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Research Paper

Prevalence of Neuro Myths Among Indian School Teachers

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ABSTRACT

Generally, teachers do have Psychology in their teacher training program and it is about human behaviour. Cognitive psychology refers to the study of mind and mental function with insights on brain structure and function. Teachers teaching science have an understanding that they have knowledge on brain science. Yet they do hold some myths like left-brain and right-brain, learn while you sleep etc. Based on the OECD/CERI's project, research studies carried over in OECD countries reveal the fact about teachers holding Neuromyths. In line with the above, the researchers intend to find out the Indian school teachers' understanding on brain science. Hence a tool had been constructed and validated and administered among schoolteachers in India. It focuses on whether teachers understand brain sciences; whether the teachers teach science holding neuromyths; whether demographic factors influence on holding neuromyths; and whether reading habit influences on understanding brain science. The schoolteachers from various states in India were identified as sample and the data were collected and analyzed on the hypotheses framed. The result is discussed on research studies reviewed.

Keywords: *Neuromyths, Brain science, Cognitive science and Demographic variables*

Teachers, and educators have fascination for brain science. They do believe in the right brain versus the left brain and that would be an educational agreement of brain-based curricula, mostly based on misconceptions and overgeneralizations about the brain, and there is not much to offer to educators (Chipman, 1986). The emergence of Cognitive Science during the early 80s was the science of mind that serves as a basic science answering the doubts on learning and instruction. John T. Bruer (1997) in his paper titled, "Education and the Brain: A Bridge Too Far" elaborately discussed over the need for bridging Neuroscience and Education. He suggests on connecting educational practice with cognitive psychology, and cognitive psychology with brain science.

Cognitive psychology refers to the study of mind and mental function with insights on brain structure and function. The attention of the cognitive scientists are on finding out the mental functions and processes that generate observed behavior. Their focus is on analysing those functions into specific cognitive operations. Cognitive psychology is considered to be the basic science of learning and teaching (Bruer, 1993) and has bestowed upon design of

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effective instructional tools (McGilly, 1994). Bruer analyses critical periods, synaptogenesis and enriched environments and synaptic growth with biological and educational perspectives. He determines that educators may not have a thorough understanding of the working of brain towards educational implications though they work on goals and outcomes.

In 1999, the Organization for Economic Cooperation and Development's (OECD) Centre for Educational research and Innovation (CERI) ignited association between learning sciences and brain research on the one hand, and researchers and Policy makers on the other hand. The above operation initiated OECD countries focused on new understanding about the brain into educational practice. At the outset it identified the fact that there is a gap between researchers and practitioners that has caused the misinterpretation and oversimplification of scientific research and facilitated the rapid augmentation of several misunderstanding about the mind and the brain, known as neuromyths (Organization for Economic Co-operation and Development [OECD], 2002, 2007; Goswami, 2006; Waterhouse, 2006; Geake, 2008; Kalbfleisch and Gillmarten, 2013; Howard-Jones, 2014).

Inferences from research studies:

With this background knowledge, we explored the findings of educational research to understand the prevalence of neuromyth among teachers. Almost all findings say that there is a wide spread of neuromyths across schools and there are many factors behind. On the one hand, the inclusion of neuroscientific content encourages lay people to believe that psychological explanations are more scientifically sound (Racine etal. , 2005;Weisbergetal., 2008; Lindell and Kidd, 2013).On the other hand, the promulgations of publications, conferences, workshops, or educational materials developed by non-professionals facilitate the spread of neuroscientific content of arguable validity throughout the educational community (Goswami, 2006;BussoandPollack, 2014; Simmonds, 2014). In a similar way, there has been an exponential increase of "brain-based" profitable programs that have popularized pseudo-scientific exercises in schools (Goswami, 2006; Sylvan and Christodoulou, 2010).

The alarm on the rise of neuromyths existence among the educational community alerted educational scientists and researches were carried over. Howard-Jones et al. (2009) surveyed trainee teachers with a questionnaire on facts about the brain (Herculano-Houzel, 2002) and several common Neuromyths (Pickering and Howard-Jones, 2007). The findings of the research stated that more than half of the sample agreed with a substantial number of myths about the brain (Howard-Joneset al., 2009). Similar to this research, Dekker et al. (2012) found a high prevalence of neuromyths among primary and secondary school teachers in the UK and the Netherlands, with some variations. The surveys developed by Howard-Jones et al. (2009) and Dekker et al. (2012) have also been applied to educators in Greece (Deligiannidi and Howard-Jones, 2015), China (Pei et al., 2015), Turkey (Karakus et al., 2015), and Latin America (Gleichgerrcht et al., 2015), and to trainee teachers in Spain (Fuentes and Risso, 2015). Similar to the above, a questionnaire has been applied in Portugal (Ratoetal., 2013). All these studies firmly established a high universality of neuromyths among the teachers in all these countries.

Marta Ferrero, Pablo Garaizar and Miguel A. Vadillo (2016) in their research titled, "Neuromyths in Education: Prevalence among Spanish Teachers and an Exploration of Cross-Cultural Variation" gave a lot of input to us. They have surveyed the prevalence of neuromyths among teachers of different regions in Spain as well as their understanding of the brain. They explored associations, if any with factors such as demographic profile of

teachers, or access to various neuroscientific materials. They found out that Spanish teachers believed a considerable number of the neuromyths. Fifty percentage of the educators have faith over five neuromyths out of the total twelve presented. It is similar to the patterns observed in British and Dutch teachers and only slightly better than the results obtained in Latin America and Turkey. Inversely, sixty percentage Spanish educators have the mean score on general knowledge questions about the brain. According to them it is worse than the one obtained in the UK, Netherlands, and Latin America and assumed the reason probably would be due to the quality and quantity of the educational materials available in Spain.

Rationale of the study

For a decade, the reports from UNESCO and OECD keep reminding preparation of future learners for the undefined challenges ahead. Teachers are slowly shifting their focus from subject experts to that of guides and facilitators. The future is viewed as something to be planned and managed rather than something to be actively shaped. The curriculum must help the future learners to reflect upon their strengths and weaknesses and motivate them to set goal and proceed with self-directed learnings.

Teachers' understanding of the human brain and its function play a greater role in making effective teaching. It affects the curricular, instructional and assessment decisions they make every day in a very positive way. The prominent field of educational neuroscience bestows opportunities as well as challenges for 21st century education. It contributes a common language and ways to bridge the gulf between educators, psychologists, and neuroscientists. Neuroscience can provide an understanding of mechanisms of learning and the biological factors that influence the learners. Educators' best strategy, therefore, is to hold cognitive psychology to educational practice and build connections between cognitive science and systems neuroscience. At this juncture, OECD,2002 has identified the prevalence of Neuromyths among teachers and considered it a threat in designing and transacting the curriculum. We have many brain-based research findings giving important neuroscientific evidence to support the broad aim of lifelong learning.

Having understood the significance of teachers' comprehension over brain science for effective teaching and to know about the existing status of schoolteachers in India, we tried on developing a tool on Neuromyths. It consists of 25 items with correct and incorrect statements on cognitive neuroscience related to human behaviour. Teachers were expected to find out whether the statements are correct or not.

METHODOLOGY

The participants were schoolteachers of all levels currently working in Secondary Education Schools in India. It covered 8 states of both north and south India. The sample included 341 teachers from various states of India. Eighty (28.07%) participants were males and 204 (71.57%) females. These percentages are corresponding to the distribution. The sample was recruited from public (27.7%), private (6.3%), and state schools (64.9%). The average teaching experience of the participants was 16.9 years (SD = 9.69). Except for gender, age, and years of experience, these demographic and professional data were requested only for descriptive purposes and were not explored any further in subsequent analysis.

Research Question

Though we wanted to apply various factors, initially we attempted on one research question.

1. *Do the demographic variables influence the teachers in holding the Neuro myths?*

Hypothesis

H01: No significant difference exists among teachers on holding the neuro myths based on gender.

H02. No significant difference exists among teachers on holding the neuro myths based on locality.

H03: No significant difference exists among teachers on holding the neuro myths based on training programmes attended.

H04: No significant difference exists among teachers on holding the neuro myths based on age.

H05: No significant difference exists among teachers on holding the neuro myths based on Educational Qualifications.

H06: No significant difference exists among teachers on holding the neuro myths based on type of subjects studied.

H07: No significant difference exists among teachers on holding the neuro myths based on type of Institution.

H08: No significant difference exists among teachers on holding the neuro myths based on years of teaching experience.

H09: No significant difference exists among teachers on holding the neuro myths based on interest in reading.

		Response	
SN	**Items**	**Correct(%)**	**Not Correct(%)**
1	Individuals learn better when they receive information in their preferred learning style. [C]	94%	6%
2	Children must acquire their native language before a second language is learned. If they do not do so, neither language will be fully acquired. [C]	82%	18%
3	Exercises that rehearse coordination of motor-perception skills can improve literacy skills. [C]	86%	14%
4	A Dyslexic child tends to see letters back words. [C]	68%	32%
5	Classical music cannot enhance a child's reasoning power. [IC]	68%	32%
6	Multi-tasking is not the smart way of getting things done in a better way. [IC]	58%	42%
7	Children provided with Omega 3 supplements excel in academics.[C]	56%	44%
8	Learning problems associated with developmental differences in brain function cannot be remediated by education. [IC]	55%	45%
9	Drinking coffee won't alerts individuals for learning. [IC]	41%	59%
10	Normal development of the human brain involves the birth and death of brain cells.	69%	31%
11	Mental capacity is hereditary and cannot be changed by the environment or experience. [IC]	81%	19%
12	Circadian rhythms ("body clock") shift during adolescence, causing pupils to be tired during the first lessons of the school day. [IC]	35%	65%
13	Extended rehearsal of some mental processes cannot change the shape and structure of some parts of the brain. [C]	52%	48%
14	Productions of new connections in the brain can continue into old age. [C]	61%	39%

RESULT & DISCUSSION

The responses of the participants were analyzed on percentage.

Descriptive analysis of responses

Hypothesis: 1 No significant difference exists among teachers on holding the neuro myths based on gender.

Gender	Mean	Std. Deviation	Std. Error Mean	t	df	P Value	95% Confidence Interval of the Difference	
							Lower	Upper
Female	65.20	10.027	0.850	0.403	339	0.687	-1.847	2.799
Male	64.73	11.165	0.785					

Therefore, the Null Hypothesis is accepted.

Hypothesis: 2 No significant difference exists among teachers on holding the neuro myths based on locality.

Location	Mean	Std. Deviation	Std. Error Mean	t	df	P Value	95% Confidence Interval of the Difference	
							Lower	Upper
Rural	64.88	10.91	0.94	-0.06	339	0.95	-2.41	2.26
Urban	64.96	10.60	0.74					

Therefore, the Null Hypothesis is accepted.

Hypothesis: 3 No significant difference exists among teachers on holding the neuro myths based on training programmes attended

Training	Mean	Std. Deviation	Std. Error Mean	t	df	P Value	95% Confidence Interval of the Difference	
							Lower	Upper
Attended	63.76	11.37	1.38	- 1.00	339	0.32	-4.30	1.40
Not Attended	65.22	10.53	0.64					

Therefore, the Null Hypothesis is accepted

Hypothesis: 4 No significant difference exists among teachers on holding the neuro myths on the basis of age.

AGE	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
20-25	2	66.00	14.14	10.00	-61.06	193.06	1.194	0.309
26-30	34	67.29	10.40	1.78	63.67	70.92		
31-35	60	63.33	11.37	1.47	60.40	66.27		
36-40	63	65.33	10.41	1.31	62.71	67.96		
41-45	76	66.16	11.27	1.29	63.58	68.73		
46-50	51	65.49	11.40	1.60	62.28	68.70		
>50	55	62.47	8.62	1.16	60.14	64.80		

Therefore, the Null Hypothesis is accepted.

Hypothesis: 5 No significant difference exists among teachers on holding the neuro myths on the basis of Educational Qualifications.

Education	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
UG	11	65.45	13.18	3.97	56.60	74.31	1.900	0.110
UG with B.Ed.,	60	67.80	9.95	1.28	65.23	70.37		
PG	61	62.89	10.28	1.32	60.25	65.52		
PG with B.Ed.,	183	64.42	10.92	0.81	62.82	66.01		
Others	26	66.46	9.93	1.95	62.45	70.47		

Therefore, the Null Hypothesis is accepted.

Hypothesis: 6 No significant difference exists among teachers on holding the neuro myths on the basis of subjects studied.

Teaching	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
Arts	146	64.90	11.02	0.91	63.10	66.71		
Science	188	64.83	10.55	0.77	63.31	66.35		
Other	7	68.00	8.64	3.27	60.01	75.99	0.295	0.744

Therefore, the Null Hypothesis is accepted.

Hypothesis: 7 No significant difference exists among teachers on holding the neuro myths on the basis of age.

Age	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
20-25	2	66.00	14.14	10.00	-61.06	193.06	1.194	0.309
26-30	34	67.29	10.40	1.78	63.67	70.92		
31-35	60	63.33	11.37	1.47	60.40	66.27		
36-40	63	65.33	10.41	1.31	62.71	67.96		
41-45	76	66.16	11.27	1.29	63.58	68.73		
46-50	51	65.49	11.40	1.60	62.28	68.70		
>50	55	62.47	8.62	1.16	60.14	64.80		

Therefore, the Null Hypothesis is accepted.

Hypothesis: 8 No significant difference exists among teachers on holding the neuro myths on the basis of type of institution.

Institution	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
Aided	12	60.00	12.30	3.55	52.19	67.81	2.116	0.122
Government	144	65.94	10.09	0.84	64.28	67.61		
Private	185	64.45	11.00	0.81	62.86	66.05		

Therefore, the Null Hypothesis is accepted.

Hypothesis: 9 No significant difference exists among teachers on holding the neuro myths on the basis of interest in reading.

Interests in reading	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		F stat	P value
					Lower Bound	Upper Bound		
Journals Only	6	71.33[a]	9.27	3.78	61.61	81.06	3.363	0.006
Magazine Only	17	64.00[b]	8.94	2.17	59.40	68.60		
Subject books only	99	63.03[b]	11.39	1.14	60.76	65.30		
Subject books and related	53	63.32[b]	10.28	1.41	60.49	66.15		
General books only	43	62.88[b]	9.93	1.51	59.83	65.94		
General books and others	123	67.67[a]	10.34	0.93	65.83	69.52		

Mean values having different superscripts are statistically different (P<0.05). Therefore, the Null Hypothesis is rejected.

Linear regression for interests in reading and total myth score

Model		Unstandardized Coefficients		t	Sig.	R square
		B	Std. Error			
1	(Constant)	60.573	1.860	32.567	0.000	0.018
	Interest in Reading	0.989	0.402	2.462	0.014	

Regression equation: **Y**=60.573+.989X

DISCUSSION

Table 1 shows the percentage wise analysis of teachers holding the neuro myths. Out of the 341 respondents it was found that the most endorsed neuromyths amidst the teachers were related to learning styles and knowledge on brain. The most frequently accepted neuromyth item was “individuals learn better when they receive information in their preferred learning style (e.g., auditory, visual, kinesthetic)” (94%). This is in concordance with the study that shows 90% of teachers in the UK and Netherlands believe in the idea of a preferred mode of delivery (Dekker et al. 2012). A similar study in Portugal has found that the majority of teachers, upwards of 50%, believe in instruction tailored to LS (Rato et al. 2013), whilst 91% of Spanish teachers believe that student performance is enhanced by delivery of material in the individual’s preferred LS (Ferrero et al. 2016). In the context of Greece, which is where the current study took place, studies have shown that 97% of teachers believe in LS (Deligiannidi and Howard-Jones 2015), whilst the percentage for prospective teachers is 94% (Papadatou-Pastou et al. 2017). In addition, a review by a UK academic supports the idea that LS are still thriving in higher education (Newton 2015). The second most endorsed neuromyth is There are sensitive periods in childhood when it's easier to

learn things (91%). The less endorsed neuromyth was, “Circadian rhythms ("body clock") shift during adolescence, causing pupils to be tired during the first lessons of the school day (35%)”.

From Table 2,3 & 4, it is understood that gender, locality and age does not have a significant difference on the holding of neuro myths among the teachers. Thus, the respective null hypotheses were accepted.

Table 5, 6 & 7 shows that Age, Educational qualifications, and subjects studied do not show any significant difference in the holding of neuro myths among Teachers. Thus, the null hypotheses were accepted.

From Table 9 it is found that significant difference were found in the interests in reading and holding of neuro myths among the teachers. F – Test (ANOVA- analysis of Co variance was performed and the F value 3.36 indicates that there are significant differences in the various interests in reading and holding of neuro myths. This result is in contradictory with the Spanish educators employed to learn about the brain, such as books or web sites. The resources that seem to promote general knowledge are the least popular among the teachers tested in their study. Contrary to the results obtained by Gleichgerrcht et al. (2015) in Latin America, only a small percentage of teachers in their study reported reading primary scientific journals. According to them this difference can be explained by the way the different kinds of publications were presented to their sample. It was found that more than half of the teachers who had taken a course about the brain and learning had done so through their own schools, that calls special attention to the role of schools in the proliferation of neuromyths.

There are research studies on reading and its impact over memory. Using MRI scans research findings convey that reading involves a complex network of circuits and signals in the brain. As our reading ability develops, those networks also get stronger and more refined. Reading is not loading facts into the brain. It is a way to rewire the working of the brain in general. It strengthens the ability to conceive alternative tracks, remember specific details, depict varied scenes, and think through complicated glitches. In short, reading makes one not just more knowledgeable, but also functionally smarter. It improves one’s memory. At every time, we read something new, we are creating a space for new information.

CONCLUSION

Over the last years, cognitive neuroscience has gradually taken on the challenge of understanding the neural mechanisms that enable human learning (Meltzoff et al., 2009). However, the translation of neuroscience research to the education community has not been straightforward (Bruer, 1997; Blakemore and Frith, 2005) and misconceptions about neuroscientific claims are widespread amongst educational practitioners (Goswami, 2006). The present study examined the prevalence of these neuromyths among teachers of different states in India as well as their general knowledge about the brain. Besides this, we investigated whether demographic variables of teachers influence their holding of neuromyths. The result of the study shows that there is no significant difference existed among the demographic variables except the interest in reading and the holding of neuro myths.

The outcome of the research endorses the significance of reading for meaning among teachers. Reading alone widen the thinking and ignites the scientific temper among the

teachers. What Bruer envisioned three decades ago become the utmost need of the hour. Of course, the reference on neuroscience is visible in all National and international educational policies of today.

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Conflict of Interest

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