC and ST are not statistically significant in all age group. It is significant only in upper age group i.e. 8, 9 and 10. This means that in lower age group the reaction time for audio is same in both SC and ST groups, but significant difference was seen in the upper age between the groups. SC children response on audio reaction time was quick and fast in comparison to ST children in age group 4, 5, 6, 9 and 10 only.

Table. 2:- Mean and standard deviation of audio reaction time of SC and ST children.

Statistical Significance	t-test	Std. Error Mean	Std. Deviation	Mean	No. of children	Caste	Age	
No (P value 0.657)	-0.446	21.400	151.322	716.56	50	Scheduled caste	**Audio**	4
		18.821	140.843	729.27	56	Scheduled tribes		
No (P value 0.529)	-0.631	16.227	121.435	695.57	56	Scheduled caste	**Audio**	5
		21.460	166.229	712.55	60	Scheduled tribes		
No (P value 0.702)	-0.384	19.631	125.699	697.66	41	Scheduled caste	**Audio**	6
		20.688	132.465	708.61	41	Scheduled tribes		
No (P value 0.705)	0.379	16.440	127.347	684.42	60	Scheduled caste	**Audio**	7

P value	t-test	Std. Error Mean	Std. Deviation	Mean	No. of children	Caste	Age	
		13.171	112.534	676.53	73	Scheduled tribes		
Yes (P value 0.000)	3.652	19.773	132.641	702.98	45	Scheduled caste	**Audio**	**8**
		15.023	107.289	612.29	51	Scheduled tribes		
Yes (P value 0.000)	3.595	17.605	121.969	511.50	48	Scheduled caste	**Audio**	**9**
		14.530	109.700	592.82	57	Scheduled tribes		
Yes (P value 0.000)	3.305	14.883	105.237	532.36	50	Scheduled caste	**Audio**	**10**
		13.919	115.619	600.72	69	Scheduled tribes		

In Table 3 and 4 comparisons between SC and ST for both VRT and ART was done in female and male children respectively. In table 3 a significant difference was seen between SC and ST females in age group 4, 5, 7 and 8 while comparing VRT, whereas in ART it is significant only in age group 5 and 9. Form the given table we can see that the same age group of female with different groups were performed better and fast in the visual reaction time than from audio reaction time. This is same with the male children they also performed fast and quick in VRT than in ART in almost all age groups.

In table 4 a significant difference was seen between SC and ST male children in age group 6, 7, 8 and 9 while comparing VRT, whereas in ART it was significant in all age group except in age 6. But the mean of VRT and ART of SC and ST children was very high in comparison to accepted figures for mean simple reaction time. This result revealed prolonged reaction time in both SC and ST children for VRT and ART.

Table 3:- Age related comparison between the female children of SC and ST groups in both audio and visual reaction time.

P value	t-test	Std. Error Mean	Std. Deviation	Mean	No. of children	Caste	Age	
Yes (P value 0.023)	2.334	31.838	162.343	622.23	26	Scheduled caste	**visual**	4
		29.336	157.977	521.34	29	Scheduled tribes		
No (P value 0.099)	1.677	25.954	132.341	792.04	26	Scheduled caste	**audio**	
		26.428	142.318	729.66	29	Scheduled tribes		
Yes (P value 0.000)	- 4.861	10.776	58.031	471.21	29	Scheduled caste	**visual**	5
		11.513	63.058	547.97	30	Scheduled tribes		
Yes (P value 0.000)	- 5.276	14.310	77.063	642.69	29	Scheduled caste	**audio**	
		27.112	148.497	804.43	30	Scheduled tribes		
No (P value 0.318)	- 1.011	21.046	96.444	494.19	21	Scheduled caste	**visual**	6
		12.195	54.536	519.10	20	Scheduled tribes		
No (P value 0.893)	0.135	23.355	107.028	720.62	21	Scheduled caste	**audio**	
		29.576	132.269	715.55	20	Scheduled tribes		
Yes (P value	- 8.418	10.433	57.143	437.33	30	Scheduled	**visual**	7

P value	t-test	Std. Error Mean	Std. Deviation	Mean	No. of children	Caste		Age
0.000)						caste		
		6.811	42.534	538.31	39	Scheduled tribes		
No (P value 0.099)	- 1.674	17.793	97.457	638.90	30	Scheduled caste	**audio**	
		19.387	121.069	684.21	39	Scheduled tribes		
Yes (P value 0.000)	- 7.674	10.002	47.966	413.65	23	Scheduled caste	**visual**	8
		10.949	58.961	530.21	29	Scheduled tribes		
No (P value 0.315)	1.015	25.652	123.024	667.74	23	Scheduled caste	**audio**	
		21.796	117.375	633.76	29	Scheduled tribes		
No (P value 0.349)	0.947	33.551	153.750	580.95	21	Scheduled caste	**visual**	9
		15.234	74.633	547.50	24	Scheduled tribes		
No (P value 0.106)	-1.660	29.864	136.855	523.71	21	Scheduled caste	**audio**	
		17.981	88.090	581.58	24	Scheduled tribes		
No (P value 0.069)	-1.875	20.40	95.71	496.32	22	Scheduled caste	**visual**	10
		12.40	73.40	541.09	35	Scheduled tribes		
No (P value 0.137)	-1.511	19.79	92.843	567.14	22	Scheduled caste	**audio**	
		20.996	124.214	613.69	35	Scheduled tribes		
P value	**t-test**	**Std. Error Mean**	**Std. Deviation**	**Mean**	**No. of children**	**Caste**	**Age**	
No (P value 0.675)	0.42	24.644	120.730	546.38	24	Scheduled caste	**visual**	4
		20.522	106.637	532.93	27	Scheduled tribes		
Yes (P value 0.01)	-2.47	26.084	127.786	634.79	24	Scheduled caste	**audio**	
		27.318	141.951	728.85	27	Scheduled tribes		
No (P value 0.76)	0.307	8.954	46.529	537.70	27	Scheduled caste	**visual**	5
		11.484	62.903	533.17	30	Scheduled tribes		
Yes (P value 0.00)	3.75	26.055	135.387	752.37	27	Scheduled caste	**audio**	
		23.592	129.221	620.67	30	Scheduled tribes		
Yes (P value 0.00)	-3.06	9.560	42.754	455.60	20	Scheduled caste	**visual**	6
		21.506	98.551	528.86	21	Scheduled tribes		
No (P value	-0.65	31.632	141.462	673.55	20	Scheduled	**audio**	

P value	t	col3	col4	mean	N	Group	Stimulus	Age
0.51)						caste		
		29.584	135.572	702.00	21	Scheduled tribes		
Yes (P value 0.00)	-9.24	7.680	42.064	394.03	30	Scheduled caste	**visual**	7
		9.789	57.081	511.26	34	Scheduled tribes		
Yes (P value 0.04)	2.01	25.304	138.598	729.93	30	Scheduled caste	**audio**	
		17.659	102.969	667.74	34	Scheduled tribes		
Yes (P value 0.00)	-8.31	8.221	38.560	386.73	22	Scheduled caste	**visual**	8
		13.633	63.946	519.09	22	Scheduled tribes		
Yes (P value 0.00)	4.55	28.782	135.002	739.82	22	Scheduled caste	**audio**	
		18.541	86.964	584.00	22	Scheduled tribes		
Yes (P value 0.00)	-8.91	7.825	40.659	394.93	27	Scheduled caste	**visual**	9
		11.096	63.740	521.27	33	Scheduled tribes		
Yes (P value 0.00)	-3.23	21.319	110.774	502.00	27	Scheduled caste	**audio**	
		21.544	123.767	601.00	33	Scheduled tribes		
No (P value 0.07)	-1.85	16.966	89.775	511.36	28	Scheduled caste	**visual**	10
		8.534	49.761	546.53	34	Scheduled tribes		
Yes (P value 0.00)	-3.01	20.384	107.865	505.04	28	Scheduled caste	**audio**	
		18.220	106.241	587.38	34	Scheduled tribes		

Table 4:- Age related comparison between the male children of SC and ST groups in both audio and visual reaction time.

Discussion:-

In our study, the reaction time was very longer for the responses to the auditory and visual stimuli from both group's children. The cause of this was their less attentive minds and slow information processing speeds. Most likely it was because of the environment in which they were growing. Various environmental factors have been shown to influence the development of cognitive, language and behavioral in infant and children like maternal IQ, education level, and socioeconomic status (SES) of the parents, quality of the home environment **(16),** maternal knowledge of the child development and maternal coping **(17).** All of these environmental factors were lacking in our study group. In our study we observed that their only interest in going school was because of the mid-day meal provided by the government. Children were mostly available in the early hours of school and after eating meal they mostly escape the school. On the other hand their education lacks various exercises and activities which are very important for cognitive development. Our study data reveals that in VRT SC children response were little faster than the ST children, and hence their comparison were found statistically significant in all age groups. Where as in ART SC and ST comparison was statistically significant only in the upper age groups (8, 9 and 10 years). In ART also SC children performance was little better than ST children but not in all age groups. Most disappointing thing which we observe in our study was that with an increase in the age there was not much difference in their responses.

Researchers use reaction time to examine recognition of their subjects. **Kircher et al. (2001)** used a reaction time experiment to examine recognition in his samples. Hence their slow performance in both ART and VRT shows a

very low recognition power in them. They couldn't recognize three different sounds for three different buttons. Recognizing three different buttons for three different colors was easy but not for all. **McEvoy, Pellouchoud, Smith and Gevins (2001)** conduct reaction time experiment to study memory whereas **Stuss et al. (1999)** use it for exploring attention. Hence slow responses in both ART and VRT means low memory and attention in children. Both SC and ST children had taken very longer time in giving responses to the stimulus.

Another most important reason for their slow reaction time is the lack of good anticipatory skill. Children living in the rural areas of the Sonbhadra district weren't very comfortable with these instruments. Despite of our best efforts in making them comfortable with us they were not. They highly lack confidence. Lack of proper nutrition is also another most important cause for this. Children belonging to poor socio cultural environment suffer highly from nutritional deficiencies and infections which adversely affect their intellectual and behavioral development **(21, 22).** These children because of the overcrowded homes with poor sanitation and water supply, low income, limited parent's education and intelligence and a little knowledge of child development and importance of play may also suffer from depression.

Conclusion:-
From our study we conclude that the cognitive development in SC and ST children is very poor. Children were taking very long time in giving responses to the stimulus. Their performance in both VRT and ART was very bad. There wasn't much difference in 4 years and 10 year children response and also not much difference between the genders in both groups. Low anticipatory skills, less attentive minds and slow information processing speeds are the main reason for their poor performance. Various other factors are all there which affect their performance like physical unfit, lack of practice, weight and poor nutritional status. These children aren't very social in nature they rarely get the chance to interact with urban people and their lifestyle. Hence they weren't able to mix up with us properly in spite of our all efforts. This may be one of the reasons for their slow performance. Scheduled caste and scheduled tribes wherever they are living they are facing a lots of problem. In our society almost all activities like economical, political, educational and socio-cultural revolve around the notions of caste. This structural form and relationships has come to some change in the urban setting but not in rural. Hence our government should require paying attention on this group. Proper education facilities with various exercise and activities which help the children in improving their scholastics performance were provided to them.

Acknowledgments:-

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