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Original Research Article

Effectiveness of competency improvement module on primary school teacher's competency regarding early diagnosis and management of childhood learning disabilities: a pilot study

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ABSTRACT

Background: Learning disabilities (LDs) affect a significant proportion of school-age children globally. Primary school teachers are ideally positioned for early identification and management; however, their competency in this domain remains inadequate. This pilot study evaluated the effectiveness of a Competency Improvement Module (CIM) on primary school teachers' competency regarding early diagnosis and management of childhood learning disabilities.
Methods: A quasi-experimental, non-randomized control group design was employed. Forty primary school teachers from District Reasi, Jammu and Kashmir, India, were allocated to an experimental group (n=20) and a control group (n=20). The experimental group received a structured CIM comprising 17 sessions. Competency was assessed using three validated instruments: a Structured Questionnaire, the Questionnaire on Teachers' Competence in Identifying Pupils with Learning Disabilities (QTCIPLD), and Structured Case Vignettes. Assessments were conducted at baseline, 21 days post-intervention (post-test 1), and 42 days post-intervention (post-test 2). Data were analyzed using repeated-measures ANOVA and independent t-tests.
Results: The experimental group demonstrated statistically significant improvements across all three competency domains post-intervention ($p<0.001$), with large effect sizes (Cohen's D: 2.33-4.13). Significant between-group differences were observed at both post-test time points. The demographic variables, such as monthly income and employment type, were significantly associated with competency gains among teachers.
Conclusions: The CIM is an effective, feasible intervention for enhancing primary school teachers' competency in early diagnosis and management of childhood learning disabilities. Findings support the large-scale implementation of structured teacher training programs.

Keywords: Competency improvement module, Learning disabilities, Primary school teachers, Early identification, Teacher training, Quasi-experimental study

INTRODUCTION

Learning disabilities (LDs) constitute a significant category of neurodevelopmental conditions affecting millions of school-aged children globally. These disorders are characterized by persistent challenges in mastering core academic competencies such as literacy, numeracy, and written expression, substantially compromising scholastic performance and psychosocial development.[1] The three primary subtypes dyslexia, dysgraphia, and dyscalculia each present distinct diagnostic profiles requiring differentiated pedagogical responses. Epidemiological data indicate that LDs affect approximately 5%-15% of the global school-age

population.[2] Within India, prevalence estimates demonstrate marked heterogeneity, ranging from 9%-39% depending on screening instruments, diagnostic criteria, and demographic characteristics.[3,4] Recent school-based screening initiatives revealed that nearly 37% of children aged 6-8 years exhibit cognitive difficulties placing them at elevated risk for learning disabilities.[5] These figures underscore the substantial public health burden and highlight the critical need for systematic early detection mechanisms within educational systems.

The foundational years of primary education represent a crucial developmental window during which early identification and intervention can profoundly alter long-term trajectories for children with LDs. Delayed recognition is associated with cascading academic failure, erosion of self-efficacy, and increased vulnerability to school disengagement.[6] Conversely, prompt identification coupled with evidence-informed classroom accommodations can significantly enhance educational attainment and psychosocial adjustment.[3] Primary school teachers, by virtue of sustained daily interaction with students and direct observation of academic performance patterns, occupy a uniquely advantageous position to detect early warning indicators. However, empirical evidence consistently reveals substantial deficits in teacher preparedness for this critical function.[7]

It is reported that primary school teachers demonstrated inadequate understanding of LD etiology, diagnostic criteria, and classroom management strategies and found that urban schoolteachers exhibited limited proficiency in screening for learning disabilities.[4-8] A large-scale investigation involving 902 primary school teachers in Saudi Arabia revealed that 64.52% possessed only average knowledge about specific learning disabilities, while 35.48% demonstrated poor knowledge.[9] Within India, a study documented baseline knowledge levels as low as 26.7% among primary school teachers.[10] These deficits encompass poor comprehension of neurobiological underpinnings, limited capacity to differentiate LDs from intellectual disability or behavioral disorders, and insufficient practical skills for implementing classroom-based identification protocols.[7]

Teacher preparation inadequacy stems from multiple systemic factors. Pre-service teacher education curricula in India typically provide minimal coverage of special educational needs, including learning disabilities.[11] In-service professional development opportunities focused on LD identification remain scarce, particularly in rural and semi-urban regions.[5] Structured teacher training interventions have demonstrated considerable promise in addressing these competency gaps. A study implemented a developmental pediatrics-based training module and observed sustained increases in awareness regarding medical and developmental factors contributing to educational difficulties.[3] Another study evaluated a competency-based teacher education (CBTE) module and reported dramatic improvements, with overall knowledge scores rising from 24.7%-76%, and the proportion of teachers with good knowledge increasing from 21%-84%.[12] These findings suggest that well-designed training modules can produce meaningful and sustained enhancements across knowledge, attitude, and practical skill domains.

Despite this growing evidence base, several methodological limitations constrain generalizability. Most published studies have employed pre-experimental designs without control groups, limiting causal inference.[3] Many investigations focused exclusively on knowledge outcomes, neglecting the broader construct of competency encompassing procedural skills and practical application in authentic classroom contexts.[13] Furthermore, few studies incorporated extended follow-up assessments to examine durability of training effects. Geographically, research has concentrated in urban centers and southern states, with limited representation from northern and mountainous regions.[5]

The present study employs a quasi-experimental design with a matched control group, enabling more robust causal inference compared to pre-experimental designs dominating existing literature.[12] This study operationalizes competency as a multidimensional construct encompassing knowledge, skills, and practical application, assessed through validated instruments including case-based scenarios approximating real-world classroom decision-making.[13] This research incorporates two follow-up assessments to examine both immediate post-intervention effects and retention of competency gains over time, addressing a significant limitation of prior studies relying solely on immediate post-test measurements.[3]

Geographically, the study was conducted in District Reasi, Jammu and Kashmir, a region characterized by mountainous terrain, socioeconomic diversity, and limited prior research on teacher competency in learning disabilities. Enhanced teacher competency can increase screening rates, reduce referral delays, and improve classroom accommodation for children with learning disabilities.[6] Ultimately, these improvements have the potential to positively impact educational trajectories and life outcomes of thousands of children with LDs who might otherwise remain unidentified and unsupported.

Research objectives

The study aims to assess the competency of primary school teachers in relation to the early diagnosis and management of learning disabilities among children, both before and after the implementation of the CIM, in both the experimental and control groups. It also seeks to evaluate the effectiveness of the CIM in improving teacher competency related to early screening and management of learning disabilities by comparing outcomes between the experimental and control groups. Additionally, the study examines the association between the level of teacher

competency in early diagnosis and management of learning disabilities and selected demographic characteristics of teachers in both groups.

METHODS

Study design and participants

This study employed a quasi-experimental, non-randomized control group design with pre-test and repeated post-test measurements. This design was selected to evaluate the effectiveness of the CIM while acknowledging the practical constraints of randomization in naturalistic school settings. The quasi-experimental framework allowed for meaningful causal inference through the inclusion of a matched control group and rigorous statistical control for baseline differences. The schools were selected through convenience sampling and within each selected school, eligible teachers were recruited using total enumerative samples. This approach ensured complete representation within each school and minimized selection bias.

Study place

The study was conducted in four primary schools of District Reasi, Jammu and Kashmir. The experimental group was drawn from the primary class teachers of two schools (Green Field Public School, n=11; Govt. Middle School Sirah, n=9), while the control group comprised teachers from the remaining two schools (Holy Trinity Convent High School, n=12; Govt. Middle School Panthal, n=8). A total of 40 primary school teachers were enrolled: 20 in the experimental group and 20 in the control group.

Study duration

The study was conducted for three months from February 2025 to April 2025.

Inclusion and exclusion criteria of study subjects

All primary class teachers employed in the selected schools who were willing to participate were recruited into the study. Inclusion in the final data analysis required 100% attendance at the Competency Improvement Module Program. Part-time teachers and those with any prior training in learning disabilities were excluded from the study.

Intervention: competency improvement module (CIM)

The Competency Improvement Module (CIM) was a structured training program delivered exclusively to the experimental group. Prior to implementation, the module was reviewed by eight subject experts, and all content items achieved acceptable content validity ratios. The module comprised 17 sessions delivered over a total of 7 days. Following the Chief Education Officer's recommendation to avoid disrupting routine school activities, the researcher conducted sessions twice weekly for two hours each day. This schedule extended the original seven-day program over 30 days to complete all 17 sessions of the CIM. All sessions were provided in the schools as per the pre-prepared schedule. The researcher adopted a small group session to deliver CIM comprising of 8 to 12 members in the group for better outcome. The participants were provided a kit comprising of printed booklet of CIM, Case vignettes, screening tools, and practice toolkit materials.

The content covered the definition, classification, and etiology of learning disabilities; early warning signs and behavioral indicators of dyslexia, dysgraphia, and dyscalculia; standardized screening approaches and referral pathways; evidence-based classroom management strategies; and collaborative approaches involving parents and allied health professionals. To build practical skills, teachers solved case vignettes on the management of learning disabilities. They also practiced worksheets from specially prepared tool kits, which they could later use in the classroom for children diagnosed with learning disabilities. In addition, sample notebook pages from children with learning disabilities were presented to illustrate diagnostic features. Sessions were delivered through a variety of interactive methods, including didactic instruction, group discussions, case-based learning, role-play exercises, and hands-on practice with screening tools and toolkit materials. After data collection was completed, the control group received a comprehensive handout summarizing the module content. This step fulfilled the ethical obligation to provide educational benefits to all participants.

Data collection process and instruments

The researcher initially obtained permission from the Chief Education Officer, Reasi, to conduct the study in the selected schools. In addition, a No Objection Certificate was secured from the participating schools to enable the delivery of the training sessions. Informed consent was obtained from all participants prior to data collection. For the experimental group, pre-test data were collected on Day 1. The Competency Improvement Module intervention was delivered from Day 2-Day 31. The first post-test data was collected on Day 52, and the second post-test data was collected on Day 73. For the control group, a 21-day interval was maintained between each successive round of data collection.

Three validated instruments were used to assess teacher competency Sociodemographic Fact Sheet, Structured Questionnaire, Questionnaire on Teachers' Competence in Identifying Pupils with Learning Disabilities (QTCIPLD) and Structured Case Vignettes. The data was collected through group administration. All teachers were made to sit in the classroom, and the validated instruments were handed over to each participant. The participant took approximately 1 hour to complete answering the instruments. The datasheet was coded and stored.

Ethical clearance

This study adhered to established ethical criteria, receiving approval from the Institutional Ethics Committee (IEC/AIB/AUH/2023-9) and administrative clearance from the Chief Education Officer, Reasi (CEO/Rsi/Estt/3241-52) before data collection commenced. Participation in the survey was wholly optional, and informed consent was secured from all teachers prior to their involvement. Participants were guaranteed the confidentiality and privacy of their information, and the gathered data were utilized solely for research reasons. Educators were notified that they might disengage from the study at any point without repercussions.

Data analysis

All data were entered and analyzed using IBM SPSS Statistics, Version 25.[14] Psychometric properties were estimated for all instruments used in the study to check its reliability and validity. Descriptive statistics were used to characterize the sample. Baseline homogeneity between groups was assessed using independent samples t-tests for continuous variables and chi-square tests for categorical variables. Repeated-measures analysis of variance (ANOVA) was employed to examine within-group changes across time points, between-group differences, and time x group interaction effects. Effect sizes were calculated using partial eta-squared (η^2) and Cohen's D. Between-group comparisons of gained mean scores (difference between final and baseline assessments) were performed using independent samples t-tests. Associations between competency scores and demographic variables were examined using one-way ANOVA. Statistical significance was set at $p<0.05$ (two-tailed) throughout.

RESULTS

Overall, 40 teachers completed the study. 20 each in experimental groups and control groups. All instruments were reviewed by eight subject experts. For the Structured Questionnaire, all 35 items demonstrated item-level content validity index (I-CVI) values≥0.80, with a mean content validity ratio (CVR) of 0.88 and a scale-level CVI (S-CVI) of 0.94. Item discrimination analysis using point-biserial correlation (r_p^b) yielded significant values ($p<0.05$) for all items. Item difficulty indices were acceptable for all items, and distractor efficiency analysis confirmed efficient distractors across all items.

Internal consistency was excellent (Kuder-Richardson 20=0.90), test-retest reliability was 0.95, and split-half reliability was 0.80. For the QTCIPLD, formal permission was obtained from the original authors. Cronbach's alpha was 0.92, indicating excellent internal consistency. Test-retest reliability was 0.91, and split-half reliability was 0.86. For the Structured Case Vignettes, all 20 items demonstrated I-CVI values ≥0.75, mean CVR of 0.86, and S-CVI of 0.92. Point-biserial correlations were significant ($p<0.05$) for all items. KR-20 internal consistency was 0.86, test-retest reliability was 0.92, and split-half reliability was 0.86.

Table 1: Demographic distribution of primary school teachers (n=40).

Variable	Category	Total (n=40) f (%)	Experimental (n=20) f (%)	Control (n=20) f (%)
Age (years)	20-30	23 (57.5)	11 (55.0)	12 (60.0)
	31-40	15 (37.5)	9 (45.0)	6 (30.0)
	41-50	2 (5.0)	0 (0.0)	2 (10.0)
	51-60	0 (0.0)	0 (0.0)	0 (0.0)
	Mean (SD)	30.63 (5.73)	30.05 (5.76)	31.20 (5.79)
Gender	Male	13 (32.5)	8 (40.0)	5 (25.0)
	Female	27 (67.5)	12 (60.0)	15 (75.0)
Marital status	Single	18 (45.0)	10 (50.0)	8 (40.0)
	Married	22 (55.0)	10 (50.0)	12 (60.0)
Educational qualification	Diploma	4 (10.0)	4 (20.0)	0 (0.0)
	Graduate	16 (40.0)	7 (35.0)	9 (45.0)
	Postgraduate	20 (50.0)	9 (45.0)	11 (55.0)
Type of family	Nuclear	22 (55.0)	11 (55.0)	11 (55.0)
	Joint	18 (45.0)	9 (45.0)	9 (45.0)
School administration	Government	17 (42.5)	9 (45.0)	8 (40.0)
	Private	23 (57.5)	11 (55.0)	12 (60.0)
Nature of employment	Temporary	21 (52.5)	12 (60.0)	9 (45.0)
	Probation	5 (12.5)	2 (10.0)	3 (15.0)
	Permanent	14 (35.0)	6 (30.0)	8 (40.0)
Location of school	Rural	23 (57.5)	11 (55.0)	12 (60.0)
	Sub-urban	17 (42.5)	9 (45.0)	8 (40.0)
Place of residence	Rural	32 (80.0)	15 (75.0)	17 (85.0)
	Sub-urban	8 (20.0)	5 (25.0)	3 (15.0)

Continued.

Variable	Category	Total (n=40) f (%)	Experimental (n=20) f (%)	Control (n=20) f (%)
Monthly income (₹)	≤6,767	7 (17.5)	6 (30.0)	1 (5.0)
	6,768-20,273	19 (47.5)	5 (25.0)	14 (70.0)
	20,274-33,792	7 (17.5)	4 (20.0)	3 (15.0)
	33,793-50,559	6 (15.0)	4 (20.0)	2 (10.0)
	50,560-67,586	1 (2.5)	1 (5.0)	0 (0.0)
	Mean (SD)	<₹17,550 (13,235)	<₹20,050 (15,561)	<₹15,050 (10,211)
Teaching experience (years)	0-5	29 (72.5)	15 (75.0)	14 (70.0)
	6-10	4 (10.0)	3 (15.0)	1 (5.0)
	11-15	6 (15.0)	2 (10.0)	4 (20.0)
	16-20	1 (2.5)	0 (0.0)	1 (5.0)
	Mean (SD)	4.90 (4.47)	4.45 (3.75)	5.35 (5.14)

Note: SD=standard deviation. Percentages may not sum to 100 due to rounding.

Table 2: Baseline homogeneity assessment: comparison of demographic characteristics between groups.

Variable	Category	Exp. (n=20) f (%)	Ctrl. (n=20) f (%)	X^2/t	P value
Age (years)	Mean (SD)	30.05 (5.76)	31.20 (5.79)		
	20-30	11 (55)	12 (60)	T=−0.63	0.533
	31-40	9 (45)	6 (30)	X^2=2.643	0.267
	41-50	0 (0)	2 (10)		
Gender	Male	8 (40)	5 (25)	X^2=1.026	0.311
	Female	12 (60)	15 (75)		
Marital status	Single	10 (50)	8 (40)	X^2=0.404	0.525
	Married	10 (50)	12 (60)		
Educational qualification	Diploma	4 (20)	0 (0)		
	Graduate	7 (35)	9 (45)	X^2=4.450	0.108
	Postgraduate	9 (45)	11 (55)		
Family type	Nuclear	11 (55)	11 (55)	X^2=0.000	1.000
	Joint	9 (45)	9 (45)		
School administration	Government	9 (45)	8 (40)	X^2=0.102	0.749
	Private	11 (55)	12 (60)		
Employment	Temporary	12 (60)	9 (45)		
	Probation	2 (10)	3 (15)	X^2=0.914	0.633
	Permanent	6 (30)	8 (40)		
School location	Rural	11 (55)	12 (60)	X^2=0.102	0.749
	Sub-urban	9 (45)	8 (40)		
Place of residence	Rural	15 (75)	17 (85)	X^2=0.625	0.429
	Sub-urban	5 (25)	3 (15)		
Monthly income	Mean (SD)	<₹20,050 (15,561)	<₹15,050 (10,211)		
	6767 or less	6 (30)	1 (5)		
	6,768-20,273	5 (25)	14 (70)	T=1.201	0.237
	20,274-33,792	4 (20)	3 (15)	X^2=9.644	0.047*
	33,793-50,559	4 (20)	2 (10)		
	50,560-67,586	1 (5)	0		
Teaching Experience (years)	Mean (SD)	4.45 (3.75)	5.35 (5.14)	T=−0.632	0.531
	0-5	15 (75)	14 (70)	X^2=2.701	0.440

Note: * p<0.05. Exp.=Experimental group, Ctrl.=Control group; χ^2=chi-square; t=independent samples t-test.

The demographic profile of participants is presented in Table 1. The sample comprised 40 teachers (experimental group, n=20; control group, n=20). The majority were female (67.5%), aged 20-30 years (57.5%), married (55%), and held postgraduate qualifications (50%). Most were employed in private schools (57.5%) on a temporary contract basis (52.5%) and resided in rural areas (80%). The mean age was 30.63 years (SD=5.73), and the mean teaching experience was 4.90 years (SD=4.47). The mean monthly income was less than ₹17,550 (SD=₹13,235.44).

Table 2 presents the comparison of demographic characteristics between the experimental and control groups at baseline. Independent samples t-tests and chi-square tests revealed no statistically significant differences between groups on any demographic variable (all p>0.05), except for the monthly income distribution (χ^2=9.644, p=0.047). This single significant difference was noted and controlled in the subsequent analyses. Overall, the groups were considered adequately homogeneous at baseline, supporting the validity of subsequent group comparisons.

Table 3: Baseline competency comparison between groups using independent sample t-test.

Instrument	Score range	Total mean (SD) (n=40)	Exp. Group mean (SD) (n=20)	Ctrl. Group mean (SD) (n=20)	T	P value
Structured questionnaire	0-35	13.38 (4.656)	12.00 (3.524)	14.75 (5.300)	−1.932	0.061
QTCIPLD	18-72	33.03 (5.015)	31.95 (4.828)	34.10 (5.088)	−1.371	0.178
Structured case vignettes	0-20	6.30 (2.462)	6.30 (2.494)	6.30 (2.494)	0.000	1.000

Note. QTCIPLD=Questionnaire on Teachers' Competence in Identifying Pupils with Learning Disabilities.

Table 4: Within-group and between-group comparisons using repeated-measures ANOVA.

Instrument	Time point	Exp. Group mean (SD)	Ctrl. Group mean (SD)	Time effect F (p)	Group effect F (p)	Time× group F (p)	η^2
Structured questionnaire	Pre-test	12.00 (3.524)	14.75 (5.300)	F=239.83 P<0.001 DF=1.57	F=45.29 P<0.001 DF=1	F=175.47 P<0.001 DF=1.57	0.822
	Post-test 1	29.55 (4.045)	15.70 (4.390)				
	Post-test 2	28.30 (2.658)	16.55 (3.502)				
QTCIPLD	Pre-test	31.95 (4.828)	34.10 (5.088)	F=174.85 P<0.001 DF=1.017	F=66.12 P<0.001 DF=1	F=72.19 P<0.001 DF=1.017	0.655
	Post-test 1	61.00 (7.807)	40.35 (6.133)				
	Post-test 2	60.55 (7.605)	40.40 (6.244)				
Structured case vignettes	Pre-test	6.30 (2.494)	6.30 (2.494)	F=125.498 P<0.001 DF=1.115	F=109.894 P<0.001 DF=1	F=56.432 P<0.001 DF=1.115	0.598
	Post-test 1	17.00 (2.317)	8.25 (2.468)				
	Post-test 2	16.50 (1.906)	8.50 (2.482)				

Note. η^2=partial eta-squared (effect size). All effects significant at p<0.001. QTCIPLD=Questionnaire on Teachers' Competence in identifying Pupils with Learning Disabilities.

Table 5: Comparison of gained mean scores between groups using independent samples t-test.

Instrument	Exp. Group gained mean (SD) (n=20)	Ctrl. Group gained mean (SD) (n=20)	T	DF	P value	Cohen's D
Structured questionnaire	16.30 (3.672)	1.80 (3.334)	13.074	37.651	<0.001	4.13
QTCIPLD	28.60 (9.075)	6.30 (7.554)	8.446	36.789	<0.001	2.67
Structured case vignettes	10.20 (3.019)	2.20 (3.820)	7.348	36.076	<0.001	2.33

Note: Gained mean=post-test 2 score minus pre-test score, Cohen's D≥0.80=large effect; D≥2.0=very large effect. QTCIPLD=Questionnaire on Teachers' Competence in Identifying Pupils with Learning Disabilities.

Table 3 presents the baseline competency scores for both groups. No statistically significant differences were observed between the experimental and control groups on any of the three competency instruments at baseline: Structured Questionnaire (t =−1.932, DF=38, p=0.061), QTCIPLD (t=−1.371, DF=38, p=0.178), and Structured Case Vignettes (t=0.000, DF=38, p=1.000). These findings confirm pre-intervention equivalence of competency between groups. Repeated-measures ANOVA results are presented in Table 4. Significant time effects, group effects, and time x group interaction effects were observed across all three outcome measures (all p<0.001), indicating that the experimental group demonstrated substantially greater competency improvements over time compared to the control group. Assumption of sphericity (Mauchly's Test of Sphericity) was violated during the analysis, and hence, the Greenhouse-Geisser correction for sphericity was applied. For the Structured Questionnaire, the experimental group's mean score increased from 12.00 (SD=3.524) at pre-test to 29.55 (SD=4.045) at post-test 1 and 28.30 (SD=2.658) at post-test 2, compared to marginal changes in the control group (14.75 to 15.70 to 16.55). The time x group interaction was highly significant (f=175.47, p<0.001, η^2=0.822). For the QTCIPLD, the experimental group's mean score rose from 31.95 (SD=4.828) to 61.00 (SD=7.807) at post-test 1 and 60.55 (SD=7.605) at post-

test 2, versus a negligible change in the control group (34.10 to 40.35 to 40.40). The time x group interaction was significant (f=72.187, p<0.001, η^2=0.655). For the Structured Case Vignettes, experimental group scores rose from 6.30 (SD=2.494) to 17.00 (SD=2.317) at post-test 1 and 16.50 (SD=1.906) at post-test 2, compared to minimal change in the control group (6.30 to 8.25 to 8.50). The time x group interaction was the significant (f=56.432, p<0.001, η^2=0.598). The mild changes in outcome scores among the control group are maturational changes.

Table 6: Association of gained scores (structured questionnaire-MCQS) with demographic variables (n=40).

Variable	Category	N	Mean (SD)	F/t	P value
Age (years)	20-30	23	8.61 (8.256)	F=2.613	0.087
	31-40	15	11.20 (7.243)		
	41-50	2	-2.00 (4.243)		
Gender	Male	13	11.23 (7.769)	F=1.404	0.243
	Female	27	8.00 (8.213)		
Marital status	Single	18	9.94 (8.544)	F=0.391	0.535
	Married	22	8.32 (7.876)		
Educational qualification	Diploma	4	14.75 (5.560)	F=1.264	0.294
	Graduate	16	9.25 (7.514)		
	Postgraduate	20	7.75 (8.783)		
Family type	Nuclear	22	8.45 (8.803)	F=0.258	0.614
	Joint	18	9.78 (7.377)		
School administration	Government	17	10.12 (8.131)	F=0.505	0.482
	Private	23	8.26 (8.198)		
Employment	Temporary	21	9.76 (8.252)	F=0.164	0.850
	Probation	5	8.40 (9.072)		
	Permanent	14	8.21 (8.116)		
School location	Rural	23	8.04 (8.461)	F=0.828	0.368
	Sub-urban	17	10.41 (7.665)		
Place of residence	Rural	32	8.38 (8.241)	F=1.109	0.299
	Sub-urban	8	11.75 (7.479)		
Monthly income (₹)	≤6,767	7	14.57 (6.106)	F=3.402	0.019*
	6,768-20,273	19	4.79 (7.239)		
	20,274-33,792	7	11.00 (7.853)		
	33,793-50,559	6	12.50 (7.918)		
	50,560-67,586	1	17.00		
Teaching experience (years)	0-5	29	9.28 (7.901)	F=0.747	0.531
	6-10	4	12.75 (9.777)		
	11-15	6	6.83 (8.773)		
	16-20	1	1.00		

Note: * p<0.05.

Table 5 presents the comparison of gained mean scores (difference between final and baseline assessments) between groups. The experimental group demonstrated significantly higher gained mean scores than the control group across all three instruments.

For the Structured Questionnaire, the experimental group gained a mean of 16.30 (SD=3.672) compared to 1.80 (SD=3.334) in the control group (t=13.074, DF=37.651, p<0.001, Cohen's D=4.13). For the QTCIPLD, and gained means were 28.60 (SD=9.075) versus 6.30 (SD=7.554) (t=8.446, DF=36.789, p<0.001, Cohen's D=2.67). For the Structured Case Vignettes, gained means were 10.20 (SD=3.019) versus 2.20 (SD=3.820) (t=7.348, DF=36.076, p<0.001, Cohen's D=2.33).

All effect sizes were very large, indicating the practical as well as statistical significance of the intervention. Tables 6, 7, and 8 present the associations between gained competency scores and selected demographic variables.

Table 7: Association of gained scores (structured case vignettes) with demographic variables (n=40).

Variable	Category	N	Mean (SD)	F/t	P value
Age (years)	20-30	23	6.26 (5.421)	F=0.521	0.598
	31-40	15	6.60 (5.275)		

Continued.

Variable	Category	N	Mean (SD)	F/t	P value
	41-50	2	2.50 (4.950)		
Gender	Male	13	6.38 (5.810)	F=0.023	0.881
	Female	27	6.11 (5.132)		
Marital status	Single	18	7.44 (5.554)	F=1.852	0.182
	Married	22	5.18 (4.953)		
Educational qualification	Diploma	4	8.50 (2.380)	F=0.813	0.451
	Graduate	16	5.06 (5.767)		
	Postgraduate	20	6.65 (5.274)		
Family type	Nuclear	22	6.05 (5.550)	F=0.041	0.841
	Joint	18	6.39 (5.101)		
School administration	Government	17	4.82 (5.271)	F=2.058	0.160
	Private	23	7.22 (5.178)		
Employment	Temporary	21	7.62 (4.924)	F=2.113	0.135
	Probation	5	2.80 (5.805)		
	Permanent	14	5.29 (5.254)		
School location	Rural	23	7.00 (5.161)	F=1.247	0.271
	Sub-urban	17	5.12 (5.419)		
Place of residence	Rural	32	6.38 (5.476)	F=0.172	0.681
	Sub-urban	8	5.50 (4.721)		
Monthly income (₹)	≤6,767	7	11.86 (2.673)	F=3.330	0.021*
	6,768-20,273	19	4.42 (4.857)		
	20,274-33,792	7	4.86 (4.634)		
	33,793-50,559	6	6.50 (6.221)		
	50,560-67,586	1	8.00		
Teaching experience (years)	0-5	29	6.59 (5.507)	F=0.912	0.445
	6-10	4	7.50 (4.796)		
	11-15	6	4.67 (4.367)		
	16-20	1	1.00		

Note: * p<0.05.

Table 8: Association of gained scores (QTCIPLD) with demographic variables (n=40).

Variable	Category	N	Mean (SD)	F/t	P value
Age (years)	20-30	23	16.65 (14.929)	F=0.084	0.920
	31-40	15	18.53 (13.627)		
	41-50	2	18.50 (9.192)		
Gender	Male	13	17.54 (14.678)	F=0.001	0.978
	Female	27	17.41 (13.918)		
Marital status	Single	18	19.83 (14.798)	F=0.950	0.336
	Married	22	15.50 (13.298)		
Educational qualification	Diploma	4	32.00 (5.354)	F=2.651	0.084
	Graduate	16	15.13 (15.431)		
	Postgraduate	20	16.40 (12.584)		
Family type	Nuclear	22	17.68 (14.167)	F=0.013	0.909
	Joint	18	17.17 (14.151)		
School administration	Government	17	14.88 (14.499)	F=0.997	0.324
	Private	23	19.35 (13.590)		
Employment	Temporary	21	22.57 (12.722)	F=4.006	0.027*
	Probation	5	6.40 (9.127)		
	Permanent	14	13.71 (14.398)		
School location	Rural	23	19.04 (13.930)	F=0.698	0.409
	Sub-urban	17	15.29 (14.176)		
Place of residence	Rural	32	17.28 (13.952)	F=0.023	0.881
	Sub-urban	8	18.13 (15.037)		
Monthly income (₹)	≤6,767	7	29.14 (10.254)	F=2.712	0.046*

Continued.

Variable	Category	N	Mean (SD)	F/t	P value
	6,768-20,273	19	13.16 (12.567)		
	20,274-33,792	7	13.57 (15.544)		
	33,793-50,559	6	18.67 (13.382)		
	50,560-67,586	1	37.00		
Teaching experience (years)	0-5	29	16.48 (14.576)	F=0.709	0.553
	6-10	4	27.00 (7.071)		
	11-15	6	16.67 (14.814)		
	16-20	1	12.00		

Note: * p<0.05. QTCIPLD=Questionnaire on Teachers' Competence in Identifying Pupils with Learning Disabilities.

Monthly income was the only demographic variable that demonstrated a statistically significant association with competency gains across all three outcome measures: Structured Questionnaire (f=3.402, p=0.019), Structured Case Vignettes (f=3.330, p=0.021), and QTCIPLD (f=2.712, p=0.046). Notably, teachers in the lowest income bracket (≤ ₹6,767) and the highest income bracket (₹50,560-₹67,586) demonstrated the highest gained mean scores, suggesting a non-linear relationship between income and competency gains. Nature of employment was additionally associated with QTCIPLD gained scores (f=4.006, p=0.027), with temporarily employed teachers demonstrating higher gains than those on probation or permanent contracts. No significant associations were observed for age, gender, marital status, educational qualification, family type, school administration type, school location, or place of residence (all p>0.05).

Hypothesis testing outcomes

H1 was accepted: Significant pre-test to post-test improvements in competency scores were observed in the experimental group across all three instruments (p<0.001). H2 was accepted: Significant between-group differences in post-test competency scores were confirmed between the experimental and control groups (p<0.001). H3 was partially accepted: A significant association was found between monthly income and competency gains across all three instruments; the nature of employment was also significantly associated with QTCIPLD. H3 was rejected for all other demographic variables.

DISCUSSION

This study provides robust evidence for the effectiveness of the Competency Improvement Module (CIM) in enhancing primary school teachers' competency in the early diagnosis and management of childhood learning disabilities. The experimental group demonstrated statistically significant and practically large improvements across all three competency domains: general knowledge, identification competency (QTCIPLD), and management competency (Case Vignettes) at both post-test time points, with very large effect sizes (Cohen's D=2.33 - 4.13). The control group demonstrated negligible changes over the same period, confirming that the observed gains were attributable to the CIM rather than to maturation, testing effects, or other confounds. Competency gains were sustained at post-test 2 (42 days post-intervention), indicating durable learning. Monthly income was the only demographic variable significantly associated with competency gains, while most other demographic characteristics showed no significant influence. The magnitude of competency gains observed in the present study is consistent with, and in some respects exceeds, findings from comparable teacher training studies. A study reported an increase in overall knowledge from 24.7%-76% following a training intervention for 150 primary school teachers in India, with the proportion rated as having 'good' knowledge rising from 21%-84%.[8] Similarly, another finding reveals that the training guidelines for trainee school teachers toward identification and management of children with SPLD were effective in improving the knowledge and attitude significantly over the time period.[15] An international study's pre- and post-intervention assessments, including a co-teaching test and a collaboration skills scale, reveal substantial advantages of the training program, with participants exhibiting enhanced performance in both the co-teaching post-test and collaboration scale. Special education teachers significantly surpassed their general education peers in co-teaching competencies.[16] The present study extends these findings by employing a quasi-experimental design with a control group, thereby providing stronger causal evidence for the effectiveness of structured teacher training.

The very large effect sizes obtained in the present study (Cohen's D=2.33-4.13) are noteworthy. Another study similarly reported large effect sizes following a competency enhancement program for elementary school teachers in Saudi Arabia regarding gifted students with learning disabilities.[16] These consistent findings across diverse cultural and geographic contexts suggest that structured, content-specific teacher training modules can produce substantial competency gains regardless of setting. The sustained nature of competency gains at post-test 2 (42 days post-intervention) is particularly encouraging.[17] Another study demonstrated that teacher knowledge gains from content-specific professional development were durable and translated into enhanced instructional practices.[18] The present findings suggest that the CIM's multi-modal delivery format, combining didactic instruction, case-based learning, and practical exercises, may facilitate deeper encoding and retention of learning. Sansano et al, in their evaluation of a Response-to-Intervention model in the Canary Islands, they similarly

found that structured teacher training with follow-up support produced sustained improvements in teacher competency and associated student outcomes.[19]

The control group demonstrated minimal changes in competency scores across the study period, consistent with findings from which documented persistently low baseline knowledge in the absence of structured training.[20,21] This underscores the inadequacy of passive exposure to educational materials for producing meaningful competency gains, and reinforces the necessity of active, structured training programs.

Demographic influences on competency gains

Monthly income was the only demographic variable significantly associated with competency gains across all three outcome measures. Teachers in the lowest income bracket demonstrated the highest gains, potentially reflecting greater motivation to acquire new competencies that could enhance their professional standing and employment security. Conversely, teachers in the highest income bracket also demonstrated high gains, possibly reflecting greater access to prior educational resources and a stronger foundation for new learning.

The non-linear pattern observed warrants further investigation in larger samples. The absence of significant associations between competency gains and other demographic variables, including age, gender, educational qualification, and teaching experience, is consistent with findings from quasi-experimental teacher training studies in India, which reported no significant association between selected sociodemographic variables and knowledge gains.[8] These findings suggest that the CIM is broadly effective across diverse teacher profiles, supporting its potential for wide-scale implementation without the need for differential targeting based on demographic characteristics.

Practical implications

The findings of this study have several important practical implications. First, the demonstrated effectiveness of the CIM supports its integration into pre-service teacher education curricula and in-service professional development programs across India, particularly in regions with a high prevalence of undetected learning disabilities. Second, the feasibility of delivering the CIM within a school setting, without requiring specialist infrastructure, suggests potential for scalability. Third, the broad effectiveness of the CIM across diverse demographic profiles implies that large-scale implementation does not require complex targeting strategies.

The inclusion of case vignettes as a competency assessment tool beyond traditional knowledge-based questionnaires represents a methodological advance that captures practical competency in management scenarios. This approach aligns with competency-based education frameworks and provides a more ecologically valid measure of teacher readiness for real-world LD identification and management.[16] Policy-makers and school administrators should consider mandating structured LD competency training as part of annual teacher professional development requirements, particularly given the high prevalence of LDs in Indian primary school populations.[22]

Study strengths

This study possesses several notable strengths. The quasi-experimental design with a matched control group provides stronger causal evidence than the pre-experimental designs that predominate in the existing literature. The use of three validated instruments spanning multiple competency domains knowledge, identification, and management offers a comprehensive assessment of teacher competency beyond single-domain measures. The inclusion of two post-test assessments (on 52nd and 73rd day of completing intervention) enables evaluation of both immediate and sustained competency gains. The rigorous psychometric validation of all instruments, including content validity indices, item discrimination analysis, and confirmatory factor analysis (for the QTCIPLD), ensures measurement quality.

Study limitations

Several limitations of this study warrant acknowledgement. First, the pilot sample of 40 teachers from a single district (zone) limits the generalizability of findings to other geographic and cultural contexts. Second, the absence of true randomization introduces the possibility of selection bias, although baseline homogeneity testing did not reveal significant pre-existing differences between groups on most variables.

Third, the study did not assess the downstream impact of improved teacher competency on student outcomes, which represents a critical next step in evaluating the real-world effectiveness of the CIM. Fourth, self-report instruments may be subject to social desirability bias, particularly for the QTCIPLD Likert-scale items. Fifth, the relatively short follow-up period (42 days post-intervention) does not permit conclusions about the long-term durability of competency gains.

CONCLUSION

This pilot study demonstrates that the CIM is an effective and feasible intervention for enhancing primary school teachers' competency in the early diagnosis and management of childhood learning disabilities. Significant and large improvements were observed across all three competency domains in the experimental group, with gains sustained at 42 days post-intervention. The control group demonstrated negligible change, affirming the specific effectiveness of the CIM. Monthly income was the only demographic variable significantly associated with

competency gains, and the CIM demonstrated broad effectiveness across diverse teacher profiles. These findings provide a strong empirical foundation for the large-scale implementation of structured LD competency training for primary school teachers in India, with the potential to significantly improve early identification rates and management outcomes for children with learning disabilities.

Recommendations

Future research should address the limitations of the present study through: a large-scale randomized controlled trial (RCT) with adequate statistical power across multiple districts and states; longitudinal follow-up assessments extending to six months and one year post-intervention to evaluate the durability of competency gains; assessment of downstream student outcomes (e.g., LD identification rates, referral rates, academic achievement) to establish the full impact of the CIM; evaluation of the CIM's effectiveness across diverse cultural and linguistic contexts within India and internationally; and exploration of optimal delivery formats, including digital and blended-learning modalities, to enhance scalability and accessibility.

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