ASIA-PACIFIC JOURNAL OF RESEARCH
IN EARLY CHILDHOOD EDUCATION
Vol.7, No.1, January 2013, pp.1-29

ISSN 1976-1961

Metacognition in 3-6 Years Old: Evidence from a Kindergarten in Hong Kong

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Abstract

The study explores metacognition in young children of 3-6 years old. It presents finding from a study exploring the development of self-regulatory and metacognitive abilities in young children. The study takes the form of a descriptive, interpretative investigation using both quantitative and qualitative research methods. It involved 60 children in a local kindergarten in Hong Kong to participate in three different activities. Children participated in the activities were either done without any helped or with some forms of support. The first two activities were conducted two times, children needed to finish the task on their own the first time and with help the second time. For the third activity, the children were divided into a control and an experimental group while the control group needed to finish the task on their own and support was provided to the experimental group. In the first two activities quantitative data was collected according to the correct amount of items children were able to remember and in the third activity, a score was given to each child based on their metacognitive ability using the rubrics from Project Spectrum as reference. Qualitative data was collected in all three activities based on their behavioural performance in each activity that was video-taped. The findings showed children in age 3-6 years old have a certain sense of metacognition and the older the children the more traits of metacognitive ability can be seen during the tasks. Furthermore, in a meaningful task with different external factors provided, children were able to perform better.

Keywords : metacognition, metacognitive ability, cognitive ability, self-regulation, and support.

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Introduction

Early research suggests that metacognitive ability is not found in young children. When looking at the word "metacognition", it seems to be a very complicated concept, so people expect that this complexity means that this ability is too advanced for young children. However, increasing evidence shows later that much of the historical research seriously under-estimated the metacognitive abilities of young children. Istomina's (1975) research showed that in a meaningful environment and with enough scaffolding from teachers, children were able to understand the purpose of remembering and forgetting. Deloache, Sugarman & Brown (1985) also found evidence of very young children who are able to restructure their learning process by working on some simple mathematic tasks. More recently, Larkin (2007) found that children 5-6 years old, when asked, were able to use some assistance strategies to remember a group of 16 objects. There is increasing evidence showing that children who are provided enough time to work on tasks, are taught in a meaningful environment and have proper facilitations do show metacognition.

General Aims of the Study

This paper will present insights into the development of 3-6 year-old children's metacognitive abilities. The study provides an in-depth exploration of the development and changes of metacognitive abilities in young children in educational settings in Hong Kong with stimulus from the kindergarten teachers and the difference of ability in relation to the difference of age. It was hypothesized that children from age 3-6 years old were able to show metacognitive abilities in their daily learning and with the help of others and different external controls children will have better development in their metacognitive ability. Furthermore, children who have been exposed to a variety of learning experiences will affect the development of their metacognitive ability.

Key Research Questions:

1. Do children 3-6 years in age have metacognitive ability?

2. How does age and rewards affect children's metacognitive ability?

3. How can external factors, such as scaffolding, modeling and/or external motivators help children develop metacognitive ability?

Methodology

A local Hong Kong kindergarten was selected and the target was a group of 3-6 years old children. Ten children from each full day class in each level (K1, K2, K3) were randomly selected from three age groups (3.0-3.11 years old, 4.0-4.11 years old, & 5.0-6.0 years old) and these children participated in 3 different activities to assess their metacognitive ability.

Both quantitative and qualitative data were collected during the observation of the three activities. Class teachers for each class had a short briefing with the investigator before implementing the three designed activities. Quantitative data were collected in two of the activities as both the teachers and the investigator marked down the correct number of objects children remembered in each of the activities. Qualitative data were collected according to the children's behavior in all three activities using observations. All results were analyzed and compared based on the three metacognitive domains:

1. Metacognitive knowledge (Flavell, 1987): the individuals' knowledge about personal, task, and strategy variables affecting their cognitive performance,

2. *Metacognitive regulation* (Brown, 1987): the cognitive processes taking place during ongoing activities; involves planning, monitoring, control, and evaluation and

3. *Emotional and motivational regulation* (Boekaerts, 1999; Corno, 2001; Zimmerman, 2000): the learner's ongoing monitoring and control of emotions and motivational states during learning tasks.

Furthermore, all activities were video recorded focusing on the behaviour of children which reflect their metacognitive ability. After recording the video, the result were shown to different people so that different views and opinions about the development of children's metacognitive ability in the observed activities were included.

Literature Review

Metacognition

Metacognition means to reflect on one's thinking, on one's learning process and on one's knowledge. Breaking the word down, "meta" refers to a change of position to a higher level, and "cognition" refers to our faculty for knowing or thinking. In the 1970s, Flavell used the term metamemory in regard to an individual's ability to manage and monitor the input, storage, search, and retrieval of the contents of his or her own memory. In his 1976 article, Flavell recognized that metacognition consisted of both monitoring and regulation. He defined metacognition as "the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in service of some concrete goal or objective."(p.232).

Hacker (1998) offered a more comprehensive definition of metacognition, which includes the knowledge of one's own cognitive and affective processes and states as well as the ability to consciously and deliberately monitor and regulate those processes and states. In this paper, meaning of metacognition is broken down into three areas, metacognitive knowledge, regulation of metacognition, and emotional and motivational regulation. **Metacognitive knowledge** includes the components of knowledge about, and awareness of, one's own thinking, knowledge of when and where to use acquired strategies and knowledge of plans and goals. **Metacognitive regulation** includes the components of planning, evaluation, and monitoring (Gredler, 1997 & Brown 1987). Lastly, **emotional and motivational regulation** includes children's ongoing monitoring and control of emotions during learning tasks, and the reasons for their success or failure (Weiner, 1986 & Boekaerts, 1999; Corno, 2001; Zimmerman, 2000).

Metacognition in Young Children

Metacognition is a vital element in children's learning. In this study, "metacognition" pertains to conscious thinking about thinking, conscious monitoring and control of one's thinking. It may be that when the cognitive skills are practiced many times in many different

situations, it may become automated, but in working with children with little or no apparent metacognitive processing, there is a need to be explicit and to model conscious metacognitive behavior.

Metacognitive ability, teachers' inspiration, and learning experiences are closely connected. Not all children's metacognitive ability develop as the same pace as their age mates. Yim, Kim and Kei (1999) pointed out "people do not born with metacognitive ability, metacognitive ability develop slowly as children's learning experiences increases, it will grow according to age, from external control to internal control, unconscious to conscious and then automation and parts to whole"(pp. 203-205). If teachers/adults allow children time and provide proper guidance, their metacognitive ability can be enhanced. Teachers can:

1. provide time for children to explore during different activities, allow children to develop their abilities spontaneously during the learning process,
2. allow the children to develop gradually through occasional coaching, and
3. allow children to learn to take charge of their own learning through facilitation.

Teaching Strategies on Metacognition

This paper used some of the suggestions Garner (1987) promoted on strategies that can enhance children's metacognitive ability.

Introduce different strategies and how to use the strategies. Teachers should teach young children different learning strategies and how to use them. Garner's (1987) research identified that some children who had weaker learning ability were only able to follow the instructions provided by the teacher and use it on the same situation. Therefore it is suggested that teachers should demonstrate the strategies using different situations and allow the children to understand that some strategies could be used in many other situations.

Focus on the learning process. Constructivism's pedagogy is that children's learning should be built on their prior knowledge and they learned something when they understood the relationship between different concepts through exploring and experiencing their

environment. When teaching, teachers need to focus on the learning process and allow the children to spend time thinking about their own learning. The best way to let children understand their own thinking is through the method of "thinking aloud." When a teacher is demonstrating in class, the teacher should also talk about individuals' thinking process. Only providing demonstrations in class without an explanation of the thinking process, children will only imitate the modeler but not able to understand the rationale.

Guided practice. Teachers must provide students with opportunities to practice strategies they have been taught. Garner (1987) believed that even though it is a conscious action when children think of what strategies to use in activities the process of using such strategies could become automatic through practices. Learners come to use strategies concurrently and semi-automatically through temporally distributed practice. To ensure that students practice strategies, teachers must allocate some school time to the activity. Overall, practice makes preferred systems of processing more quickly executed, more automatic, and thus more likely to be applied in school settings.

Assessing Metacognitive Ability

In order to measure metacognitive ability teachers need to look at the process of how children solve problems or achieve the answers. Children are encouraged to talk about and discuss their thinking in order for others to assess their metacognitive ability. This paper agrees with Baker and Brown (1984) who has said, "One simple way of assessing what children know is to ask them" (p.358). In the meantime, more recent studies have used observations of children's behaviors (Stipek et al, 1995; Perry, 1998; Boekaret, 1999) or have asked children to comment or report immediately upon particular cognitive experiences, or give immediate explanations of theirs or others behavior, and have shown these kinds of measures can also indicates children's metacognitive processing (Whitebread, 1999; Siegler,2000) This paper will use both self-report and observations of children's behaviours to assess children's metacognitive processes.

Methodology

Research Design

This study on metacognition is a combination of both a qualitative and quantitative research methods. Mixed mode of data collection methods, are achieved through observations and data collected after conducting different designed activities with the three age groups of young children. In the research, investigator triangulation is employed. In this study, all the activities conducted with the children are video recorded and watched many times by another early childhood educator whom worked in the field for more than 25 years to ensure validity.

This study is carried out in three different activities with young children in three different age groups. In the pre-tests of the first two activities the children were told to remember different items and retrieved them afterwards. In the post-test, children were guided by occasional coaching or were taught to use different strategies to remember the items. During the process, the researcher will observe the children's ability to manage and monitor the input, storage, search, and retrieval of the contents of their memories in both pre and post-tests. The third activity is on storytelling and was done in smaller groups. Each group of children was broken down into a control and an experimental group. The children in the control group were asked to retell a familiar story to the researcher on their own while the experimental group of children retold the story with the researcher's scaffold. Furthermore, teachers who are involved in implementing the activities with children were trained to use different strategies to help children in using their metacognitive ability.

Subject of the Study

In this study, 60 children from one kindergarten in Hong Kong age 3-6 years old participated. Ten children from each whole day classes (a total of 6 classes including two K1, two K2 and two K3 classes) age 3-6 years old were randomly selected to take part in the above activities. For activity one, and two, the researcher conducted the activity with the sixty children individually; for activity three, the ten target children from each class were randomly divided into groups with five children each to complete the activity.

Instruments

Data collection was mainly achieved through three instruments and provided both qualitative and quantitative data:

1. Checklists (see Appendices A1-A3) on items that children were able to remember correctly after the first two activities.
2. Scoring rubrics and Checklist (Appendix B) related to children's ability on retelling the story (Activity 3). Areas and items used in the checklist were referenced from Project spectrum (1994) where some areas were amended by the investigator.
3. Samples of events on all three activities are subjected to protocol analysis (Appendix C) related to the three domains on Metacognitive process.

Data is collected and analyzed base on the checklists and detailed descriptions related to the children's performance throughout the three activities.

Checklists Design

Two types of checklists were used in the research. The first type of checklists focused on the number of items children remembered at the end of Activities 1 and 2. The second type of checklist was used in the storytelling activity. This checklist based its reference on the Project Spectrum (1994). There are five areas in the checklist and each area has 4 levels of abilities from 0-4 listed clearly on the form. The four areas included "Engage in activity/level of scaffold", "Parameter of remembering and forgetting", "Accuracy of content", "Sense of Structure/Theme" and "Complexity of Vocabulary/Level of Detail".

The first area in the second checklist focused on children's motivation in retelling the story, children's initiative and how well they focused during the storytelling process. The above area revealed children's ongoing monitoring and their motivational states during the storytelling tasks on emotional and motivational regulation. The second area focused on how well children remembered and revealed to others if they remembered or forgot the story. The third area focused on the ongoing storytelling process to see if the children were able to monitor their behavior and did not talk about their own ideas when telling the story. The forth area

focused on children's understanding on the structure related to the story and can they predict the situations accordingly. The above four areas showed certain aspects related to metacognitive regulation; in self-regulated comprehension, readers whose predictions and performance are highly correlated are judged to have good calibration of comprehension, whereas children whose predictions and performance are minimally correlated are judged to have poor metacomprehension (Hacker, D. J. & Others, 1998). The last area assessed on children's personal knowledge about the task of storytelling and the vocabulary used when retelling the story; their metacognitive knowledge.

Protocol Analysis Design

Categories of metacognitive behavior were drafted and the behavior of three children from K1-K3 respectively were listed in details for the pre- and post-test in both Activity 1 and 2 (Appendix C). Another protocol analysis focused on Activity 3 (control and experimental group) was conducted by the investigator, which combined aspects of metacognition and the 5 areas used in the checklist (see Appendix C).

Activity One – Metamemory

Rationale on implementing the activity. According to Larkin (2010), "Metamemory was one of the first components of metacognition to be studied"(p.36). It was from the study of metamemory that Flavell constructed his model of metacognition. While metamemory is the pre-cursor of theories of metacognition, and in the early days the term was used interchangeably with metacognition, the below activity is used to investigate on how many objects the children can recall after looking at them for 1 minute.

Implementation of the activity. The children were shown 10 different objects (see Appendix A) that they were familiar with and the researcher named the 10 objects for the children before conducting the activity. The investigator then conducted the activity with the child one at a time. Each child was given one minute to look at the 10 objects and was told to memorize everything they saw. After one minute, the items were covered up by a cloth and

the child was asked to recall as many as possible. In the one minute memorizing process, the researcher observed and marked down the children's self-regulate behavior and checked the number of objects each child was able to recall in different age group. The same activity was conducted the next day with a different set of objects (see Appendix A) and this time the children were given a present as reward. The children were told before participating in the activity that if they could remember all the objects they would be given a present. In this post-test, the investigator also observed the children's metacognitive behavior and compare with the pre-test.

Activity Two –Shopping

Rationale on implementing the activity. This activity was conducted using the theme of food. In the activity, the children were told to buy 5 different things from a play supermarket. A meaningful environment is most likely to facilitate children's articulation of their metacognitive knowledge and self-regulation of their performance (Whitebread, 2005). Similar to Istomina's (1975) study on young children's memory performance, children were involved in a pretend game and were asked to remember items to buy from a store where the children clearly understood the purpose of remembering, and from this activity hope to see the children showing evidence of awareness of forgetting, and simple strategies to avoid it.

Implementation of the activity. This activity is done with one child at a time in the designated play area. Each child was asked to buy 5 things from the dramatic supermarket and then gave them back to the investigator.

The investigator prepared 10 different shopping lists (see Appendix B) with each consisting of 5 items for the children to purchase. Each time, the researcher randomly drew one list out and asked the child to buy the five things listed on the paper. After the child finished shopping and gave the items back to the researcher, both a teacher and the investigator marked down the correct number of things each child bought. After finishing the shopping activity with the children in the first day, the researcher taught the children different strategies (e.g. classification) in order to buy the objects they were asked to purchase. In the second day, the same group of children played the shopping activity again.

Activity Three -Story telling

Rationale on implementing the activity. This was a story telling activity. The children had to use their own methods to retell a story they were told earlier. At the same time, some of the first studies of metacognition in practice involved reading. There is a reciprocal reading program in which Palinscar and Brown (1984) involved teachers modeling the key principles of reviewing or summarizing, questioning, clarifying and predicting in order to aid comprehension of a text. The second part of the story telling activity involved teachers' guidance. With "guided practice" children should benefit from the teacher and help children retell the story in a more completed way.

Implementation of the activity. This read-aloud activity is conducted with a group of 5 children each time. The preceding two activities were done with a group of 10 children in each whole day class from K1-K3 and these groups of 10 were broken down into two groups of 5 with a control group and an experimental group. Both the control and the experimental groups were told a story in Cantonese by their class teacher. The story that the K1 children listened to is called "Where are you going little raindrop," the K2 story is called "Henry the smiling crocodile," and the K3 story is "I'll always love you" (for story details see Appendix D). Both control and experimental groups were asked to retell the story one week later. The children in the control group told the investigator the story on their own while the children in the experimental group were guided with scaffolding when retelling the story. The investigator video recorded the children's behavior when they were telling their stories and analyzed the video according to the content of the story.

Results

Introduction

This chapter presents findings from the children's result of the three activities on metacognition. It includes data derived from the three activities and the observation records

on the children's performance. In the first and the second activity, quantitative data was collected according to the correct number of items the children remembered at the end of the activity while qualitative data was collected on the children performance from all three activities and analyze according to the three domains of metacognition covered with and without guidance.

Findings from Activity One

In the pre-test of the metamemory game 4 children were absent and did not participate. In one-way ANOVA test, it agrees that the factor has three levels and 18 participants in K1 and K2, and 20 participants in K3, a total of 56. The p-value (Sig.) for Levence F Statistic is .843 (not significant). The non-significance of the Leven Statistic of the Test of Homogeneity of Variances indicates that the assumption of homogeneity of variance is tenable. The mean scores under K1 (M = 4.56, SD = 1.294), K2 (M = 5.33, SD = 1.715) and K3 (M = 7.50, SD = 1.277). The mean scores were higher as the age of the children increase. The one-way ANOVA showed F to be significant beyond the .01 level: $F(2, 53) = 21.65$; $p<.0005$. Partial eta squared = .45. The children who were absent and did not participate in the pre-test did not join the post-test. In the post-test, in addition to the 4 children who were absent in the pre-test, 4 more children were absent resulting in only 52 children participated. These 52 children were given another set of 10 materials to remember and at the same time the researcher told the children if they were able to remember all the items they would receive a present as rewards. In the post test, the p-value (Sig.) for Levence F Statistic is .246 (not significant). The non-significance here again indicates that the assumption of homogeneity of variance is tenable. The mean scores under 15 K1 (M = 5.33, SD = 1.759), 18 K2 (M = 6.83, SD = 1.15), and 19 K3 (M = 7.79, SD = .976). Similar to pre-test the mean scores were higher as the age of the children increase. The results of the pre- and post-test are shown in table 4.1, and the data collected on the 60 children individually is listed in Appendix E. The graphs in 4.2 (a) - 4.2 (c) showed each level of children's results and compared the differences in both the pre and post-test.

In the post-test, the children were tested again to see if a reward can stimulate them to use more strategies to remember the items and aim for a higher correct rate. Using the

paired-samples t-test, the mean response for the pre-test (M = 5.98, SD = 1.863) was smaller than the mean for the post-test (M = 6.65, SD = 1.691). A related-samples *t* test showed significance beyond the .05 level: t (51) = 2.762; p = .008(two-tailed). The 95% confidence interval was (.184, 1.162), which does not include the value of zero specified by the null hypothesis.

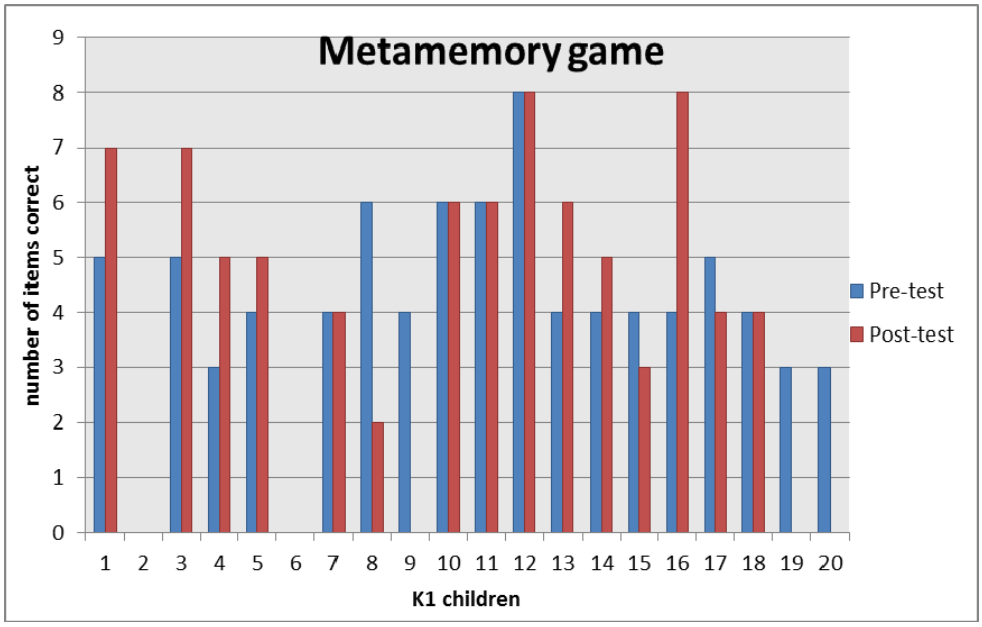
When the children were completing Activity 1 the first time, metacognitive knowledge was observed. Children were able to use some simple strategies to help them to remember the items. More uses of different strategies were observed in the older group of children meaning they are more knowledgeable and competent in using different strategies to help them remember the items.

Based on the protocol, all the children showed the use of strategies during the memory process. The older children showed better control and monitoring during the one minute duration. The K1 child was able to point to the objects and repeated their names. The K2 child was able to point to different objects and repeat their names more than 5 times. The K3 child pointed and named the object one at a time and she was able to control her method of naming the items by going left to right. Instead, the K1 and K2 children tried to recite the items without a systematic approach. Most of the children in the younger age group stared at the items and tried to remember them while the older children were able to use a finger to point to the items. Some continued to repeat the names of each item and some tried to recite the items on their own. Using metacognitive regulation, some children were able to monitor and control the memory process while some children lost control and played with the objects or looked around the environment.

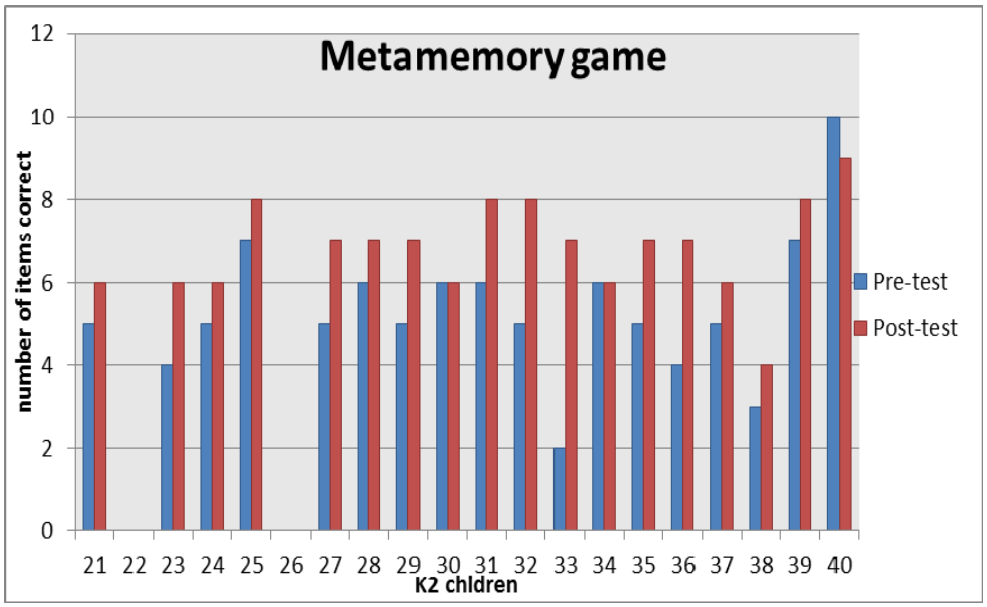
In the second round with an external motivator, the children showed improvement in the three metacognition domains. More children used strategies to remember the items. More children pointed to the items and named the items many times; some of them counted and recited the number of items and one girl even closed her eyes and recited the 10 items during the memory process. On the other hand, fewer children were distracted by the environment or played with the items during the memory process. Most however, were able to stay focused during that one minute. Lastly, more children showed emotional and motivational regulation; they were able to tell the researcher how many items they forgot or the location of the forgotten item under the cloth.

Table 4.1. *Result from Metamemory Game*

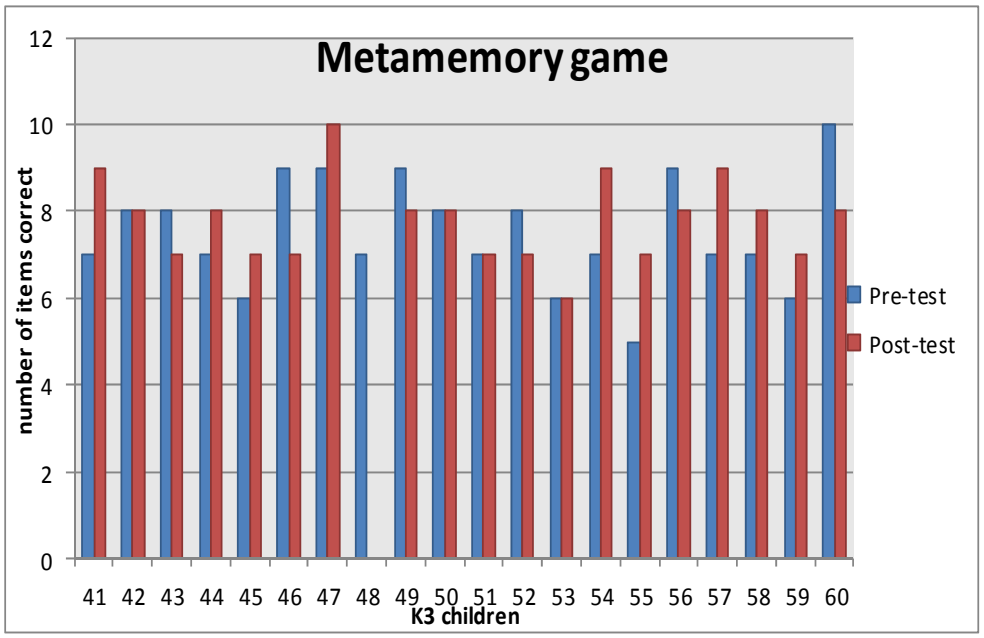
Metamemory game	Pre-test	Post-test	Increase in avg. of correct items (%)
# of K1 children	18/20	15/20	
Avg. items remembered	4.56 = 4.6	5.3	15%
# of K2 children	18/20	18/20	
Avg. items remembered	5.3	6.8	28%
# of K3 children	20/20	19/20	
Avg. items remembered	7.5	7.78 = 7.8	15%
Number of children	56/60	52/60	
Avg. items remembered	5.86	6.73	15%



Graph 4.2 (a). *K1 Result in Metamemory Game*



Graph 4.2 (a). *K2 Result in Metamemory Game*



Graph 4.2 (a). *K3 Result in Metamemory Game*

Findings from Activity Two

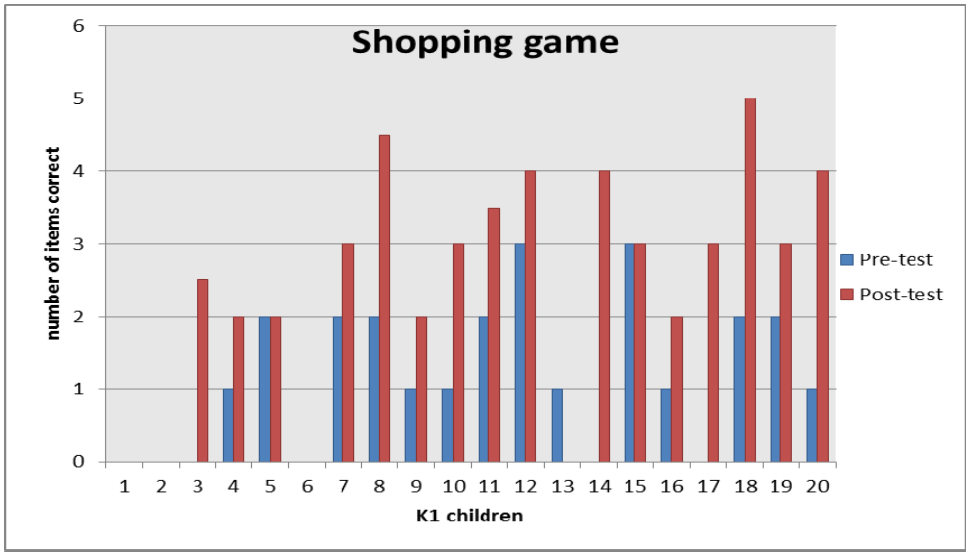
The findings collected from Activity 2 were similar to the first activity. The children were able to buy more correct items at the pretend supermarket the second time. There were 7 children absent in the pre-test and 6 children absent in the post-test meaning 53 children took part in the pre-test and 54 children took part in the post-test. The result of the pre- and post-test is listed in table 4.3, and the data collected on the 60 children individually is listed in Appendix F. The one-way ANOVA test agrees that the factor has three levels and 15 participants in K1 for the pre and 16 in the post-test, and 19 participants in both pre and post-test for K2 and K3. In the pre-test, the p-value (Sig.) for Levence F Statistic is .563 (not significant). The non-significance of the Leven Statistic of the Test of Homogeneity of Variances indicates that the assumption of homogeneity of variance is tenable.

Table 4.3. *Result from Shopping Activity*

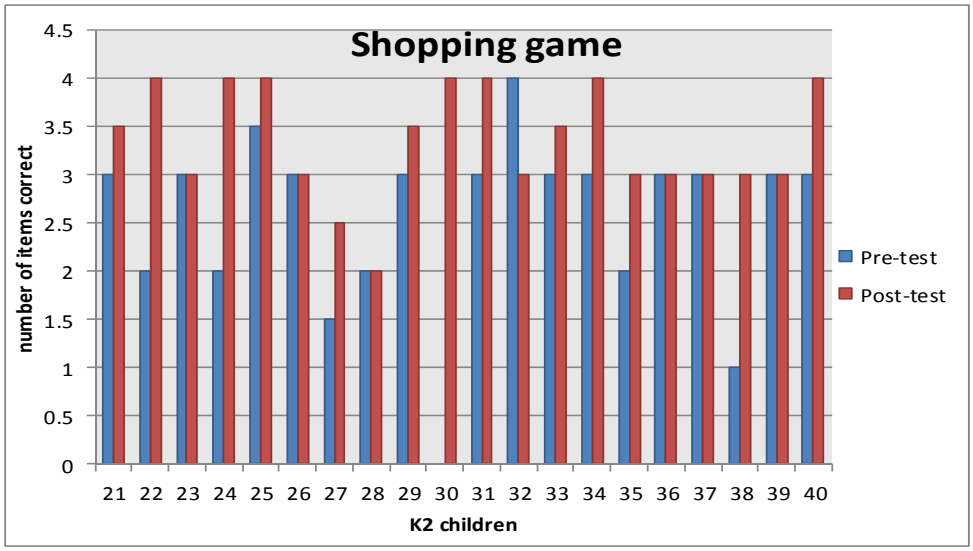
Shopping activity	Round 1	Round 2	Increase in avg. of correct items (%)
# of K1 children	15/20	16/20	
Avg. items remembered	1.6	3.2	100 %
# of K2 children	19/20	19/20	
Avg. items remembered	2.47 = 2.5	3.36 = 3.4	36 %
# of K3 children	19/20	19/20	
Avg. items remembered	3.0	3.9	30 %
# of Children	53/60	54/60	
Avg. items remembered	2.43	3.2	32 %

The mean scores under K1 (M = 1.6, SD = .8281), under K2 (M = 2.474, SD = .8893) and under K3 (M =3.026, SD = 1.1115). The mean scores were higher as the age of the children increase. The one-way ANOVA showed F to be significant beyond the .01 level: F (2, 50) = 9.292; $p<.0005$. Partial eta squared = .271. In the post-test, the p-value (Sig.) for Levence F Statistic is .185 (not significant). The non-significance of the Leven Statistic of the Test of Homogeneity of Variances indicates that the assumption of homogeneity of variance is tenable. The mean scores under K1 (M = 3.156, SD = .9437), under K2 (M = 3.368, SD = .5973) and under K3 (M =3.924, SD = .7123). The mean scores were higher as the age of

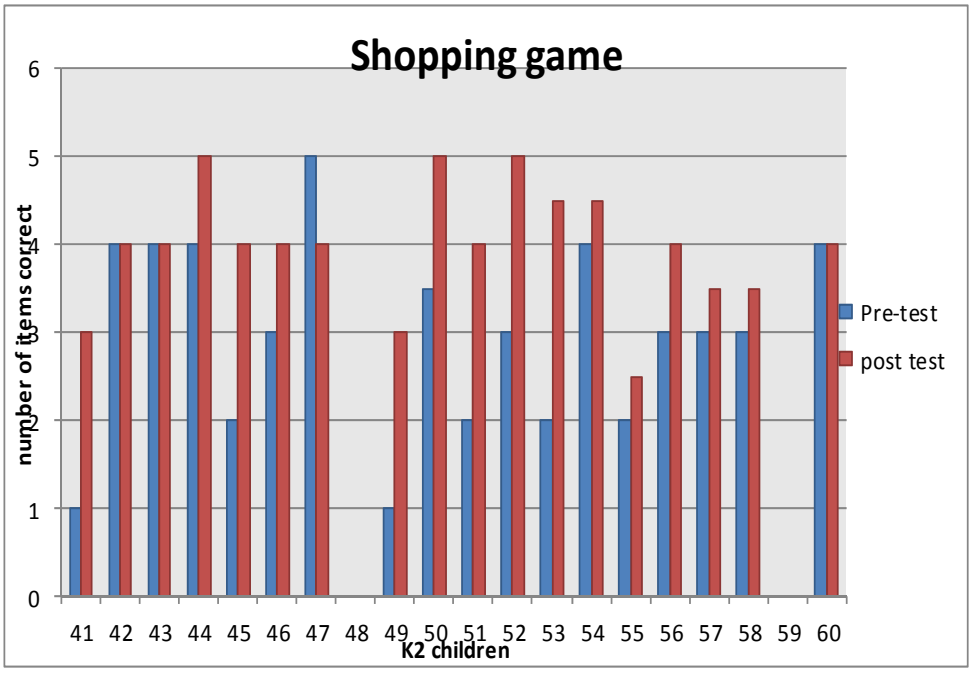
the children increase. The one-way ANOVA showed F to be significant beyond the .01 level: F (2, 51) = 4.929; p<.0005. Partial eta squared = .162. In graphs 4.4 (a) - 4.4 (c) showed each level of children's results and compared the differences in both the pre and post-test.



Graph 4.4 (a). *Result of K1 in Shopping Activity*



Graph 4.4 (b). *Result of K2 in Shopping Activity*



Graph 4.4 (c). *Result of K3 in Shopping Activity*

In the post-test, the children were tested again to see if the children were able to bring more items back correctly using strategies taught by the teacher. Using the paired-samples t-test, the mean for the K1 group response for the pre-test (M = 1.643, SD = .8419) was smaller than the mean for the post-test (M =3.143, SD = .9693). A related-samples t test showed significance beyond the .05 level: t(13) = 5.408; p<.05 (two-tailed). The 95% confidence interval was (.9008, 2.0992), which does not include the value of zero specified by the null hypothesis. As for K2, response for the pre-test (M = 2.55, SD = .9305) was smaller than the mean for the post-test (M = 3.35, SD = .5871). A related-samples t test showed significance beyond the .05 level: t(19) = 3.31; p = .004(two-tailed). The 95% confidence interval was (.2941, 1.3059), which does not include the value of zero specified by the null hypothesis. Lastly, for K3, response for the pre-test (M = 2.972, SD = 1.1177) was smaller than the mean for the post-test (M = 3.972, SD = .696). A related-samples t test showed significance beyond the .05 level: t(17) = 4.443; p <.05(two-tailed). The 95% confidence interval was (.5252, 1.4748), which does not include the value of zero specified by the null hypothesis.

When the children were completing Activity 2 the first time, they were exposed to a

familiar and meaningful environment. In a meaningful environment the children understood their task immediately and were all able to tell the researcher that they were able to buy the items the researcher wanted which revealed children's metacognitive knowledge. After the children learned the items they needed to buy, they were able to search in different areas and look for the items. The table in 4.5 shows an example of the detailed protocol analysis of two K2 children's metacognitive behavior in both the pre- and post-test.

Based on the aforementioned example, the older children were able to showed better skills in monitoring their shopping process. In the post-test, after the researcher taught the children some strategies to remember their shopping list, children were able to remember more items from the supermarket especially the K1 children.

Table 4.5 (a). *K2 Shopping Game Pre-test on Child 31*

Child	Aspects of	Metacognition	Child's behavior
31	Metacognitive Knowledge	Individuals' knowledge	Child was told to buy pretzel and she told the researcher she did not know what it is.
		Use of strategy	Walked to the dramatic supermarket and took one egg out from the egg carton then chose an apple next to the egg and walked to the cookie area an took a box a pretzel.
	Metacognitive regulation	Planning	Child looked the items and took one thing at time.
		Monitoring	After taking three items from the supermarket, she stopped and looked around, a friend gave her a box of pretzel she looked at it and said "I bought this already."
		Control	Child took egg and pretzel immediately when she was at the supermarket.
		Evaluating	When the researcher asked if she finished buying she node her head
	Emotional and Motivational regulation	Ongoing monitoring	Child took one item at a time and remembered the things that she had already bought
		Motivational states	She walked to the supermarket with a smile on her face.

Table 4.5 (b). *K2 Shopping Game Pre-test on Child 31*

Child	Aspects of	Metacognition	Child's behavior
31	Metacognitive Knowledge	Individuals' knowledge	Child named the items she bought.
		Use of strategy	She walked towards the egg and took an egg first then took the fish behind the egg and walked to the vegetable area and took the carrot and then corn. After that, the child looked at the items she bought.
	Metacognitive regulation	Planning	Child walked to the supermarket and took two items in the same area and walked to another area and took two more items.
		Monitoring	Child double checked the items in the bag after taking the four items.
		Control	
		Evaluating	When finished buying four items, child immediately told researcher "I bought all of them."
	Emotional and Motivational regulation	Ongoing monitoring	Child went to the supermarket and bought one thing at a time and then told the researcher she finished. When revealing the items bought she counted there were only 4 items and told the researcher she did not buy enough.
		Motivational states	

Findings from Activity Three

The children who participated in the story telling activities showed different levels of metacognitive ability. When the children retold the story to the investigator, they were video recorded and the content was transcribed by the investigator. Based on the transcription and the scoring rubrics (see Appendix B) the investigator scored the checklist below (see Table 4.6). Fifty-eight of the 60 children participated in the story-telling activity because two children were absent. There were 9 children in the K1 experimental groups with 5 and 4 children in each group respectively, and 10 children in the control groups with 5 children per group. The average score the 10 children achieved in the control groups was 5.3 and the average score the 9 children achieved in the experimental group was 5.7. There was an 8% increase in the average score for the K1 control group compared to the K1 experimental group. In the K2 level, 9 children were in the experimental group and 10 children were in the control.

The average score the 10 children achieved in the control group was 5.7 while the average score the 9 children achieved in the experimental group was 7.2, representing a 26% increase in the average score for the K2 control group compared to the K2 experimental group.

Table 4.6. *Scoring Rubrics for Storytelling Activity*

Child's name 1_____ Age: _____
Date: _____ Observer: _____

Skills	Score	Descriptive behaviour
Engage in activity		
Parameter of remembering and forgetting		
Correctness of content		
Structure or theme		
Detail of the story		
Total		

Table 4.7. *Result from Storytelling Activity*

Storytelling	Control group	Experimental group	Increase in score (%)
# of K1 children	10/10	9/10	
Avg. score	5.3	5.7	8%
# of K2 children	10/10	9/10	
Avg. score	5.7	7.2	26%
# of K3 children	10/10	10/10	
Avg. score	6.3	8.8	40%
# of children	30/30	28/30	
Avg. Score	5.8	7.3	26%

In the K3 level, 10 children participated in both experimental and control group. The average score the control group achieved was 6.3 and the average score the experimental group achieve was 8.8, which was a 40% increase in the average score for the K3 control group compared to the K3 experimental group.

The average scores the children received for the experimental and control group are listed in Table 4.7 and the data collected on the 60 children individually are listed in Appendix G. A

Table 4.8(a). *Storytelling Pre-test Protocol K1 Child*

Child	Aspects of	Metacognition	Areas in checklist	Child's behavior
20	Metacognitive Knowledge	Individuals' knowledge	Complexity of Vocabulary/Level of Detail	When the researcher asked what the story was about child said "raining," when flipped to another page where the mouse is playing, child said "play."
	Metacognitive regulation	Planning	Accuracy of content	Child identified picture and he said "This is a mouse."
		Monitoring	Parameter of remembering and forgetting	When researcher asked what the story was about, he was the first child to answer and said "talk about animal" then said "rain."
		Control	Sense of Structure/ Theme	Child is able to understand some structure that is related to the story; when a child said the mouse's daddy left, child 20 mentioned the little mouse tried to look for rain and he said "look for rain, look for rain, it is not raining, it is looking for rain."
		Evaluating	Correctness of Content	Child is able to mention the character and the theme of the story. He said "This is a mouse,'…"The rain dropped on the flower."
	Emotional And Motivational regulation	Ongoing monitoring	Engage in activity/level of scaffold	From the beginning towards the end of the story telling child 20 provided many comments; he talked about seeing a mouse, talked about what the mouse was doing and talked about the rain drop and where the rain drop landed.
		Motivational states	Engage in activity/level of scaffold	When a child said the mouse is hiding, child 20 immediately said "play." Each time when the researcher turned the page, child 20 said, "This is a mouse."

protocol analysis of the children in the control group and experimental group of K1 is shown in table 4.8 (a-b).

Table 4.8 (b). *Storytelling Post-test Protocol K1 Child*

Child	Aspects of	Metacognition	Areas in checklist	Child's behavior
14	Metacognitive Knowledge	Individuals' knowledge	Complexity of Vocabulary/ Level of Detail	Child used phases when telling the story. Child 14 talked about where did the raindrop land he said "fall on the face, flower and on the child."
	Metacognitive regulation	Planning	Accuracy of content	Child identified what is happening in the story he said "Daddy and mouse go out."
		Monitoring	Parameter of Remembering and forgetting	When researcher asked what the story is about child immediately said "about rain"
		Control	Sense of Structure/ Theme	When researcher talked about the raindrop landed on the grass child 14 said "looks like playing on the slide" and expressed the raindrop slide down from the grass.
		Evaluating	Accuracy of Content	At the end of the story, child 14 concluded and said little mouse played with the rain.
	Emotional and Motivational regulation	Ongoing monitoring	Engage in activity/level of scaffold	Most of the time child 14 told others what was happening in the story and until the very end, he added his own comment: "because little mouse play with the rain and daddy is angry."
		Motivational states	Engage in activity/level of scaffold	Child was eager to tell the story, he talked from time to time, he stood up and pointed to the sky and said "look at the thing up there."

Discussion, Limitations and Conclusion

Analysis

The purpose of the study was to explore children's cognitive ability in relation to their age and external factors. Data from the checklist and observation records in the three activities

conducted are described in the previous chapter. This chapter summarizes and interprets the major findings of the study. The first section mainly focuses on analyzing children's metacognitive ability and their metacognitive ability in relation to ages and rewards. The second section focuses on analyzing children's metacognitive ability in relation to the external factors. Interpretation of the analysis and possible factors affecting the outcomes will also be discussed in the two sections, respectively. Implications and recommendations with regard to the future development of teaching strategies on metacognition will also be discussed in the third section. Lastly, a conclusion is provided in the context of limitations of the study and areas that future research might explore are discussed.

Children's Metacognitive Ability

The results from the research showed that children age 3-6 do have a certain degree of metacognitive ability. When comparing the metacognitive ability, the older children have better results. Moreover, when children know that their ability will be rewarded, they pay more attention in the task and were able to show better self-regulation ability during the process.

Based on the results of the protocol analyses, children showed certain degree of metacognitive ability in all three activities. This was especially true in Activities 1 and 2. Children clearly understood the purpose of remembering and showed evidence of awareness of forgetting and simple strategies to avoid it. Children without any help from adults were able to tell others they forgot what else was in the list of things to buy or the number of items they forgot after the activity. At the same time, children showed that they were able to monitor and evaluate the process. Children attentively listened to instructions and focused on the items they needed to remember during the activities and many of them were also able to talk about how well they did. The result from activity two reveals that K2 and K3 children might have more world knowledge compared to K1 children since many K2 and K3 children had shopping experiences and many of them also learned the strategies the researcher taught. After the K1 children gained experience and using their new strategies, they were able to use them well when they did the shopping activity again. More children were able to explain to the researcher how many items they needed to buy or how many items they forgot to buy.

Lastly, looking at the results of all activities, the children in the older age group performed better. In Activity 1, the K1 children achieved an average of 4.6 items correctly, whereas the K2 children achieved 5.3 and the K3 group achieved 7.5 correct items in the pre-test. In Activity 2, K1 achieved an average of 1.6 correct items, while K2 achieved 2.5 and K3 achieved 3 correct items. Lastly, in Activity 3, the average score for K1 was 5.3, K2 achieved 5.7, and K3 achieved 6.3 under the control group. The results of all three activities showed a gradual increase in metacognition score in the three age groups. For this reason, it can be concluded that the older the children are, the better their metacognitive development.

Children's Metacognitive Ability in Relation to External Factors

With external factors, and scaffolding from teachers, children show significant improvement on their abilities in different activities. This was especially true in Activity 3. In the post-test for Activity 1, the children are provided rewards and with the stimulus of the motivators, the children were more focused in remembering the 10 items. According to the findings in the protocol analyses, children paid more attention to the 10 objects and used more strategies to remember the 10 objects in order to get the reward. In the pre-test the children achieved an average score of 5.86 whereas in the post-test, the average score was 6.73. With an external motivator, almost each child was able to remember one more object compared to the pre-test.

In the post-test for Activity 2, the children are provided more time to explore in the pretend supermarket and were taught some strategies to remember the items they needed to buy. According to the findings in the protocol analyses for Activity 2, more children were able to count the number of objects they needed to buy and were able to know where to look for the items. In the pre-test the children achieved an average of 2.43 points and 3.2 in the post-test. The result also showed that K1 children improved the most. The reason is K1 children have the least experiences compare to the older children so when they were taught how to look for the items in the supermarket, they performed much better in the post-test.

The third activity mainly focused on how external factors can affect children's metacognitive development. In this activity, the researcher provided scaffolds to the experimental group children when they retold the story. While the results from activity three

suggest that the K3 children benefited most from the teacher's scaffold in the storytelling activity.

The older the children the more benefit the children gained from the teacher's scaffolding efforts. The results suggest that the children were engaged in the story in general and able to reveal different traits of metacognition. The children from the experimental groups were able to explain the content in a more accurate way and they also showed better sense of structure pertaining to the story. With the help of the researcher, more children spoke up more often during story telling time. Furthermore, looking at the quantitative results, the experimental group achieved an average score of 7.3 on metacognitive ability, whereas the control group scored 5.8. When comparing the findings of each level of children, few differences were identified between the K1 control group and experimental group.

The K1 children were younger and did not have enough word knowledge. Even when the researcher provided guidance during the storytelling process, not much of an improvement was observed.

The three external factors used above (introduce different strategies, external motivator and guided practice or scaffolding) can benefit children's metacognitive development. Comparing the three factors, rewards seems to have the least effect. Using rewards, however, is still a significant factor in helping children enhance their metacognition. Teachers introducing different strategies on providing scaffolds to young children helped children to improve their metacognitive ability. New methods are available to help children improve their memories, monitor and control their thinking processes and provide the children better and faster strategies for performing different tasks and achieving different goals. Furthermore, using scaffolding facilitates the child's ability to build on prior knowledge and internalize new information. Others who are more capable provide the scaffolds so that the learner can accomplish (with assistance) the tasks that he or she could otherwise not complete, thus helping the learner through the Zone of Proximal Development (ZPD) (Bransford, Brown, & Cocking, 2000).

In Activity 3 scaffolds motivate or enlist the child's interest related to storytelling, simplify the task to make it more manageable and achievable for a child, and provide some direction in order to help the child focus on telling the story.

Limitation of the Study and Further Research

The study was based on the researcher's interest and experience with children's metacognition. It only focused on a group of children in one kindergarten and the findings only covered a very small percentage of the 3-6 –year-olds population. When conducting the activities, some children did not take part in the tasks from time to time, and sometimes during an activity, some children were moody and did not want to participate. Furthermore, metacognitive ability also relied on the experiences the children were exposed to before conducting the activities and the children's individual ability also affected their capabilities in using different strategies to complete each task. Based on the results of this study, children in different age group have different abilities and/or prior knowledge; therefore, when conducting different activities with young children, teachers also need to beware of their abilities.

In future studies, when educators are planning activities to enhance children's cognitive ability, it would be helpful to consider the ways children process information; new information will only be transferred to long term memory (LTM) when it is linked in some way to prior knowledge already in LTM, and learning is the result of individuals successfully encoding new information or recoding existing information in a new way. As a result, before implementing tasks for children to complete, educators should provide enough experience related to the subject matter before-hand in order to achieve a more reliable result. In general, the group of children who participated in this study was able to show metacognitive abilities in their daily learning and improved in the abilities when engaging in scaffolding with others. Further research to explore on how peer scaffolding in kindergarteners daily activities can foster children's metacognitive ability can be investigated. For such studies, mixed-group learning should be encouraged in kindergarten.

Conclusion

The primary objective of this study was to investigate children's metacognitive ability and said ability's relation to age and external factors. The study revealed that children were able to

demonstrate metacognitive ability even without help from others. Furthermore, in order to help children to improve their metacognitive ability, teachers should introduce to children different strategies and how to use the strategies, provide meaningful learning environments, external motivators and use guided practice more often. To summarize, teachers should provide more opportunity for children to work with peers in different age groups, to enhance their cognitive ability and thinking skills, and strive for teaching effective learning strategies.

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