



# Concept Mapping Instructional Strategy and Numeracy Skills Acquisition of Preschoolers in Public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State

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## Abstract

This study sought to examine the effect of concept mapping instructional strategies on the numeracy skills acquisition of preschoolers in public early childhood education centres in Rivers East Senatorial District of Rivers State. Quasi-experimental research design was adopted for the study. Two specific research objectives were drawn up with two corresponding hypotheses were formulated to guide the study. Out of a population of 5,684 a sample of 140 preschoolers was drawn. The instrument for data collection was the 20 item cognitive skills development observation inventory. Data collected were subjected to analysis of covariance statistics. The results showed the following findings: There is a significant difference in the numeracy skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State; there is no significant difference in the literacy skill acquisition of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method, given their gender, in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.

**Keywords:** Concept mapping, Spider Map, Literacy Skill, Preschoolers.

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## INTRODUCTION

Children grow and develop rapidly in their first five years across the four main areas of development. These areas are motor (physical), language and communication, cognitive and social skills. Cognitive development means how children think, explore and figure things out. It is the development of knowledge, problem solving skills and dispositions, which help children to think about and understand the world around them. Numeracy skills fall under cognitive development.

Thornton (2003) defined numeracy skills as the ability to use, interpret and communicate mathematical information to solve real-world problems. These include the ability to understand basic math like addition, subtraction, division and multiplication. Numeracy is the ability to recognize and apply mathematical concepts in all areas of life. It involves understanding numbers, counting, solving number problems, and measuring, estimating, sorting, noticing patterns, adding and subtracting numbers, and so on. Children need numeracy and mathematical skills to do everyday things.

A child's everyday experiences are full of learning opportunities that lay the foundations for numeracy. As revealed by Gauvain and Richert (2016), numeracy skills are the ability to understand and work with numbers. It was once believed that infants lacked the ability to think or form complex ideas and remained without cognition until they learned language. It is now known that children are aware of their surroundings and interested in exploration from the time they are born. From birth, children begin to actively learn. They gather, sort, and process information from around them, using the data to develop perception and thinking skills.

Children start learning numeracy skills from the time they are born. This learning happens from watching and experiencing numeracy in action, especially in everyday play and activities. For example, it happens when a child hears anyone counting their fingers and toes, they start to recognize numbers and shapes on objects like clocks and phones or in books, they can also decide how many slices of bread they want.

According to Sellars (2018), as children get older, they learn more numeracy skills which comprises of pre- number concepts, number operations, shapes and spatial understanding, measurements and patterns. Young children, even infants, develop essentially non-verbal basic concepts of quantity: more or less, order, same, and adding or subtracting. Children learn most of these things on their own, without much adult help. Children often use these concepts in everyday life, for example, to determine who has more or less ice cream. Children's concepts and procedures are useful under certain conditions but need to be enriched. This is what children know and what they need to learn at roughly ages three, four and five. At first, children memorize the counting words from about one to ten. But their learning does not involve only memory. Children learn some ideas and rules about number too, namely that proper order is essential; numbers are different from letters; and you are not supposed to skip or repeat numbers when you count.

Understanding patterns is a basic numeracy skill that can be built upon to develop many other mathematical skills. For example, having an understanding of patterns helps with learning skip counting, times tables and addition. Patterns are things that repeat in a logical way. When we teach children about patterns, they will learn to recognize them, see how they change and notice irregularities.

For a child to have a long lasting memory of things, he/she needs more than an imagination of the idea being taught. A picture representation of the concept being taught, will

be stored in the child's memory for a longer period of time. Concept maps play a very big role in child cognition. Concept maps are visual representations of information. They can take the form of charts, graphic organizers, tables, flowcharts, Venn Diagrams, timelines, or T-charts. Concept maps are especially useful for children who learn better visually, although they can benefit any type of learner. They are a powerful study strategy because they help the child see the big picture; by starting with higher-level concepts, concept maps help the child chunk information based on meaningful connections. In other words, knowing the big picture makes details more significant and easier to remember. A concept map is more than just bubbles and lines. It's a powerful tool that can help the child understand the ins and outs of the topic at hand.

Concept mapping is a way of representing knowledge or ideas as concepts and relationships between them. A concept in the map is anything we want to talk about, i.e., any real-world object, an abstract term, an event, or even a fact. Concepts are usually represented by text in rectangles and relationships as oriented links between the rectangles, with arrows showing the reading direction. Visually, concept maps look like mind maps, but the essential thing about concept mapping is not the visual representation. Instead, it is the idea of structuring knowledge into small pieces, thinking about how these small pieces are related to each other, and the idea that the child should learn by trying to link every new bit of knowledge to something he/she already knows well.

Concept maps work very well for classes or content that have visual elements or in times when it is important to see and understand relationships between different things. They can also be used to analyze information and compare and contrast. According to the "dual coding" theory of information storage (Paivio, 2001), information is processed and stored in memory in two forms: a linguistic form (words or statements) and a nonlinguistic, visual form (mental pictures or physical sensations). Visual representations also help children remember and recall information more easily. Visual representations can be created and supported by tools such as graphic organizers, physical models, pictographs (i.e., symbolic pictures), and engaging students in kinesthetic activities, that is, activities that involve physical movement (Marzano et al., 2001).

Concept maps are a powerful tool for identifying relationships among ideas the children learn in class. Understanding these relationships and depicting them visually can help the child learn course material at a much deeper level and retain it better, too (Javonillo & Martin-Dunlop, 2019). Although there is a large developing body of literature on concept mapping as an instructional and learning tool in primary, secondary, and higher education, little has yet been written about the use of concept maps in early childhood education (Zanting et al., 2003). Perhaps the assumption is that preschool children do not yet have the ability to use various types of representations (e.g., networks of propositions or words, sequence of events in time and space). However, current knowledge about early learning emphasizes children's capacity to represent knowledge that is presented in ways that are developmentally appropriate (Smith & Blades, 2001)

The child, of course, tries to achieve meaningful learning just by being highly focused and disciplined, thinking hard, and asking the right questions. But that is like doing complex math calculations just in the child's head instead of using pen and paper or a calculator as an aid. Similarly, it is much easier to learn meaningfully if the child uses concept mapping as an aid because concept maps can help the child materialize his/her thoughts and record them so that the child does not have to rely just on his/her working memory.

To better familiarize children with concept maps, pictures (or photos or drawing images) can replace text labels (words) because children of this age communicate their ideas better

through symbols (Pearson & Somekh, 2003). Drawings or pictures can also be used by and for children who speak a different language or have reading or writing problems (Pearson & Somekh, 2003).

Concept mapping can serve as an instructional tool that is currently gaining popularity in the field of science education. It is seen as a product of recent advances in cognitive science and a new philosophy of science. The new philosophers of science reject the traditional cumulative view of scientific knowledge and replace it with a conceptual change, as reflected in the works of Abimbola and Bello (1997). The theoretical foundation of concept map rest upon the constructivist views on education, Ausebel's theory of meaningful learning on one, hand and rote learning on the other (Heize-Fry & Novak, 1990). Iuli and Helled (2004) asserted that concept maps were developed as a met-cognitive tool that helps students understand the science they study by revealing gaps in understanding, identifying misconceptions, promoting reflective thinking and facilitating shared understanding. Concepts maps usually represent an individual's knowledge within the framework of concept relationships thereby allowing assessment of an individual's understanding.

Spider maps, as a form of concept mapping, are graphic maps that are used by caregivers to generate and sort what children know or would like to learn about a topic, concept, or theme and to stimulate questions and ideas for activities (Katz & Chard, 2000). Spider diagrams mirror how our brains connect information. They also increases focus and comprehension. A spider map forces the child to order knowledge around a theme, in creating the map, children will have to think about different connections and relationships between the data. Another benefit of spider maps is the ability to spark creativity.

A spider map prompts the child to actively sort through information as the child craft his/her diagram, make new connections, increase understanding, and surfaces additional ideas. Spider maps are graphic maps that are used by caregivers to generate and sort what children know or would like to learn about a topic, concept, or theme and to stimulate questions and ideas for activities (Katz & Chard, 2000).

One thing is certain, child cognition is gender sensitive. There are no longer distinguishing differences in the cognitive, affective and psychomotor skills performances of pupils in respect of gender (Erinsho, 2005). Girls are being encouraged and sensitized into developing positive attitudes towards learning. However, some researchers still found that there are still significant differences in the cognitive, affective and psychomotor skill performances of students in respect of gender (Kolawole, 2007). The way a girl reasons is quite different from the manner in which a boy reasons (Hecman & Ziff, 2017). The researchers therefore hold a conviction that concept mapping may play a key role in relation to numeracy skills of preschoolers in Rivers East Senatorial District of Rivers State.

### **Statement of the Problem**

Preschoolers in every learning center, gain numeracy skills, based on how they are taught. The operations of addition, subtraction, multiplication and division are the four basic operations that need to be mastered by pupils. However, there is a constraint faced by most pupils that is lack in problem solving skills. Their failure to master problem-solving skills has disrupted the subsequent learning process and caused them to fail in assessments. Non-routine questions require pupils to think outside the box and cause them to be less confident. The trend to enforce academic curriculum for preschoolers, diminishes the use of special methods like concept

mapping, to impart knowledge. Early Childhood educators need to limit the use of conventional methods of teaching and introduce Concept Mapping methods taught in a fun way that the preschoolers will not forget in a hurry. Thus, there is a need for caregivers to develop teaching aids that can help pupils master these skills. Early childhood educators should create a variety of learning experiences in the classroom so that they can improve the level of knowledge and skills of pupils.

The new technique or innovation developed is also expected to have a positive effect on students' critical thinking skills. With reference to public Education Centers found within Rivers East Senatorial District in Rivers State, experience has shown that numeracy skills are acquired based on the method used to teach a preschooler. It is likely that a child taught using the conventional method may differ, in terms of numeracy skills acquisition, from a child taught using concept mapping method of teaching. One of the objectives of Early Childhood Education is to attain numeracy skills of preschoolers. Consequent upon this, the study tends to find answer to the question: what is the influence of concept mapping on the numeracy skills of preschoolers in public Education Centers found within Rivers East Senatorial District in Rivers State?

### **Objectives of the Study**

The aim of the study is to determine the effect of concept mapping on the cognitive development of preschoolers in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State. Specifically, the study will:

- Determine the mean difference in the cognitive development skills of preschoolers taught using spider map concept mapping instructional strategy and those taught using conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.
- Examine the mean difference in the cognitive development skills of preschoolers taught using spider map concept mapping instructional strategy and those taught using conventional method, given their gender in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State

### **Hypotheses**

For the purpose of this study, the following hypotheses are formulated:

- There is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.
- There is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method, given their gender, in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.

### **METHODS**

The research design for this study was Quasi-experimental Research Design. 5,684 preschoolers constituted the population of the study. The sample size consists of 140 preschoolers found in the intact classes of two early childhood education centers. The two public early childhood education centres in Obio/Akpor Local Government Area were chosen using simple random sampling technique, thereafter; the purposive sampling technique was used to select the intact classes for the study. One of the early childhood education centres chosen was used for the experiment group (the spider map concept mapping instructional strategy), while the other centre was used as the control group. The instrument for data collection was the researchers designed observation inventory titled “Concept Mapping and the Cognitive Development of Preschoolers Observation Inventory (CMCDPOI). The CMCDPOI for both pretest and posttest consist of 20 test items drawn from the topics taught. The instrument was validated by two experts in Early Childhood Education Department, Faculty of Education, Ignatius Ajuru University of Education, Port Harcourt, and one caregiver in the public early childhood education centre. The reliability coefficient of the instrument was found to be 0.67.

The researchers first obtained permission from the head teachers of the sampled schools before proceeding to the classrooms where the copies of the instrument were administered. A pre-experimental orientation was organized for the caregivers who served as research assistants. This was followed by the administration of the pre-test of the Concept Mapping and the Cognitive Development of Preschoolers Observation Inventory to the preschoolers in the classes in that same first week before they were exposed to the concept mapping instructional strategy and the conventional teaching methods, respectively and lasted for six weeks using three periods in a week. At the sixth week, a posttest of the Concept Mapping and the Cognitive Development of Preschoolers Observation Inventory were administered both to the experimental group and control group. Analysis of covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

## RESULTS AND FINDINGS

**Null Hypothesis One:** There is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.

**Table 1:** Summary of analysis of covariance (ANCOVA) of preschooler’s post-test score classified by treatment groups and instructional strategies with Pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pre- Test	3838.316	1	3838.316	12.092	.001
Treatment	4838.087	2	2419.043	7.621	.001
Error	45392.295	136	317.429	-	-
Total	483837.000	139	-	-	-
Corrected Total	53996.177	140	-	-	-

In Table 1 the calculated F-ratio for the effect of instructional strategies on the cognitive skills development of preschoolers with df 2,136 is 7.621; while its corresponding calculated level of

significance is .00 alpha level. The F-cal 7.621 is greater than the F-crit3.09 at .05 alpha, indicating that instructional strategies used had statistically significant effect on the cognitive skills development of preschoolers when taught using spider map concept mapping method. Hence hypothesis one which states that there is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State is rejected.

**Null Hypothesis Two:** There is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method, given their gender, in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.

Table 2: Summary of analysis of covariance (ANCOVA) of preschooler’s post-test score classified by treatment groups and gender with Pre-test as covariate

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Pre- Test	3895.918	1	3895.918	12.185	.001
Treatment	4986.636	2	2493.318	7.798	.001
Gender	504.906	1	504.906	1.579	.211
Treatment * Gender	64.449	2	32.224	.101	.904
Error	44762.671	133	319.733	-	-
Total	483837.000	140	-	-	-
Corrected Total	53996.177	139	-	-	-

In Table the calculated F-ratio for the effect of instructional strategies on the cognitive skills development of preschoolers with df 2,133 is 7.798 while its corresponding calculated level of significance is .00 alpha level. The F-cal .101 is less than the F-crit3.09 at .05 alpha, indicating that instructional strategies used had no statistically significant effect on the cognitive skills development of male and female preschoolers. Hence hypothesis two which assumed a no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method, given their gender, in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State is retained.

## DISCUSSION OF FINDINGS

### Difference in Cognitive Skills Development Mean Score of Preschoolers between Spider Map and Conventional Method

The findings with respect to hypothesis one as shown in table 1 indicates a significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State. The preschoolers in the experimental group taught by concept mapping instructional strategy exhibited cognitive skills

significantly better than their counterparts in the control group who were taught with the conventional method. This can be attributed to the direct involvement and active participation of the preschoolers in the experimental group during the teaching-learning session, which also could have captured the learners' interest.

These findings support earlier studies of Hapidin (2020) who found that the use of spider mapping methods can help early childhood educators to improve their mastery of the teaching/learning experience. Also, the finding of the study agrees with the finding of Alake and Ogunseemi (2013), who reported that students exposed to concept mapping instructional strategy performed significantly better than their counterparts who were exposed to traditional method.

### **Difference in Cognitive Skills Development Mean Score of Preschoolers between Spider Map and Conventional Method with Respect to Gender**

The findings from the results in table 2 revealed that the F-cal .101 is less than the F-critical 3.09 at .05 alpha. This means that there is no significant difference in the cognitive development skills of preschoolers taught with spider map concept mapping instructional strategy and those taught using the conventional method, given their gender, in public Early Childhood Education Centers in Rivers East Senatorial District of Rivers State.

This finding supports the earlier study of Uduafemhe (2015) who reported that there is no statistical significant difference between the mean scores of male and female students when taught using spider map concept mapping instructional approach. To corroborate this view, Azih and Nwosu (2011) in their study on the effects of concept mapping on the achievement of male and female students in financial accounting reported that the test of interaction showed that gender had no significant interaction with teaching approach on students mean achievement.

### **CONCLUSION**

Concept mapping instructional strategies enhance preschoolers learning and development of skills better than the traditional method, and preschoolers' ability level and gender are not significant determinants of preschoolers learning and reception when taught using concept mapping instructional strategies. The researchers are of the view that the use of concept mapping instructional strategy in Rivers East Senatorial District has not been encouraging, and that a good utilization of concept mapping instructional strategies in the classroom will positively enhance and sustain learning for preschool children.

### **Recommendations**

Consequent on the findings of the study and the conclusion drawn therefrom, the researcher recommends as follows:

- Concept mapping instructional strategy is an effective instructional tool than the traditional classroom teaching. Therefore, concept mapping instructional strategy should be used in classroom teaching/learning interaction by caregivers to enhance the teaching and learning of preschoolers as well as improve their performance in the classroom.
- Workshops for practicing caregivers should be organized by government through the Ministry of Education and the State Universal Basic Education Board to train and retrain



caregivers on the use of concept mapping instructional strategy and other viable teaching strategies.

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