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Impact of Quality Teaching Learning Materials on Cognitive Development of Preschool Children

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ABSTRACT

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A study on “Impact of quality teaching learning materials on cognitive development of preschool children” has been conducted at University of Agricultural Sciences, Dharwad, Karnataka in selected 8 preschools. The sample for the study comprised of children of 3-5 years from selected preschools. Equipment and materials questionnaire consisting of 92 items with 9 components which facilitates development of children was used. Based on the total scores of teaching learning materials, preschools were categorized as high teaching learning material schools (HTLM) and low teaching learning material (LTLM) schools. Cognitive development of children was assessed using Kaufman Assessment Battery for children, [KABC-II] 2004. Results indicated that, the children from HTLM had high Mental processing indices (117.59) than LTLM children (95.38). With age factor, three year old children performed better in all cognitive tests compared to four and five year old children in both HTLM and LTLM schools. Mental processing indices were found better for girls in both type of schools. In most of cognitive subsets the mean scores of children both type of schools are showing decreasing tendency as they were growing, this may be due to the fact that clubbing of all aged children (3-5 yrs) under one session and giving the same teaching learning material to younger and older children suppresses and hinders the activity level and cognitive skills among children. Hence, separate sessions/ classes are to be held for different age group of children. So that, they can be provided with age and developmental task related teaching learning materials for better cognitive development.

Introduction

Play is special for children. Not only is it fun, but it is also important for healthy development. It is their “work” and their way of learning about the world. Through play, children try out new skills, explore their imagination and creativity, and develop

relationships with other people in their lives. Parents and Early childhood centers should provide a safe environment that offers a variety of play materials to meet the different developmental skill levels and support the creative interests of children. Toys and materials that promote active learning motivate children to pursue their own ideas

and interests enthusiastically. Many toys, for example, encourage children's interest in concepts like same/different, patterned/planned, classifying, and sorting. Construction items help children learn about science and number concepts, and hardwood unit blocks help children learn about geometry, gravity, shapes, and balance. Children practice problem solving as they figure out how things work, and when children create with paint, they learn to mix colors and to use their own unique ideas, which helps them in exploring and discovering consequences.

Early childhood education and care (ECEC) environments (learning environments) are many-sided, and consist of physical, psychological and social elements including the facilities, immediate neighbourhood, and social and psychological settings as well as various materials and equipment. Outdoor and indoor learning environments should be motivating and inviting to all children, so that they are encouraged and helped to explore and to use all the possibilities offered for fun, adventure, challenge and creativity (NCCA, 2004). McMillan (cited in Smith *et al.*, 2005) believed in the importance of first hand experiences and active learning. Convinced of the value of play she ensured there were ample materials available to stimulate children's imaginations.

Choosing toys and activities that are suitable for infants and toddlers can challenge even the most experienced teacher. By being mindful of the basic principles of child development and the role of play, teachers can intentionally select toys to meet young children's unique needs and interests, supporting learning. It is also important to be aware of the essential role of teacher-child interactions. When teachers engage with children as they play, teachers help children make sense of their experiences and promote

children's further exploration (Johnson & Johnson 2006).

Teachers can build on children's play by providing engaging toys. Effective toys are safe and suited to the child's age, abilities, and interests. When teachers are aware of how specific cognitive skills can be practiced through play, they can choose toys and activities intentionally. As the underlying reasons for selecting specific toys and activities become clearer, a world of limitless possibilities for invented toys opens up.

As the primary vehicle for early childhood education, toys are an essential classroom ingredient. Readily available materials, when used appropriately, can stimulate play and development across all domains. While toys are important instruments in facilitating a child's development, above all, toys should be considered tools with which teachers can engage children.

Considering all these points, the present study has been taken up with the objective to know how the quality teaching and learning materials provided in ECCE helps to enhance the cognitive development of preschool children.

Materials and Methods

Research design

A correlation research design was employed to study the relationship of cognitive skills and high and low use of teaching learning materials in the early childhood education centers.

Population and sample

The population for the study comprised of pre-school children of Dharwad city. Children between 3-5 years attending day care centers,

play homes and nursery schools were selected as samples for the study.

Selection of centres: Survey was conducted in the Dharwad city to prepare the list of number of schools existing in the prime localities of the city.

Variables considered for the study

In the study, cognitive skills and teaching learning material were selected as depending variables. Age and gender of children were considered as independent variables.

Tools used for the data collection

General information schedule: General information schedule consists of information pertaining to children’s age, gender, type of school attending.

Equipment and materials questionnaire: Equipment and materials questionnaire consists of 9 categories as given in the below table. ECCE centres surveyed in Dharwad city were observed for the presence of these categories of materials.

Sl.No	Category	Number of items
1	Outdoor equipment	13
2	Garden set	3
3	Sand and water activity	20
4	Creative work material	19
5	Cognitive activity	6
6	Manipulative	9
7	Imaginative	5
8	Musical instruments consists	4
9	Indigenous material	13

If the ECCE centre has the listed items then the one score was given otherwise a zero score was given. Based on the total score the ECCE centre were categorised as High

Teaching Learning Material (HTLM) and Low Teaching Learning Material (LTLM). The categories are as follows

Categorization of centre with high and low teaching learning material

Category of ECCE centers based on teaching learning material	High teaching learning material	low teaching learning material
Outdoor equipment(13)	6 -13	0-5
Garden set(3)	2 -3	0-1
Sand and water activities(20)	10 -20	0-9
Creative work materials(19)	10 -19	0-9
Cognitive activity(6)	3 -6	0-2
Manipulative (9)	5 -9	0-4
Imaginative (5)	0-2	3 -5
Musical instruments(4)	2 -4	0-1
Indigenous materials(13)	7-13	0-6
Total(92)	47-92	0-46

Kaufman Assessment Battery for children, second edition [KABC-II]: Developed by Kaufman and Kaufman (2004). It is an individually administered tool which measures processing and cognitive abilities of preschool children and adolescents from 3 to 18 years.

For the study purpose tests suitable for preschool years i.e., 3 -5 year were used. It has 18 subtests of two types: Core subtests and Supplementary subtests. There are two interpretive models: Luria model and Cattell-Horn-Carroll (CHC) model. The subtests are grouped into 4 or 5 scales depends on the age and interpretive model chosen. Luria model consists of four scales:

Sequential processing scale (consists of number recall, word order)
 Simultaneous processing scale (consists of face recognition, triangles)
 Learning ability (consists of atlantis, rebus)
 Knowledge ability (consists of expressive vocabulary, riddles).

CHC model renames these scales as, Short Term Memory (Gsm), Visual Processing (Gv), Long Term Storage and Retrieval (Glr) and Fluid Reasoning (Gf) and additional 5th scale i.e., Crystallised Ability (Gc). KABC-II yields two general intelligence composite scores: Mental Processing Index (MPI; Luria’s model) and Fluid-Crystallised Index (FCI; CHC model).

List of core and supplementary subtests for different age group of children

Age	Core subtests	Supplementary subtests
3-3.11 years	Word Order	Number Recall
	Face Recognition	Gestalt Closure
	Triangles	
	Atlantis	
	Expressive Vocabulary (FCI only)	Verbal Knowledge
	Riddles (FCI only)	
4-5 Years	Number Recall	Hand Movements
	Word Order	
	Face Recognition	Gesalt Closure
	Triangles	
	Atlantis	
	Rebus	
	Expressive Vocabulary (FCI only)	Verbal Knowledge
	Riddles (FCI only)	

Age wise subtests were administered to selected children for each rightly said answer, one score was given after complete administration of all sub tests, the obtained scores were totalled up and these total raw scores were converted into scaled scores, which were again converted into standard scores based on the norms given in the manual. Based on these standard scores

children were categorised as follows.

Standard scores	Descriptive category
More than 131	Upper extreme
116-130	Above average
85-115	Average
70-84	Below average
Less than 69	Lower extreme

Data collection procedure

The research was planned and conducted in four phases.

Phase I- Survey of play homes/ nursery schools in Dharwad city

Play home/ Nursery schools were considered in the list were based on the certain criteria. i.e, which were existing since two years, having children strength more than 15, easy identification of the centre and willingness and cooperation of the school staff. Out of 55 schools, only 38 schools were fulfilled the above criteria. So these schools 38 were selected for study purpose.

Phase II- Selection of centre / school for study purpose

These selected schools were observed for the material and equipments present in the schools. Based on the total score of material and equipments the ECCE centre were classified as Low Teaching Learning Material centre(LTLM) and High Teaching Learning Material (HTLM). Out of total 92 materials, if centre obtained score is between 47 to 92, they were categorised as high teaching learning material and less than 47 score they were low teaching learning material centre.

Category of ECCE centers based on teaching learning material	No. of Low Schools	No. of High Schools
Outdoor equipment(13) High (6 -13) low(0-5)	16	22
Garden set(3) High (2 -3) low(0-1)	25	13
Sand and water activities(20) High (10 -20) low(0-9)	18	20
Creative work materials(19) High (10 -19) low(0-9)	5	33
Cognitive activity(6) High (3 -6) low(0-2)	17	21
Manipulative (9) High (5 -9) low(0-4)	23	15
Imaginative (5) High (3 -5) low(0-2)	17	21
Musical instruments(4) High(2 -4) low(0-1)	18	20
Indigenous materials(13) High (7-13) Low(0-6)	8	30
Total(92) High(47-92) low (0-46)	10	28

Categorization of school as low and high teaching learning material

Out of 38 schools, 10 schools were found to be LTLM schools and 28 were HTLM schools. Based on cooperation of school staff, easy approach to the school and availability of

the number of children (boys and girl). Eight schools were selected for the study purpose. Out of which 4 were LTLM and 4 HTLM.

Phase III- Selection of children and administration of assessments tools

Children between 2-5 years attending the selected 8 schools were considered as samples for the study and they were further assessed for cognitive abilities. With two-three visits to the schools. General information was obtained through, parents who used to visit the schools daily, or obtained from the school teacher.

Results and Discussion

Selection of samples (children): The children between the age of two – five years attending the selected ECCE schools were recruited as samples for the study, these children were selected based on the age and type of school attending (Table-1). Totally 118 children were selected out of which 64 were from low TLM and 54 children were from high TLM schools.

Assessment of cognitive development of children

Cognitive abilities of children was assessed using Kaufman's cognitive scale. Results on cognitive abilities of children are presented in tables from 2a-2d.

Results depicted in table 2a, reveals that in all the subtests, the mean scaled scores obtained for children of low TLM schools. More difference in mean scores was found for subtests like number recall, gestalt closure and expressive vocabulary.

Mental Processing Index (MPI) scores shows in table 2b, indicates that, for all components, children of high TLM schools were showing higher indices compared to low TLM schools. A difference of 12-16 indices was observed with the total scaled scores and standard scores. The results are in line with the study conducted by Gordon *et al.*, (2013), Slot *et al* (2015) and Howes (2001) who revealed that, space and furnishings, activities for language

reasoning and programme structure, play activities had better educational and cognitive outcomes at school which in turn depicting the quality of environment.

The difference in the mean standard scores of all children of high TLM and low TLM was found to be statically significant (table 2c).

Children were categorized based on their standard scores obtained in cognitive tests and results are depicted in table 2d. In both type of schools, higher number of children were belonged to average category. In case of low TLM schools, 16 children found to be in below average category as against only one child in high TLM school. Under lower extreme category there were 5 children in low TLM and no one in the high TLM. It was interesting to note that 18 children from high TLM belonged to upper extreme category as against only one from low TLM schools. The results from the study of Burchinal *et al.*, (2010) and Rao *et al.*, (2012) also showed that, higher quality of preschool centre was significantly associated with better school readiness and cognitive ability at preschool, indicated learning outcomes more strongly in higher quality than lower quality programs.

Results of cognitive scores of children attending high and low TLM, with respect to the age and presented in table 3a. Among children of low TLM, the mean scores for all the subtests were found to be high for 3 years old children compared to 4 years and 5 years. Except atlantis and number recall. Between children of 4 and 5 years, slight increase in the score was noticed only in the face recognition, number recall and expressive vocabulary subtests.

In case of children from high TLM, similar trend was observed, but the mean scores were higher compared to the scores of low TLM school children. Increase scores were seen in the subtests like, face recognition, number

recall, expressive vocabulary, triangle and word order(table.3a)

Results related to MPI scores, decreasing trend was observed between the ages (table 3b). This kind of result may be due to the fact that all age group children were clubbed in one class and they will provided with same kind of teaching learning materials. For 3 year old children these material showed high impact on their cognitive abilities but in later year the impact has been decreased. This clearly shows that there is a need of age related teaching learning material for attainment of better cognitive abilities. Result of table 3c shows that, the means of the standard score of all subtests, was found to be high for 3 years old. Children and scores were decreased thereafter in both low TLM and high TLM. The difference was found to be statistically significant. Results are also confirmed with results of the study by Bradley *et al.*, (2007) and Loeb *et al.*, (2007) where, results indicated that the children who entered a centre program between the ages of two and three years of age had stronger cognitive benefits.

Cognitive abilities of children with respect to gender: Cognitive abilities of boys and

girls attending low TLM and high TLM schools were showed in table 4a to 4c.

Cognitive test scores depicted in table 4a, reveals that, among children of low TLM, gives higher scores in subtests of face recognition, number recall, rebus and hand movements. In rest other tests, boys had higher scores. In case of high TLM schools, Figures in the table 4b, shows that, MPI in all components, girls tend to had high than boys in both LTLM and HTLM schools. However the indices high difference with high TLM girls.

The mean scores of cognitive abilities of boys and girls from HTLE schools was found to be higher (118.53 and 11.67 respectively) compared to boys and girls from LTLE schools (97.17 and 93.6). However, the ‘t’ value showed non significant difference between gender and cognitive abilities of children of different type of school (Table 4c). The results were in line with the study Domitrovich *et al.*, (2013) who observed that, females had better word identification and writing skills as well as cognitive skills compared to children who received two years program versus one year than the males.

Table.1 Total number of children selected from different schools

Type of school	Number of school	Number of children with age			Total number of children
		3 years	4 years	5 years	
Low TLM	1	-	8	3	11
	2	5	7	5	17
	3	7	6	2	15
	4	8	11	2	21
	Total	20	32	12	64
High TLM	1	5	6	9	20
	2	2	6	3	11
	3	5	11	-	16
	4	2	5	-	7
	Total	14	28	12	54
Total	8	34	60	24	118

Table.2a Cognitive abilities of children attending high and low teaching learning material school

Sl.no	Name of the sub tests	Low teaching learning materials of school (n=64)		High teaching learning materials of school (n=54)	
		Mean	SD	Mean	SD
1	Atlantis	4.81	2.47	7.52	2.91
2	Conceptual Thinking	6.22	1.71	7.13	1.82
3	Face Recognition	7.34	1.68	8.77	2.40
4	Number Recall	10.73	3.13	13.24	2.22
5	Gestalt Closure	4.22	1.82	6.28	2.17
6	Expressive Vocabulary	5.31	2.15	7.57	2.72
7	Verbal Knowledge	6.34	1.59	7.20	2.27
8	Rebus	5.87	1.40	5.98	1.68
9	Triangles	4.45	2.21	4.78	2.77
10	Word Order	4.78	1.81	5.39	1.51
11	Hand movements	9.27	2.07	9.43	2.99
12	Riddles	5.27	2.12	6.11	2.12

Table.2b Mental Processing Index (MPI) scores of children with respect to type of ECCE
N=118

Sl.no	MPI	Low teaching learning materials of school (n=64)		High teaching learning materials of school (n=54)	
		Mean	SD	Mean	SD
1	Sequential/Gsm	15.58	3.54	18.41	3.44
2	Simultaneous/Gv	17.66	3.65	20.76	4.48
3	Learning/Glr	10.52	2.60	13.65	3.99
4	Knowledge/Gc	10.87	3.58	14.04	3.82
5	Standard Score	95.38	18.52	117.59	21.12

Table.2c Comparison of children’s cognition by type of school

Type of School	N	Mean	SD	t
High teaching learning material school	54	117.59	21.12	6.08**
Low teaching learning material school	64	95.38	18.52	

** Significant at 1% level

Table.2d Categorization of cognitive abilities of children by type of school N=118

Category (Standard score)	Low teaching learning material school			High teaching learning material school		
	N	Mean	SD	N	Mean	SD
Lower extreme (<69)	5	62.40	9.84	0	-	-
Below average (70-84)	16	79.12	7.83	1	84.00	-
Average (85-115)	31	100.39	8.92	25	100.84	7.71
Above average (116-130)	11	116.18	10.34	10	119.20	10.87
Upper extreme (>131)	1	136.00	-	18	141.83	11.89
Total	64	95.37	18.52	54	117.59	21.12

Table.3a Cognitive scores of children in low and high teaching learning materials of school with respect to age N=118

Sl.no	Name of the sub tests	Low teaching learning materials of school (n=64)						High teaching learning materials of school (n=54)					
		3 yrs(n=20)		4yrs (n=32)		5yrs (n=12)		3 yrs(n=14)		4yrs (n=28)		5yrs (n=12)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Atlantis	4.20	1.24	5.31	2.80	4.50	2.94	7.93	3.20	7.18	3.26	7.83	1.40
2	Conceptual Thinking	6.75	1.45	6.44	1.68	4.75	1.48	7.07	2.16	7.50	1.77	6.33	1.30
3	Face Recognition	7.55	1.90	7.13	1.26	7.58	2.27	9.36	1.91	8.21	2.01	9.42	3.45
4	Number Recall	10.10	2.15	10.81	3.53	11.58	3.40	13.50	2.47	13.71	2.29	14.17	1.40
5	Gestalt Closure	4.80	1.85	4.25	1.72	3.17	1.69	7.50	2.88	5.43	1.59	6.83	1.59
7	Expressive Vocabulary	5.35	2.13	5.06	2.30	5.92	1.78	8.14	1.92	7.00	2.50	8.25	3.74
8	Verbal Knowledge	7.20	1.74	6.25	1.39	5.17	0.93	7.71	3.02	7.04	2.13	7.00	1.54
9	Rebus	6.90	1.21	5.72	1.02	4.58	1.38	6.86	1.83	5.68	1.49	5.66	1.67
10	Triangles	4.80	2.31	4.31	2.24	4.25	2.09	5.21	3.21	3.68	2.21	6.83	2.21
12	Word Order	5.50	1.00	4.44	1.97	4.50	2.20	5.86	0.95	4.89	1.71	6.00	1.21
14	Hand movements	10.20	1.74	9.28	2.00	7.66	1.92	9.79	2.55	9.32	3.23	9.25	3.11
15	Riddles	6.30	1.87	4.78	2.21	4.83	1.75	7.21	2.89	5.86	1.84	5.42	1.08

Table.3b Mental Processing Index (MPI) scores of children in low and high teaching learning materials of school with respect to age N=118

Sl.no	MPI	Low teaching learning materials of school (n=64)						High teaching learning materials of school (n=54)					
		3 yrs (n=20)		4yrs (n=32)		5yrs (n=12)		3 yrs (n=14)		4yrs (n=28)		5yrs (n=12)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Sequential/Gsm	15.60	2.30	15.38	3.80	16.08	4.62	19.36	2.71	17.00	3.67	20.58	1.98
2	Simultaneous/Gv	18.50	3.77	17.53	3.60	16.58	3.55	21.21	5.45	19.75	4.02	22.58	3.92
3	Learning/Glr	11.05	1.61	11.03	2.90	8.25	1.91	15.29	4.97	12.89	3.98	13.50	1.98
4	Knowledge/Gc	11.65	2.74	10.44	4.33	10.75	2.49	15.29	4.63	13.18	3.14	14.58	4.08
5	Standard Score	111.30	9.25	97.56	16.71	84.66	11.92	131.14	22.74	112.96	19.35	102.33	9.29

Table.3c Comparison of cognitive scores of children according to their age N=118

Age of the children	Low teaching learning material school (n=64)				High teaching learning material school (n=54)			
	N	Mean	SD	F	N	Mean	SD	F
2.5-3.5 years	20	104.2	17.52	4.926**	14	132.79	21.99	6.73**
3.6-4.5 years	32	93.88	19.01		28	114.79	19.50	
4.6-5.5 years	12	84.67	11.92		12	106.42	13.93	
Total	64	95.38	18.52		54	117.59	21.12	

**Significant at 1% level

Table.4a Cognitive abilities of children with respect to gender in low and high teaching learning materials of school N=118

Sl.no	Name of the sub tests	Low teaching learning materials of school (n=64)				High teaching learning materials of school (n=54)			
		Male (n=25)		Female (n=39)		Male (n=28)		Female (n=26)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Atlantis	4.96	2.54	4.72	2.44	6.79	2.96	6.78	2.96
2	Conceptual Thinking	6.40	1.78	6.10	1.68	6.75	1.51	6.75	1.51
3	Face Recognition	7.08	1.89	7.51	1.53	8.82	2.65	8.82	2.65
4	Number Recall	10.56	3.06	10.84	3.21	12.78	2.33	12.79	2.33
5	Gestalt Closure	4.72	1.97	3.90	1.66	6.46	2.46	6.46	2.46
6	Expressive Vocabulary	5.36	2.38	5.28	2.03	7.86	3.01	7.86	3.01
7	Verbal Knowledge	6.56	1.55	6.21	1.61	7.07	2.12	7.07	2.12
8	Rebus	5.92	1.38	5.85	1.42	5.86	1.11	5.86	1.11
9	Triangles	4.68	1.57	4.31	2.55	4.21	2.60	4.21	2.60
10	Word Order	4.76	1.73	4.79	1.88	5.61	1.34	5.61	1.34
11	Hand movements	9.04	2.13	9.41	2.05	8.46	2.65	8.46	2.65
12	Riddles	5.40	2.06	5.18	2.17	5.96	2.25	5.96	2.25

Table.4b Mental Processing Index (MPI) scores of children with respect to type of ECCE N=118

Sl. no	MPI	Low teaching learning materials of school (n=64)				High teaching learning materials of school (n=54)			
		Male (n=25)		Female (n=39)		Male (n=28)		Female (n=26)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Sequential/Gsm	15.32	3.57	15.74	3.55	18.53	2.76	18.26	4.09
2	Simultaneous/Gv	18.16	3.05	17.33	4.00	19.82	4.13	21.76	4.69
3	Learning/Glr	10.44	2.24	10.56	2.84	12.71	3.30	14.65	4.47
4	Knowledge/Gc	11.00	3.51	10.79	3.67	13.86	3.74	14.23	3.97
5	Standard Score	98.80	15.47	99.85	17.50	113.25	21.27	117.53	20.97

Table.4c Comparison of cognitive scores of children according to their gender

Age of the children	Low teaching learning material school (n=64)				High teaching learning material school (n=54)			
	N	Mean	SD	t	N	Mean	SD	t
Boys	25	97.17	14.81	1.37	28	118.53	21.72	1.49 ^{Ns}
Girls	39	93.60	8.69		26	116.67	19.81	
Total	64	95.38	18.52		54	117.59	21.12	

Ns- non significant

In conclusion, From the survey of the schools. It is observed that, the schools are not having required materials which promote cognitive and motor abilities among children. (in 38 schools, almost all are having very less no. of outdoor materials, musical instruments and cognitive materials). Though more no. of schools fell under High TLM (28 out of 38), this may be due to the reason of including lot of only creative work material and indigenous materials in their schools, other categorization of material and equipment are lacking. In most of cognitive subsets the mean scores of children both schools are showing decreasing tendency as they are growing this may be due to the fact that clubbing of all aged children (3-5 yrs) under one session and giving the same teaching learning material to younger and older which suppresses and hinder the activity level and cognitive skills among children. In both type of schools, girls had higher cognitive scores compared to boys which may be due to increased physical activity and lack of concentration among boys. Children having younger age parents and education are showing better cognitive scores compared to their counter parts.

Recommendations

Play homes and nursery schools are the learning centre for children who are in the critical stage of overall development. Hence they should provide ample number of teaching learning material to the children.

Separate sessions/ classes are to be held for different age group of children. So that they can be provided with age and developmental task related teaching learning materials.

Designing of TLM facilitates the teacher in providing and modifying suitable material to the age and gender of the children.

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