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Mathematical modelling of school teacher's knowledge and beliefs about dyslexia

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***Abstract*---**Teacher's role is very important for early identification and inclusion of dyslexic children in mainstream school. Lack of early identification and wrong perceptions of teachers regarding dyslexia may adversely affect the academic growth of dyslexic. The study primarily aimed at giving mathematical model of schoolteacher's perception of dyslexia in Himachal Pradesh. Schoolteachers of Himachal Pradesh online filled Dyslexia Belief Index developed by Weddington and Wadlington (2005). Among 142 respondents, 45.1% teachers had moderate perception towards dyslexic students, 31% had low perception while 23.9% teachers had high perception towards dyslexic students. Teachers from Arts background, Gender (Male) and, having age between 36 and 40 and teaching experience of less than 5 years remained significant predictor for perception towards dyslexic students. Males were more likely to be at a higher on perception level towards dyslexic students (OR = 4.883, 95% CI 1.728–13.795). Teachers who are the head of the institute are more likely to have high perception towards dyslexic students (OR = 1.212, 95% CI .089–16.566) as compared to teachers who are PGT, TGT and primary teachers. The results of the study suggest that the stereotypes of dyslexia are difficult to overcome and require early literacy practices and professional development for pre-service and in-service teachers in dyslexia.

***Keywords*---**dyslexia, dyslexia screening, early detection dyslexia, teacher's perception, dyslexic students.

Introduction

The term "dyslexia" was coined by Rudolf Berlin in 1887, and literally means "poor language". Dyslexia is a developmental reading disorder and affects around

15 to 20% of the population [1, 2]. Dyslexics have problems in reading, spelling and word recognition [3]. Researchers from all over the world have been interested to know about dyslexia for greater than one hundred years and have attempted to develop many theories for explaining the nature of dyslexia [4,5]. However, there are different definitions to explain the term dyslexia but there is no universally excepted definition. International Dyslexia Association [1] supplied one comprehensive definitions, "Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction.

Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge". There are fluctuated meanings of dyslexia since understanding of what the term implies stays a test for researchers. A few definitions are established in the neurological premise of dyslexia and dyslexics have deficiency in phonological awareness. The research also indicates that people with dyslexia have serious phrase learning difficulties linked to the territories of the mind connected to phonological and orthographic preparing [6]. This study differs from the previous theories that dyslexia is related to vision, hearing and intellectual deficiencies that are not, at this point substantial [7, 8]. The dyslexic children and poor readers are not always same. Other reading problems may be due to lack of cognitive abilities but dyslexia is a language-based disorder, caused due to lack of intellectual ability or cognitive processing ability [9, 10]. Though a few specialists contend that dyslexia, happen at a biological level, others accept that the issue happens at a cognitive level, Isabelle Lieberman made significant commitments to our comprehension of the cognitive procedures associated with dyslexia and her phonological theory of dyslexia is still broadly acknowledged by different specialists in the field [11].

Phonemic awareness refers to the knowledge and manipulation of sounds in spoken words. Phonemic awareness includes segmenting, blending, deleting and substituting sounds in words. Dyslexic children mostly have problem in phonemic awareness. This is a slow and laborious task for the individuals who have less phonemic awareness to get meaning from the print by reading and remembering whole words instead of decoding and encoding [12]. Lack of fluency and automaticity is often found in reading. Orton [13] who conducted research on dyslexia stated that the problem in reading occurred when the visual images sent to the proper brain were disturbed by inputs from the left hemisphere.

Teachers often have misconceptions about dyslexia. The teachers' lack of awareness and misconceptions has negative effects for the dyslexia sufferer in the classroom. Lack of early identification and wrong perceptions of teachers regarding dyslexia increases the difficulties of dyslexic children during their school life. A case study was conducted by Gonzalez and Brown [14] to explore the perceptions of early childhood educators regarding dyslexia in Head Start Centres of New Jersey and Pennsylvania. The purpose of the study was to study how these educators perceive the concept of risk for dyslexia and how the identify

the students with dyslexia. The result of the study revealed that teachers held the misconception that dyslexia is a visual processing disorder rather than a phonological processing disorder. Based on results, it is suggested that there is a need of professional development for pre-service and in-service teachers in dyslexia and teaching practices. Khaliq [15] investigated in Lahore the awareness of dyslexia among elementary school teachers. He also studied teacher's view about their awareness of identification of dyslexic children, their management and in-service and pre- service trainings of dyslexia. The study revealed that teachers had no awareness about dyslexia and most of them were unable to identify and manage dyslexic students. The teachers revealed that they received insufficient trainings on dyslexia. Alawadh [16] studied the challenges faced by primary school teachers of Kuwait while providing intervention for dyslexic children and explored the importance of providing support for dyslexic students in government primary schools. The results indicated that the teachers had not much aware of dyslexia and lack of proper training. Teachers revealed that they used inappropriate approaches for the identification of dyslexic students. Jusufi [17] found similar results in his investigation on the perception and awareness of teachers of primary school regarding dyslexia in Prishtina. Results of the study revealed that most of the participants had misconceptions of dyslexia but they were aware of their important role for providing equal opportunities for dyslexic children. Ade-Ojo [18] explored the perception of literacy teachers and found that the approaches predominantly employed by these teachers were informed by a deficit model of dyslexia. These teachers revealed that they were not so much confident about the tuition they provided to their students. The result of the study revealed an issue of awareness and understanding inside the improvement of literacy teachers. It is suggested that there is a need to explore options in terms of perceptions and tactics for the success of dyslexic learners in literacy classes.

Wadlington and Wadlington developed and validated a scale 'Dyslexia Belief Index' for measuring beliefs regarding dyslexia and by using it, assessed the beliefs of educators regarding dyslexia. The result of the study indicated that the majority of educators believed many misconceptions regarding dyslexia. Most of the educators believed that word reversal is the main factor for the identification of dyslexics. It was recommended that for the better preparation of educators more opportunities should be given to them for learning about dyslexia. A replicated study of Wadlington and Wadlington was conducted by Tillostson [19] in the Chippewa Valley of Wisconsin and found that the teachers had misconceptions and unaware of dyslexia and it could be improved by essential professional development. The teachers' lack of awareness and misconceptions has negative effects for the dyslexia sufferer in the classroom. Lack of early identification and wrong perceptions of teachers regarding dyslexia increases the difficulties of dyslexic children during their school life. It is important to understand the perception of teachers for preparation and professional development of teachers [20]. So, it can be concluded that it is very essential to explore the perception and awareness of teachers about dyslexia.

Purpose of the study

The purpose of the present study was to explore the perception of schoolteachers of Himachal Pradesh regarding dyslexia in order to provide a mathematical model to further give an insight to the professional development programs.

Research questions of the study

The present study was directed by the following questions:

1) How do schoolteachers in Himachal Pradesh perceive dyslexia?
2) Which of the demographic and other categorical variable took in this study effects the perception of the schoolteachers regarding dyslexia?

Material and methods

Participants and Data Collection

The participants of the study are schoolteachers of government and private school of Himachal Pradesh. The respondents were communicated the Google form through mail and social media platform. Structured questionnaire was used to assess the perception of schoolteachers regarding dyslexia. Finally, 142 responses were included for the purpose of analysis.

Data analysis

Data were analysed with SPSS Version 22.0. An analysis of descriptive statistics was conducted to illustrate the demographic and other selected characteristics of the respondents. Multivariate ordinal logistic regression analyses were employed in modelling a predictive relationship between independent variables and levels of perception of dyslexia. The estimates of the strengths of associations were demonstrated by the odds ratio (OR) with a 95% confidence interval (CI).

Results

The demographic and selected characteristics of the study population are shown in Table 1. Counts of participants for each of the ordinal intervals within the dependent variable in the analyses are presented in Tables 2.

Table 1. Descriptive statistics of the sample

Categorical Variable Information			N	Percent
Dependent Variable	Level of Dyslexia perception	Low	44	31.00%
		Moderate	64	45.10%
		High	34	23.90%
		Total	142	100.00%
Factor	Institution	Government	116	81.70%
		Private	26	18.30%
		Total	142	100.00%
	Gender	Male	58	40.80%
		Female	84	59.20%
		Total	142	100.00%
	Stream	Arts	64	45.10%
		Commerce	10	7.00%
		Science	52	36.60%
		Others	16	11.30%
		Total	142	100.00%
	Age	Less than 25	10	7.00%
		26 to 30	6	4.20%
		Age=31-35	10	7.00%
		Age=36-40	38	26.80%
		Age=41-45	40	28.20%
		Above 45	38	26.80%
		Total	142	100.00%
	Position in school	Head of the Institute	4	2.80%
		PGT	62	43.70%
		Primary School Teacher	14	9.90%
		TGT	62	43.70%
		Total	142	100.00%
	Duration	5 to 10 years	40	28.20%
		Less than 5 years	28	19.70%
		More than 10 years	74	52.10%
		Total	142	100.00%
	Graduate Degree	Government Institution	114	80.30%
		Open University	2	1.40%
		Other	2	1.40%
		Private Institution	24	16.90%
		Total	142	100.00%
	Class teaching level	1 to 5	20	14.10%
		Up to 10th class	56	39.40%
		Up to 12th class	58	40.80%
		Up to 8th class	8	5.60%
		Total	142	100.00%
	Teaching District	Kangra	14	9.90%
		Chamba	14	9.90%
		Sirmaur	2	1.40%
		Solan	6	4.20%
		Una	106	74.60%
		Total	142	100.00%
	Special Education certificate	No	116	81.70%
		Yes	26	18.30%
		Total	142	100.00%
	Knowingly taught dyslexic children	No	100	70.40%
		Yes	42	29.60%
		Total	142	100.00%
	Feel knowledgeable	No	70	49.30%
		Yes	72	50.70%
		Total	142	100.00%

Among 142 respondents, 45.1% teachers had moderate perception towards dyslexic students, 31% had low perception while 23.9% teachers had high perception towards dyslexic students. Among respondents 59.2% were females and 40.8% were males. Majority of the respondents i.e. 81.7%were teaching in the government institute. 45.1% teachers were of arts background, 36.6% were of science background. 28.2% teachers were between the age group 41-45 followed by equal percent of both age group 36-40 and above 45 with percentage 26.8%. 2.8 % respondents were the head of the institutes and 43.7% of both PGT and the TGT teachers each. Majority of teachers i.e. 52.1% had experience of more than 10 years. Majority of teachers i.e. 74.65 were from the Una district. 81.7% teachers did not hold a reading specialist certificate/ special education course certificate. 50.7% teachers feel knowledgeable in teaching students with dyslexia.

Ordinal regression analysis

Results of ordinal logistic regression analysis were used in modelling a predictive relationship between independent variables and levels of perception of dyslexia. The Model Fitting contains the -2 log- likelihood for an Intercept only (or null) model and the Full Model containing the full set of predictors. We also have a likelihood ratio chi-square test to test whether there is a significant improvement in fit of the Final model relative to the Intercept only model. In this case, we see a significant improvement in fit of the Final model over the null model [x^2 (28) = 75.038, p<.001]. The prediction model for perception regarding dyslexia did not show goodness of fit to our observed data (x^2 (106) = 305.892, p < 0.001). Nagelkerke's pseudo R2 of 0.134 indicated that the significant socio-demographic variables explained approximately 46.6% of the variation in teachers' perception towards dyslexic students. This pseudo R2 indicates that a model containing only independent variables is likely to be a good predictor of the outcome for any particular individual teacher.

Table 2. Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	296.901			
Final	221.862	75.038	28	0

Link function: Logit.

Table 3. Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	305.892	106	0
Deviance	219.64	106	0

Link function: Logit.

Table 4. Pseudo R-Square

Cox and Snell	0.41
Nagelkerke	0.466

McFadden	0.248

Link function: Logit.

Table 5. Parameter Estimates

Parameter		B	Std. Error	95% Wald Confidence Interval		Hypothesis Test			Exp(B)	95% Wald Confidence Interval for Exp(B)	
				Lower	Upper	Wald Chi-Square	df	Sig.		Lower	Upper
Threshold	[Level of dyslexia perception=1]	-5.817	1.7368	-9.221	-2.413	11.217	1	0.001	0.003	9.89E-05	0.09
	[Level of dyslexia perception=2]	-2.898	1.6703	-6.172	0.375	3.011	1	0.083	0.055	0.002	1.455
[Institution=Government]		-1.167	0.6148	-2.372	0.038	3.602	1	0.058	0.311	0.093	1.039
[Institution=Private]		0[a]	.	.	.	.	.	.	1	.	.
[Gender=Male]		1.586	0.5299	0.547	2.624	8.955	1	0.003	4.883	1.728	13.795
[Gender=Female]		0[a]	.	.	.	.	.	.	1	.	.
[Stream=Arts]		-2.592	0.7959	-4.152	-1.032	10.605	1	0.001	0.075	0.016	0.356
[Stream=Commerce]		-0.928	1.0194	-2.926	1.07	0.829	1	0.362	0.395	0.054	2.915
[Stream=Science]		-1.335	0.7445	-2.794	0.124	3.215	1	0.073	0.263	0.061	1.132
[Stream=Others]		0[a]	.	.	.	.	.	.	1	.	.
[Age=Less than 25]		-0.297	1.0439	-2.343	1.749	0.081	1	0.776	0.743	0.096	5.747
[Age=26 to 30]		2.15	1.3994	-0.592	4.893	2.361	1	0.124	8.589	0.553	133.376
[Age=31-35]		1.771	1.1139	-0.412	3.954	2.527	1	0.112	5.875	0.662	52.138
[Age=36-40]		-1.772	0.6543	-3.054	-0.489	7.331	1	0.007	0.17	0.047	0.613
[Age=41-45]		-0.047	0.5331	-1.092	0.998	0.008	1	0.929	0.954	0.335	2.712
[Age=Above 45]		0[a]	.	.	.	.	.	.	1	.	.
[Position in school=Head of the Institute]		0.193	1.3341	-2.422	2.807	0.021	1	0.885	1.212	0.089	16.566
[Position in school=PGT]		-0.904	0.9021	-2.672	0.864	1.004	1	0.316	0.405	0.069	2.373
[Position in school=Primary School Teacher]		-0.536	1.4482	-3.376	2.305	0.137	1	0.712	0.585	0.034	10.022
[Position in school=TGT]		0[a]	.	.	.	.	.	.	1	.	.
[Duration of teaching =5 to 10 years]		-0.228	0.5876	-1.379	0.924	0.15	1	0.698	0.796	0.252	2.519
[=Less than 5 years]		-1.251	0.6554	-2.536	0.033	3.645	1	0.056	0.286	0.079	1.034
[Duration of teaching =More than 10 years]		0[a]	.	.	.	.	.	.	1	.	.
[Graduate degree=Government Institution]		-0.719	0.6328	-1.959	0.521	1.292	1	0.256	0.487	0.141	1.684
[Graduate degree=Open University]		21.321	23020.8512	-45098.72	45141.36	0	1	0.999	1817603558	0	[b]
[Graduate degree=Other]		2.251	1.6306	-0.944	5.447	1.906	1	0.167	9.501	0.389	232.131
[Graduate degree=Private Institution]		0[a]	.	.	.	.	.	.	1	.	.
[Class teaching level=1 to 5]		-1.69	1.5501	-4.728	1.348	1.189	1	0.276	0.185	0.009	3.85
[class teaching level=Up to 10th class]		-1.586	1.3039	-4.141	0.97	1.479	1	0.224	0.205	0.016	2.638
[class teaching level=Up to 12th class]		0.092	1.6393	-3.121	3.305	0.003	1	0.955	1.097	0.044	27.254
[class teaching level=Up to 8th class]		0[a]	.	.	.	.	.	.	1	.	.
[Teaching district=Kangra]		1.468	0.8223	-0.144	3.08	3.188	1	0.074	4.341	0.866	21.755
[Teaching district= Chamba]		0.143	0.7206	-1.269	1.556	0.04	1	0.842	1.154	0.281	4.739
[Teaching district=Sirmaur]		21.359	23020.8511	-45098.68	45141.399	0	1	0.999	1889155408	0	[b]
[Teaching district=Solan]		1.24	1.3401	-1.386	3.867	0.857	1	0.355	3.457	0.25	47.794
[Teaching district=Una]		0[a]	.	.	.	.	.	.	1	.	.
[Special education certificate=No]		-0.208	0.5587	-1.303	0.887	0.139	1	0.709	0.812	0.272	2.428
[Special education certificate=Yes]		0[a]	.	.	.	.	.	.	1	.	.
[knowingly taught dyslexic children=No]		-0.359	0.6184	-1.571	0.853	0.337	1	0.561	0.698	0.208	2.347
[knowingly taught dyslexic children=Yes]		0[a]	.	.	.	.	.	.	1	.	.
[Feel knowledgeable=No]		0.045	0.4911	-0.918	1.007	0.008	1	0.927	1.046	0.4	2.738
[Feel knowledgeable=Yes]		0[a]	.	.	.	.	.	.	1	.	.
(Scale)		1[c]									

Dependent Variable: Level of dyslexia perception

Model: (Threshold), Institution, Gender, Stream, Age, Position in school, Duration of teaching, Graduate degree, class teaching level, Teaching district, Special education certificate, knowingly taught dyslexic children, Feel knowledgeable

a. Set to zero because this parameter is redundant.
b. Set to system missing due to overflow
c. Fixed at the displayed value.

Discussion

Teachers from Arts background, Gender (Male) and, having age between 36 and 40 and teaching experience of less than 5 years remained significant predictor for perception towards dyslexic students. Males were more likely to be at a higher on perception level towards dyslexic students (OR = 4.883, 95% CI 1.728–13.795). Teachers of government institution were more likely to be lower on perception level towards dyslexic students (OR = .311, 95% CI .093–1.039). Teachers who teach up to 5th and 10th are likely to be lower on perception level towards dyslexic students (OR = .185, 95% CI .008–3.850) for 5th and (OR = .205, 95% CI .016- 2.638) for 10thas compared to teachers who teach up to 12th standard who scored higher on perception level towards dyslexic students (OR = .311, 95% CI .093–1.039). Teachers who are the head of the institute are more likely to have high perception towards dyslexic students (OR = 1.212, 95% CI .089–16.566) as compared to teachers who are PGT, TGT and primary teachers. The odds of a teacher who do not hold a reading specialist certificate/ special education course certificate for being in a higher category on perception level towards dyslexic students was .812 times that of a teacher who do hold a reading specialist certificate/ special education course certificate. The odds of a teacher who do not feel knowledgeable in teaching students with dyslexia for being in a lower category on perception level towards dyslexic students was 1.046 times that of a teacher who feel knowledgeable in teaching students with dyslexia.

Implications and Conclusion

The result of the study in the form of a mathematical model can be beneficial for the teacher education and professional development programs at school level. In addition to this, the findings also suggest for content evaluation of pre-service teacher programs in the light of dyslexia [21]. We recommend that early signs of dyslexia, characteristics of dyslexia student and interventions should be included in teacher education programs. Moreover, content related to dyslexia in teacher education program may additionally help future teachers in having the right conception of dyslexia. Wadlington and Wadlington in their study concluded that teacher educators hold more knowledge about dyslexia than the pre-service teachers do, but they still are not fully equipped with the term. Thus, teaching pre-service, in-service, and professors may eradicate the anxiety of the misapplication of the concept dyslexia and the bad connotations associated with it. Schoolteachers have the capacity to make an invaluable effect at the literacy improvement of schoolchildren at-hazard for dyslexia. For this reason, teacher educators and researchers have a duty to ensure that schoolteachers have the skills and willingness to undertake this crucial venture of promoting the literacy development of children at-risk of dyslexia.

References

1. Wadlington, E. M., & Wadlington, P. L. (2005). What educators really believe about dyslexia. *Reading Improvement*, *42*(1), 16-33.
2. International Dyslexia Association. (2002). Definition of dyslexia.
3. Grigorenko, E. L. (2001). Developmental dyslexia: An update on genes, brains, and environments. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*(1), 91-125.
4. Snowling, M. J. (2012). Changing concepts of dyslexia: nature, treatment and comorbidity.
5. Ramus, F. (2003). Developmental dyslexia: specific phonological deficit or general sensorimotor dysfunction? *Current opinion in neurobiology*, *13*(2), 212-218.
6. Booker, A. B., Chen, F., Sloan, A. M., Carraway, R. S., Rennaker, R. L., LoTurco, J. J., ... & Centanni, T. M. (2016). Knockdown of Dyslexia-Gene Dcdc2 Interferes with Speech Sound Discrimination in Continuous Streams.
7. Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2003). A definition of dyslexia. *Annals of dyslexia*, *53*(1), 1-14.
8. Snowling, M. J., & Hulme, C. (2012). Annual Research Review: The nature and classification of reading disorders–a commentary on proposals for DSM-5. *Journal of child psychology and psychiatry*, *53*(5), 593-607.
9. Das, J. P. (2009). *Reading difficulties and dyslexia: An interpretation for teachers*. Sage Publications.
10. Stanovich, K. E. (1988). Explaining the differences between the dyslexic and the garden-variety poor reader: The phonological-core variable-difference model. *Journal of learning disabilities*, *21*(10), 590-604.
11. Hendren, R. L., Haft, S. L., Black, J. M., White, N. C., & Hoeft, F. (2018). Recognizing psychiatric comorbidity with reading disorders. *Frontiers in Psychiatry*, 101.
12. McBride-Chang, C., & Manis, F. R. (1996). Structural invariance in the associations of naming speed, phonological awareness, and verbal reasoning in good and poor readers: A test of the double deficit hypothesis. *Reading and Writing*, *8*(4), 323-339.
13. Orton, S. T. (1937). Reading, writing and speech problems in children.
14. Gonzalez, M., & Brown, T. B. (2019). Early Childhood Educators' Perceptions of Dyslexia and Ability to Identify Students At-Risk. *Journal of education and learning*, *8*(3), 1-12.
15. Khaliq, S., Ramzan, I., & Aslam, J. (2017). Study about awareness of dyslexia among elementary school teachers regarding Pakistan elementary educational institutes. *International Journal of Research in Business Studies and Management*, *4*(5), 18-23.
16. Alawadh, A. (2016). *Teachers perceptions of the challenges related to provision of services for learners with specific learning difficulties (dyslexia) in Kuwaiti government primary schools* (Doctoral dissertation, University of York).
17. Jusufi, Q. (2014). DYSLEXIA, AWARENESS AND DISCRIMINATORY POTENTIAL: Perceptions of dyslexia among teachers in primary schools in Prishtina.
18. Ade-Ojo, G. O. (2012). Practitioners' perceptions of dyslexia and approaches towards teaching learners with dyslexia in adult literacy classes. *International Journal of Lifelong Education*, *31*(5), 623-641.

19. Tillotson, T. L. (2011). *Perceptions of dyslexia knowledge among elementary education teachers in the chippewa valley of Wisconsin* (Doctoral dissertation, University of Wisconsin--Stout).
20. Spear-Swerling, L., Brucker, P. O., & Alfano, M. P. (2005). Teachers' literacy-related knowledge and self-perceptions in relation to preparation and experience. *Annals of Dyslexia*, *55*(2), 266-296.
21. Washburn, E. K., Mulcahy, C. A., Joshi, R. M., & Binks-Cantrell, E. (2016). Teacher knowledge of dyslexia. *Perspectives on Language and Literacy*, *42*(4), 9.