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# Analysis of SNE Learner's Performance Using NASA Scaling

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**Abstract** Computer science and computing technologies are applied into mathematical, science, medical, engineering and educational applications. The models are used to solve the issues in all the domains. Educational systems are used top down, bottom up, Gap Analysis model in the educational learning system. Educational learning process integrated with Lerner, content and the methodology. The Learners and content are same in the educational system or similar courses but the teaching methodologies are differing one with another. The determinations of teaching methodologies are based on the factors related to that particular model or subject. The learning model influencing determinations are made by the surveys, analysis and observation of data to maximize the learning outcome. This paper attempted to evaluate the SNE learners cognitive using NASA Scaling.

• **Key Words** : NASA Scaling, Learner Performance Analysis, Special Need Education

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## 1. INTRODUCTION

The educational application is one among the significant area by the researcher for the determination of educational features such as learning tool a mapping, association of learning and the learners' relationship, pedagogy analysis, e-learning analysis etc. The researchers faced the challenges to map the tools for the learning objectives and e-learning processes of the learners' groups and mapping of learners' objectives to reach the maximum level of achievement via reaching the learners' understanding by the use of clustering, classification and association techniques. The Special Need learners' behavior is observed by the researchers to visualize effectiveness in learning process. The data representation and analysis techniques are meeting the goals of the mining objectives.

## 2. COPE

This research paper aimed to design a model for to determine cognitive behaviour and educational performance of special need learners using data mining techniques through the back propagation algorithm. It is aimed to obtain the influencing behavioural pattern for the learning process and the associated cognitive memory.

## 3. BACKGROUND

The educational right act aimed to provide education for all irrespective of age, gender, region, community and challenges of the human by birth. A Global Perspective on Right to Education and Livelihoods clearly delineates the need for capacity building through the inclusion of persons with disabilities in the workplace and the larger community. The statement

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affirms the importance of things as (i) improving educational opportunities, (ii) promoting sustainable livelihood for persons with disabilities, (iii) capacity building and institutional development for realization of effective participation of persons with disabilities, (iv) promotion of the rights and dignity of persons with disabilities, (v) documentation of best practices and appropriate technologies in research on education, (vi) strengthened teacher training, development of inclusive curricula, and effective involvement of families and communities for realization of quality education for all children (United Nations Economic and Social Commission for Asia and the Pacific, 2005).

Children with special need education includes those who are physically handicapped, moderately or severely learning disabled, blind and partially sighted, deaf and partially hearing, and any child who, for some or other reasons requires additional educational provision. The special education for these children is interpreted and perceived, as much as possible, as "additional" rather than as "different." It [11,4] with SNE in the following ways.

Firstly, computers can be used as a diagnostic aid in the sense that "a combination of educational and psychological testing tools with computer technology might greatly assist in the diagnosis of learning problems" Secondly, computers can be used as a learning environment. Through different software packages such as word processors, graphics and games, children can improve their ability to solve problems. Thirdly, computers can be used as a communication aid. Finally, computers can be used as a provider of feedback for children with special learning difficulties [1].

In the special need educational process, barriers to the provision of quality education for children with disabilities identified [9]. The factors include negative attitudes, exclusionary policies and practices,

inadequate teacher training. In the teaching process, particularly training of all regular teachers to teach children with diverse abilities, inflexible curriculum, assessment procedures, inadequate specialist support staff to assist teachers of special and regular classes, lack of appropriate teaching equipment and devices and failure to make modifications to the school environment are familiar[12,10,5,2].

#### 4. METHODOLOGY

Determination of the cognitive behavioural and educational performance of special need learners using data mining techniques attempted to identify the relationship between the cognitive load and the learning performance of the learners in different learning objectives. The learns performance differ based on their cognitive load and learning objectives. This research observed the cognitive load of different challenging learners while learning the same objectives. In the learning process objectives are designed with the memory, operation and motional based activities. The learner cognitive load is observed using NASA scaling processing with the raw measure and calculated the weighted load[6][7]. The cognitive load relations of the different learner's performance are analyzed.

The Special Need learners' behavior is observed by the researchers to visualize effectiveness in learning process. The data representation and analysis techniques are meeting the goals of the mining objectives.

This research aimed to determine the cognitive behavior and educational performance of special need learners using data mining techniques through the back propagation algorithm. It is aimed to obtain the influencing behavioral pattern for the learning process and the associated cognitive memory. These objectives obtained with the proper real time dataset and implementation of the appropriate algorithm. The data

observation designed to study cognitive load such as mental, physical, temporal, performance, effort and frustration using NASA scaling. This scaling process observed in the long term, short term, working, instant, responsive, process, recollect, reference, instruction and action memory according to the specialized exercise to the special need educational learners. The observed set of data represented using cubical dataset format for the mining approach. The learners' difficulties are identified through the experimental results and recommended for the appropriate training method for the development of the skillset to reach the special need learner into normal learning group.

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## 5. MEMORY AND LEARNING

A variety of memory problems are evidenced in the learning disabled. Some major categories of memory functions wherein these problems lie are:

**Receptive memory:** This refers to the ability to note the physical features of a given stimulus to be able to recognize it at a later time. The child who has receptive processing difficulties invariably fails to recognize visual or auditory stimuli such as the shapes or sounds associated with the letters of the alphabet, the number system, etc.

**Sequential memory:** This refers to the ability to recall stimuli in their order of observation or presentation. Many dyslexics have poor visual sequential memory. Naturally this will affect their ability to read and spell correctly. After all, every word consists of letters in a specific sequence. In order to read one has to perceive the letters in sequence, and also remember what word is represented by that sequence of letters. By simply changing the sequence of the letters in name, it can become mean or amen. Some also have poor auditory sequential memory, and therefore may be unable to repeat longer words orally without getting the syllables in the wrong order, for example words like preliminary and statistical.

**Rote memory:** This refers to the ability to learn certain information as a habit pattern. The child who has problems in this area is unable to recall with ease those responses which should have been automatic, such as the alphabet, the number system, multiplication tables, spelling rules, grammatical rules, etc.

**Working memory or short-term memory:** Working memory or short-term memory lasts from a few seconds to a minute; the exact amount of time may vary somewhat.

**Long-term memory:** This refers to the ability to retrieve information of things learned in the past. Until the learning disabled develop adequate skills in recalling information, they will continue to face each learning situation as though it is a new one. No real progress can be attained by either the child or the

teacher when the same ground has to be covered over and over because the child has forgotten. It would appear that the most critical need that the learning disabled have is to be helped to develop an effective processing system for remembering, because without it their performance will always remain at a level much below what their capabilities indicate.

Strangely, though, while memory is universally considered a prerequisite skill to successful learning, attempts to delineate its process in the learning disabled are few, and fewer still are methods to systematically improve it.

There are various other categorizations of memory and types of memory that have captured research interest. Around ten exercise are designed with specific learning objectives. All these deficit processes could be occurred based on the cognitive load and the thinking capacity of the learners. Therefore the research attempted to identify the cognitive level of the learner to over come the learning deficit. The referred and optimized adoptable method could be recommends as a pattern according to the learner’s special need. The observation process is adopted using NASA scaling.

## 6. SCALING FOR COGNITIVE LOAD

NASA task load index is a multidimensional rating procedure that provides over all work load based on a weighted average of rating on six subscales: mental demand , physical demand , temporal demand , Own performance ,Effort and Frustration[3]. This technique (referred to as the “NASA Bipolar Rating Scale”) was quite successful in reducing between-rater variability and provided diagnostic information about the magnitudes of different sources of load from subscale ratings[8,13]. However, its sensitivity to experimental manipulations, while better than found for other popular techniques and as a global one-dimensional workload rating

[Table 1] frequency of Cognitive Load Observation

	Frequency						Tot. frq
	ME (1)	PH (2)	TE (3)	PE (4)	EF (5)	FR (6)	
1	2	3	3	3	1	3	15
2	4	1	2	5	2	1	15
3	0	0	0	0	0	0	0
4	3	2	2	2	1	4	14
5	4	1	5	3	1	1	15
6	3	3	2	4	1	2	15
7	4	3	5	2	0	1	15
8	4	2	4	3	0	2	15
9	4	3	2	5	0	1	15
10	4	3	2	5	0	1	15

[Table 2] Raw Rating Scale of Cognitive Load Observation

Raw Rating scale					
ME(1)	PH(2)	TE(3)	PE(4)	EF(5)	FR(6)
12	11	12	14	5	4
13	13	11	15	5	4
13	12	11	14	4	3
14	13	11	14	5	4
12	11	12	13	4	3
12	11	12	13	4	3
14	13	11	15	5	4
13	12	11	14	5	4

[Table 3] Raw Rating of Cognitive Load Observation

Raw Rating					
ME(1)	PH(2)	TE(3)	PE(4)	EF(5)	FR(6)
60	55	60	70	25	20
65	65	55	75	25	20
0	0	0	0	0	0
65	60	55	70	20	15
70	65	55	70	25	20
60	55	60	65	20	15
60	55	60	65	20	15
60	55	60	65	20	15
70	65	55	75	25	20
65	60	55	70	25	20

The degree to which each of the six factors contributes to the workload of the specific task to be evaluated from the raters' perspectives is determined by their responses to pair-wise comparisons among the six factors. Magnitude ratings on each subscale are obtained after each performance of a task or task segment. Ratings of factors deemed most important in creating the workload of the task are given more weight in computing the overall workload score thereby enhancing the sensitivity of the scale [HAR 1986]. Mental demand deals with mental and perceptual activity was required for learning the concept and implementation Cognitive performance Load (CPL). Physical demands focused physical activity was required. Temporal demand deals with time pressure of the students while learning the CPL.

Performance shows the accomplishment of goals of the task set by the experimenter. Frustration level specifies the insecure, discouraged, irritated, stressed and annoyed versus of the learning. Effort measures the work to accomplish your level of performance

### 7. Cognitive weight Calculation

From the observation of grade and the cognitive load, the Cognitive load of six demands occurrence and raw ratings are converted into the weight. The frequency values are multiple with raw rating a calculated raw rating.

Table 1. Frequency and raw rating

[Table 4] Adjusted Rating

1	8	120	165	180	210	25	60	760	51
2	10	260	65	110	375	50	20	880	59
3		0	0	0	0	0	0	0	0
4	3	195	120	110	140	20	60	645	43
5	9	280	65	275	210	25	20	875	58
6	6	180	165	120	260	20	30	775	52
7		240	165	300	130	0	15	850	57
8	3	240	110	240	195	0	30	815	54
9	10	280	195	110	375	0	20	980	65
10	9	260	180	110	350	0	20	920	61
	5.8	205.5	123	155.5	224.5	14	27.5	750	50

Table 2 : Raw rating

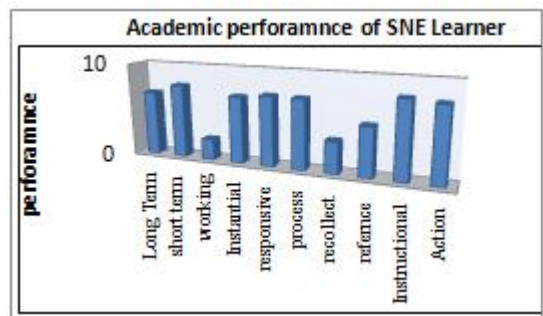
Rating = Frequency \* Raw Rating Scale The raw rating is multiplied with Frequency and the adjusted rating value is calculated. The average value of cognitive load is derived and presented below.

The observed data set is evaluated with corresponding memory values and the average is presented as table

[Table 5] memory level observations

MT	LT	ST	W	I	R	P	R	R	I	A
P	7	8	2	7	7	7	3	5	8	8

The working exercise includes mathematical calculation; therefore the SNE learners have not attended the exercise. Next to the working exercise, recollect exercise has the writing work also secured minimum mark. The short term, instructional and action memory model exercise are provides more performance value. The overall performance is 6.36 for the learners. While the learning performance differ depends on the cognitive load. The cognitive load values are differing for each learning process. The minimum and maximum and the average values are represented



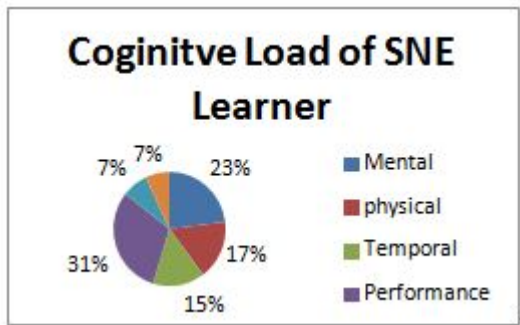
[Fig. 1] Academic performance

The memory process of learning is affected cognitive model. The six models and the obtained vales are presented as a table.

[Table 6] Cognitive Performance

	35	40	23	16	3	0	23
	358	233	181	428	203	226	71
	156	115	101	210	51	47	45
	145	118	101	223	36	28	44

The overall process of cognitive load is minimum of 23 % and the maximum of 71%. The temporal load of the learner is minimum level while the performance is maximum. The average level 45 % cognitive load is arrived for the 63.6 % of performance. The individual SNE learner’s cognitive load is represented as chart below.



[Fig. 2] Cognitive Load of SNE learner

The cognitive load and academic performance represents the external observation.

## 8. CONCLISION

The Special Need Educational learners’ cognitive load observation process is described. The cognitive factors of the learning disabilities as per the input, memory, integration and output are described. The cognitive load observation adopted NASA index load calculation procedure with the adjusted rating process. The academic process of each exercise with specific cognitive load is presented. The individual value of cognitive load is un-deterministic therefore the neural

network - back propagation model is attained and the construction model is proposed.

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