Hands-On/Mind-On Activities and Intellectual Development of Preschool Children

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Abstract
Several research findings have revealed that the more stimulating the environment and activities exposed to a child is, the more the child develops and learns. Unfortunately, the method of teaching adopted in preschool education levels in Nigeria has not been making children develop in all the domains as expected. This study therefore investigated the effects of hands-on/mind-on activities on the intellectual development of Pre-school children using pretest-posttest control group quasi experimental design. The results reveals that there is a significant main effect of treatment on Pre-school Children's Intellectual Development ($F_{(1, 18)} = 15.270$; $P<0.05$) among others.

Key Words: Hands-on /mind-on activities, Intellectual development, Pre-school Children, Learning resources, Conventional strategy

Introduction

Several research findings have revealed the extraordinary development of a child's brain during the first five years of life. Recent advances in neuroscience have helped crystallize earlier findings, bringing new clarity and understanding to the field of early childhood brain development (Wisconsin Council on Children and Families, 2007). Children are born ready to learn. About 85 per cent of their intellect, personality and skills is cultivated between birth and six years of age (Wisconsin council on children and families, 2007). The first months and years of life set the stage for lifelong development.

According to Colbert (2008), scientists have conducted studies showing the dramatic influence of early experience on the actual connection of the human brain. Early stimulation, they have said, prepares the way for later growth and development. Lack of stimulation or negative stimulation can make such growth and development impossible or extremely difficult. The human brain develops more rapidly between birth and age five than during any other subsequent period (Wisconsin Council on Children and Families, 2007). Brain development allows a child to develop the abilities to crawl, speak, eat, laugh and walk. Brotherson (2005) states that early experiences impact the development of the brain and influence the specific way in which the circuits (or pathways) of the brain become "wired".

To develop the higher areas of the brain, children must explore things around them and feel the sense of accomplishment that goes along with completing tasks independently. This explains why providing children with the best opportunity

for learning and growth during the periods when their minds are most ready to absorb new information is important. Early learning programs that are appropriate for a child's developmental level provide opportunities to learn through play and hands-on/mind-on exploration. Through this type of learning, children test new knowledge in a relaxed setting and then naturally relate it to existing knowledge and store the new information (Wisconsin Council on Children and Families, 2007).

Learning becomes more interesting for children when they are allowed to learn about the world and construct their own meaningful interpretations of events through their actions and experience. A child best learns to swim by getting into water; likewise, a child learns best by doing (Ates and Eryilmaz, 2011). Doing as opposed to simply hearing or reading about it, engages children and allows them to test their own ideas and build their own understanding. Therefore, it is difficult to imagine a teaching program for children without doing activities that will involve their physical and thinking participation. This also indicates that children in school should be provided with materials and opportunities to formulate their own understanding and explanations to their own interest.

As noted earlier, the brain is most sensitive to the influences of the external environment. The brain takes in the external world through its system of sight, hearing, smell, touch and taste. This means that a child's social, emotional, cognitive, physical and language development are stimulated during multisensory experiences (Gable, 2008). Therefore, rapid brain development affects cognitive, social and emotional growth. Such development helps to ensure that each child reaches his or her potential and is a productive part of a rapidly changing, global society. The more stimulating the early environment, the more a child develops and learns.

In the first few years of life, remarkable changes occur in children's intellectual abilities (Kagan et. al., 2005). Children gain greater knowledge and understanding of their physical and social worlds and they develop skills in logic, reasoning, observation, imagination, and problem-solving. Berk (2006) states that intellectual ability is the inner processes and products of the mind that lead to knowing. Therefore it includes all mental ability –remembering, symbolizing, categorizing, problem-solving, creating, fantasizing and even dreaming. Children also learn social conventions, the kinds of knowledge that could not be reinvented by every generation of learners. In spite of the fact that intellectual development is comprehensive and complex, it is often associated with a defined body of knowledge that children must acquire before entering school (Kagan et. al., 2005).

Young children have needs that are real and different from those of older children and adolescents. Children from birth to age eight are learning rapidly, using all of their senses and their entire bodies to take in sensations and experience the world around them. During this period of their lives, they learn through their play and exploration across four essential developmental dimensions (Scoter, Ellis, & Railsback, 2001). Because children learn in a variety of ways, it is expected that their learning needs are met through the use of different teaching styles (Lizardi, 2005). Children's need is a variable which at any point could be addressed based on

the teaching approach employed by the teacher. Generally, the different ways through which children learn includes play, drama, experiment and discovery, Inquiry, among others, (Akinbote, Oduolowu and Lawal, 2001).

Every time a child learns something new, the brain reschedules itself based on the child's understanding. It becomes extensively important therefore to ascertain the method which best promotes their intellectual composition. The best way to promote children's brains is by having them move their hands (Cleaver, 2006). This connotes that early years of children should be dominated with activities that should promote their learning through active participation in meaningful hands-on/mind-on activities.

Hands-on/mind-on activities simply mean active involvement in learning (Wilson 2008). This notion of active involvement underlying the best practices in the pre-school education of children includes such key terms as hands-on learning, participation, interactive learning, experiential learning, inquiry learning, activity-based learning and discovery learning. According to Eggers (2012), hands-on/mind-on activities and investigations are essential components of any early childhood setting, and they help lay the foundation for life-long learning and healthy development. For children to truly learn certain concepts, they both need practical opportunities to apply knowledge and also need help in integrating or exchanging the knowledge they gain. According to Ates and Eryilmaz (2011), hands-on/mind-on activities engage children's physical, as well as mental skills to solve problems. This implies that as children manipulate learning materials, they are learning by doing and also thinking about what they are doing. Based on this, children should be physically and mentally engaged in activities that encourage them to question and devise temporarily satisfactory answers to their questions.

It is also imperative to mention that Lizardi (2005) stated that the benefits of hands-on/mind-on activities include the fact that "abstract concepts become meaningful, transferable, and retained because they are attached to performance of an activity". In order words, when children have the opportunity to take learning into their hands, they become proud and motivated to continue to grow and learn. Haury and Rillero (1994) explain that benefits for students are believed to include increased learning; increased motivation to learn; increased enjoyment of learning; increased skill proficiency, including communication skills; increased independent thinking and decision making based on direct evidence and experiences; and increased perception and creativity.

The preschool years are important for the development of many skills used later in life, but some of the most valuable lifelong skills children acquire during this time are skills like language, verbal, writing, numeracy, social, and science(Wilcox, Murphy, Bacon & Thomas 2001). Numeracy skill is very important because of its known importance in the further learning of various topics. Numeracy in Pre-school children has to do with the understanding and ability to reason with number. Though there are clearly limits to preschool children's capacity to reason numerically at certain levels, but there are many fundamental numeracy concepts that are fully within their grasp (Lave, 1988; Rogoff, 1990). These

concepts, when taken together, provide a sound foundation for further conceptual understanding. Therefore, it is necessary to identify and structure initial activities according to what children have acquired naturally through interaction with their environment, and provide well-planned opportunities for children to build upon their informally acquired knowledge and abilities, or even to help them form their initial constructions at the earliest ages.

Language is another important skill in the pre-school years (Wilcox et. al.,2001). Preschool children, aged four to six years, make rapid and dramatic growth in their language skills. They move from speaking single words and two-word phrases to complex sentences and emergent reading skills (Vratny-Smith, 2010). This change in language represents the development of cognitive abilities. Children are becoming more complex thinkers and, as they grow, these changes are reflected in their language.

Social interaction is another important skill in the pre-school years (Wilcox et. al.,2001). It is concerned with the study of social relationships and the functioning of society. Since social studies is designed to promote civic competence, it is therefore important that children at Pre-school level are properly exposed to the subject through activities that will enhance their understanding of the concepts taught in Pre-schools.

Reading and writing go hand in hand. Writing is an integral part of reading and an equally critical component in overall literacy. Good readers tend to be good writers, and good writers also tend to be good readers. Gable's (2008) study is the only one of several that .suggests the importance of writing development beginning in the preschool years. During the preschool years, pre-writing skills should focus on the control of muscles used in writing, such as hand skills, and therefore activities may not look like traditional forms of writing. Based on this, the level at which children can learn these skills could be dependent on the chronological age of the child or the level of exposure to educationally rich environment.

Krueger (2005) explains that when children were allowed to learn in a controlled environment, one that offered them the tools and resources to make the most of their innate desire to learn, they would proceed through a series of stages of mental growth. Through proper manipulation of the learning environment, children can progress through these stages and have a "normalized" development. Krueger established emphasis on Montessori Method of education which is an individualized approach that nevertheless places large groups of children together in an educationally enriched environment that allows the children to interact as they learn. He explained that the Montessori Method offers children the best tools, resources, and guidance to assist them as they move from sensory learning to conceptual learning and on to discovering their role in society and their individual learning specialization. Montessori's idea of sensory education included hands-on activities that would require the child to tune into their five senses to heightening their intellectual capability. She was inspired by Aristotle's philosophy that there was nothing in intellect which does not first exist in senses, the hands and mind

work together making the learning experience one of doing rather than simply observing (Hainstock, 1997).

From the foregoing, it is established that the influence of hands-on/mind-on activities on cognitive achievement of students cannot be over emphasised. Thus, the implication of the findings of the studies that are discussed above is that hands-on/ mind-on activities can also influence the intellectual development of pre-school children. The problems however is that a close observation revealed that pre-school children in some schools are not given the opportunity to learn through hands-on/ mind-on activities. Aside this, it seems that there are little or no studies that have been carried out to establish that hands-on/mind-on activities can have effect on intellectual development of pre-school children. It is on this note that this study claims that hands-on/mind-on activities without requiring specific expensive materials can be one of the interactive engagement methods to facilitate the intellectual development of pre-school children. Therefore, this study examined the effect of hands-on/mind-on activities on intellectual development of pre-school children in Ibadan north local government area of Oyo state.

Research Hypotheses

The following research hypotheses were formulated and tested at 0.05 level of significance:

H_{o1}: There is no significant main effect of treatment on Pre-school children's intellectual development

H_{o2}: There is no significant main effect of age on Pre-school children's intellectual development.

H_{o3}: There is no significant main effect of level of exposure on Pre-school children's intellectual development.

Methodology

This study adopted a pretest-posttest control group quasi-experimental research design. Purposive sampling technique was used to select the participants in this study. Ibadan North Local Government Area was selected using purposive sampling technique on the criteria that the Local Government is located in an urban setting and that most public primary schools in the local government have pre-primary sections. After this, two public primary schools were purposively selected following the criteria that the schools have pre-primary sections that their pre-school children fall between the age of 4 and 6.

The participants of this study comprised 27 pre-school children who were selected from two pre-primary sections of public primary schools in Ibadan North Local Government. The two schools were randomly assigned to treatment groups. There are 15 pre-school children in experimental group and 12 pre-school children in the control group. The research instruments used for this study were self-developed, these are: Achievement Test on Intellectual Development of Pre-school Children (ATIDPC); The instrument contains two section, sections A and B. Section A contains demographic data of the children. The items in the section are name of school, sex and age. The section B of the instrument contained 25

questions which covered the five sub-themes used for the experiment. The second instrument was Educationally Rich Environment Scale (ERES), this instrument was designed to measure the level of exposure of the children to educationally rich environment. The third and fourth instruments were stimulus instruments. These are instructional guides for teachers on Hands-on/mind-on activities for Experimental group and instructional guide for conventional method for the Control group.

Both ATIDPC and ERES were validated and their reliability tested. The reliability coefficient of ATIDPC was 0.62 while that of ERES was 0.70. Data collected was analyzed using both descriptive and inferential statistics. The descriptive statistics used were mean and standard deviation while the inferential statistics used was Analysis of Covariance (ANCOVA). The post –hoc analysis were also carried out.

Results and Discussion

Hypothesis 1: There is no significant main effect of treatment on preschool children's intellectual development.

Table 1: Summary of ANCOVA on Intellectual development scores by Treatment, Age and Level of Exposure to Educationally Rich Environment

Source of Variance	Type III Sum of squares	Df	Mean squares	F	Sig	Partial Eta Squared
Corrected Model	6058.093a	8	757.262	4.777	.003	.680
Intercept	5212.029	1	5212.029	32.880	.000	.646
Pre Test Score	860.209	1	860.209	5.427	.032	.232
Treatment	2420.541	1	2420.541	15.270	.001	.459
Age	123.453	1	123.453	.779	.389	.041
Level of exposure	19.183	1	19.183	.121	.732	.007
Treatment* Age	296.592	1	296.592	.1.871	.188	.004
Treatment* Level of exposure	142.153	1	142.153	.897	.356	.047
Age * Level of exposure	9.867	1	9.867	.062	.806	.003
Treatment* Age * Level of Exposure	72.055	1	72.055	.455	.509	.025
Error	2853.315	18	158.517			
Total	149456.000	27				
Corrected Total	8911.407	26				
	149456.000					

Table 1 shows the summary of Analysis of Covariance of Post-test Intellectual development scores by treatment, Age and level of Exposure to Educationally Rich Environment. The table shows that there is significant main effect of treatment on

Pre-school Children's Intellectual Development ($F_{(1,18)} = 15.270$; $P<0.05$; $\eta = .459$). Therefore, hypothesis 1 is rejected. The effect size is given to be 45.9%. Table 2 reveals the magnitude of performances across the groups.

Table 2: Estimated Marginal Means

Variable	N	Mean	Standard Error
INTRECEPT			
Pre score	27	41.19	-
Post score	27	72.82	3.08
TREATMENT			
Control	12	60.95	4.91
Experimental	15	84.70	3.64
AGE			
Young(5yr)	12	70.88	4.59
Old (6yr)	15	75.56	4.14
EXPOSURE TO EDUCATIONALLY RICH ENVIRON			
Low	12	71.76	5.04
High	15	73.89	3.52

Table 2 shows the magnitude of performance across the groups. This table shows that there is a mean gain between the Pre-test and Post-test, which is (31.63). Also, those exposed to experiment have higher mean score (84.7) while those exposed to control have less score (60.95). Figure 1 presents this information in a chart form.

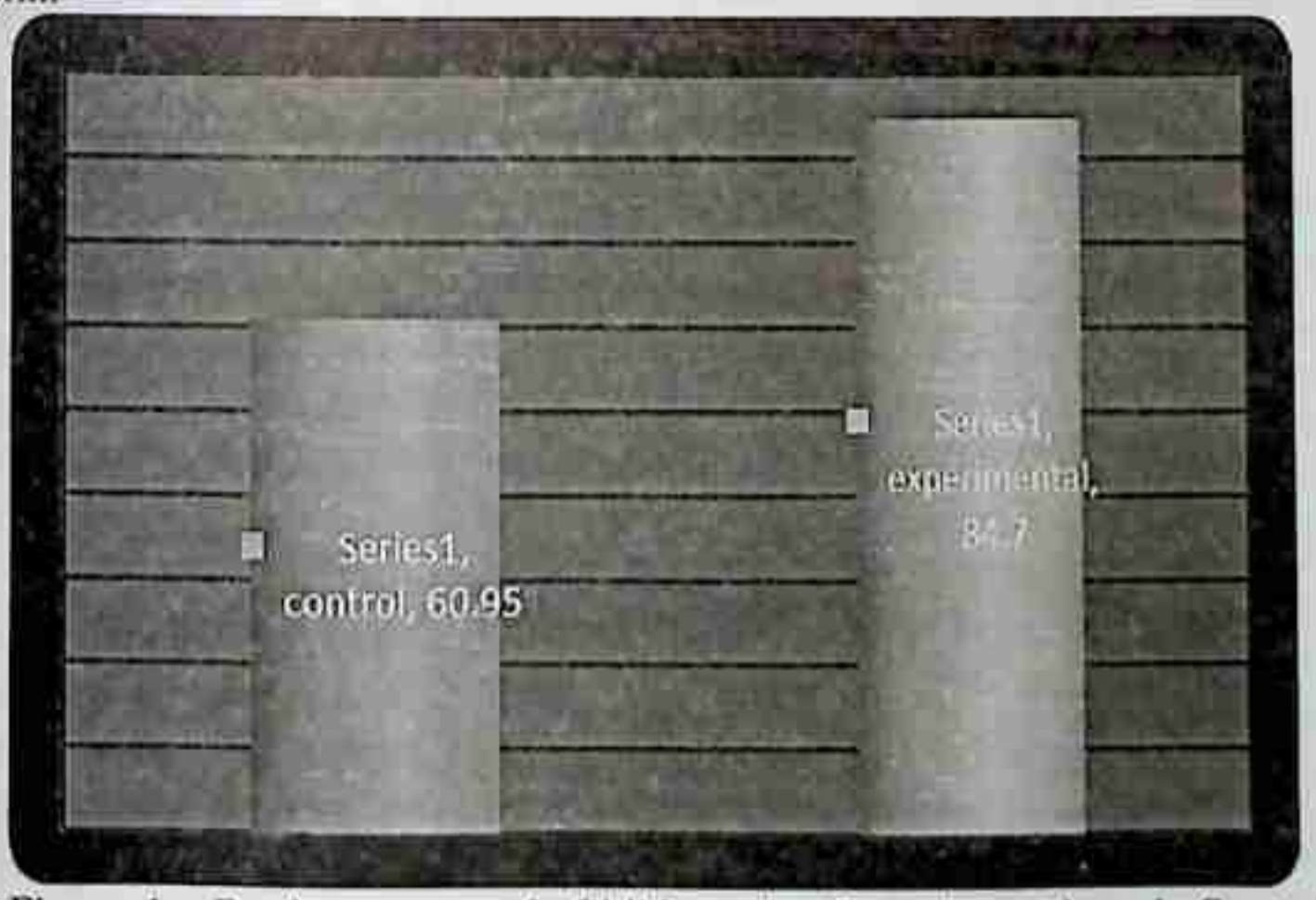

Figure.1: Performance of Children in Experimental and Control Groups

This result agrees with the findings of Ates and Eryilmaz (2011) which appraises the effect of hands-on/mind-on activities in physics because there was higher achievement in the academic performance of students exposed to it. Again this finding supports the finding of Stohr-Hunt (1996) that students who were exposed to hands-on/mind-on activities frequently (daily, once a week) had significant higher science scores of achievement than those who experienced hands-on/mind-on activities infrequently (once a month, less than once a month, never). Ernst and Monroe (2012) reviewed the effect of environmental-based education (compared to the traditional classroom setting) on ninth and twelfth grade students' critical thinking skills. The study found out that students who participated in the environmental education programs had significantly raised scores on the Cornell Critical thinking Test at both levels. The results of this finding also supports the findings of Keasal (2012); Corpuz and Rebello (2005); Superfine,1998; Klemmer,Waliczek and Zajicek (2012); and Eggers (2008), who all reported that hands-on/mind-on activities enhanced academic achievement in students. The difference in the mean gain between the experimental and control group indicated that the children in the control group were passive listeners to the teacher's reservoir of knowledge, as teachers dominated the lesson. The teacher-centred method used in the control group encouraged the children to learn by rote and they were unable to really master what they learnt. This can be attributed to what Ajitoni (2005); and Olatundun (2008) referred to as minimal student's participation usually found in the traditional classroom where teachers take dominant class room interaction. But in the case of those children exposed to hands-on/mind-on activities, they were able to do better in the cognitive activities given to them because they were able to recall from the activities done during the treatment. The children showed evidence of creating their knowledge and effective and functional learning. This finding is in line with the submission of Graue and DiPerna (2000), Anderson, Huston, Schmitt Linebarger and Wright (2001), Kirkorian, Wartella and Anderson (2008) that hands-on/mind-on activities enhances children total development.

Hypothesis 2: There is no significant main effect of age on preschool children's intellectual development.

Table 1 shows that age has no significant main effect on preschool children's Intellectual development ($F_{(1,18)} = 0.779$; $P>0.05$; $\eta = .041$). Hence, the hypothesis is not rejected. The effect size is just 4.1%. This implies that age has no significant effect on preschool children's intellectual development. This finding agrees with the findings of Dietz and Wilson (1985), May and Welch (1986), Reinherz and Kinard (1986), Kundert, May, and Brent (1995), Spitzer, Cupp, and Parke, (1995), and Graue and DiPerna (2000) which support the fact that Age does not affect children's achievement most especially when the learner-centred method is used. But negate the findings of Ulrich & Ulrich (1985), Toriola and Igbokwe (1986), Angrist and Krueger (1991), Fjørtoft (2000), Lincove and Painter (2006), Elder and Lubotsk (2008) and Venetsanou and Kambas (2011) which reported that Age has significant effect on learning achievement in children. In line with this finding, it

important to explain that age does not affect hands-on/mind-on activities in children because when children are exposed to a responsive learning environment with developmentally appropriate materials, academic achievement would take place without cognizance to the age difference amongst the children.

Hypothesis 3: There is no significant main effect of level of exposure to educationally rich environment on preschool children's intellectual development.

Table 1 shows that level of exposure to educationally rich environment has no significant main effect on pre-school children's intellectual development ($F_{(1,18)}$ = 0.121; P>0.05; η = .007). Hence, hypothesis 3 is not rejected. The effect size is just 0.7%. This finding negates the findings of Kulik (1994), Sivin-Kachala (1998), Schacter (1999), Anderson, Huston, Schmitt, Linebarger and Wright (2001), Kirkorian, Wartella and Anderson (2008) which reported that children being exposure to educationally rich environment through computers, educative television programmes enhances their academic performance. This could be as a result of the fact that during the instructions, all the children were allowed to explore the materials to fullest. Therefore, those without educationally rich background also create their knowledge with the opportunities they had. This could have made both children with and without experience in educationally rich environment to perform well in the cognitive activities given to them at the end of the treatment. This is another advantage to the use of hands-on/mind-on activities in Nigeria because it will give opportunities to the children of the masses who cannot afford to provide educationally rich home environment for their children. It should be remembered that this set of people takes the largest proportion of the total population of the country.

Conclusion

The study revealed that Hands-on/mind-on activities positively affect children's intellectual development. The use of this teaching strategy has been observed to enable the children interact effectively with their learning environment and therefore constructing their own knowledge. Child-centred method of learning enables the teacher to recognize and honour the individual differences in children making it possible for teachers to guide children at their own learning pace. In a society like that of Nigeria where teaching of children is mostly through rote learning, memorisation and drilling, this study reveals to all the preschool teachers and other practitioners that hands-on/mind-on activities is more effective in enhancing the intellectual development of the children. This study is timely in the sense that preschool section has just been introduced into the public primary schools and the teachers working with the children need to be exposed to how to teach children because most of them are not trained as early childhood educators.

Recommendation

In order for meaningful learning to take place in preschool children, Pre-school teachers should adopt hands-on/mind-on activities method of teaching instead of the teacher-centred method which is being used in Preschools. This method of teaching has an interesting and rewarding effect on the children as they learn at their best.

Based on this fact, efforts should be made by the government to ensure that teachers are trained through workshops/seminars on this learning strategy. Such workshop should be carried out by experts on the strategy.

Hands-on/mind-on activities method of teaching involves the use of instructional materials; therefore effort should be made by government to provide learning materials to the schools by setting up bodies which would supervise and monitor the availability of such materials to the schools. Government should take cognizance of the fact that the materials provided for learning are developmentally appropriate for the age level of the children and standard should be set for all preschools in the country so the private school owners could comply.

Experts in Early childhood Education should be consulted as resource persons to conduct the training for the teachers. Since there are less number of people that can deliver hands-on/mind-on strategy, the teacher trainers should be trained first before the preschool teachers are now trained. Adequate monitoring and supervision of schools should be encouraged to make sure that teachers are effectively using hands-on/mind-on activities method of teaching. This is made possible by setting up bodies that would monitor the schools weekly.

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