Monitoring Metacognitive abilities in children: A comparison of children between the ages of 5 to 7 years and 8 to 11 years

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Abstract

The paradigm shift from the teacher centered to the learner centered approach has subjected the learners to be independent of their study. Metacognitive abilities enhance self-instruction, self-awareness about one’s knowledge and strategies to solve real life problems. This study monitors metacognitive abilities in children of ages 5-7 years and 8-11 years. The study also investigates how metacognition develops during childhood and what could be the possible causes of the acquisition of these metacognitive skills? Is it maturation or environment or both and how can it be enhanced? A qualitative method was used and the approach was strictly naturalistic. Two groups from Government Bilingual Primary School Muea, Buea were selected through purposive sampling; 43 participants from class two (N=43) and 65 participants from class four (N=65), a metacognitive observation tool was designed based on Flavell’s model of cognitive monitoring. An interview was conducted with the teachers of classes two and four and an audio recorder was used to record the interview. Results from the observation showed that, Metacognitive abilities for children in class four (8-11 years) are significantly higher than that of class two (5-7 years). Children from classes two and four who do not show significant metacognitive abilities and those that do not have academic follow up from their homes thus putting the family and environment as important factors in the development of metacognition during childhood. Socio-cultural perspectives and Family-school; fusing central principle in the development of a child’s meta-level cognition.

Keywords: Metacognitive abilities, Childhood, Metacognitive Knowledge, Metacognitive Experiences, Metacognitive monitoring model, Family.

INTRODUCTION

This study makes a comparison in metacognitive abilities of children in the primary school in Cameroon between the ages of 5-7 years and 8-13 years. Vukman (2012) posits that metacognition belongs to higher-order mental processes and enables us to control and plan our own mental activities or learning processes. He added that, metacognition helps in the detection of mistakes in problem-solving or learning process, in choosing goals and adequate problem solving and learning strategies. This definition simply implies that metacognition is the citadel of awareness (internal or external) and effort (the control of object of awareness). This is not the only definition of metacognition but most of the definitions are centered on the same concepts of monitoring, self-regulation, planning, knowledge, experience etc. Flavell (1979) asserts that metacognition can be referred as the knowledge about the regulation of one’s cognitive activities in learning but most researchers generally defines metacognition as thinking about thinking. Flavell (1979) mentioned a study of preschool and elementary school children who were asked to study a set of items with the intention of evaluating their knowledge level and their metacognition. The result showed that children are quite limited in their knowledge and in their metacognition and do relatively little monitoring of their own memory, comprehension and other cognitive enterprise. This study was however carried out in the western context were cultural issues from various areas in the world were not taken into considerations. However, the fact that a child is aware of her or his activities and as well take on measures to comply with the regulations of such activity show that children at least possess some degree of metacognitive skills. Veenman et al. (2006) cited (Berk, 2003; Veenman & Spaans, 2005; Veenman et al., 2004) that metacognitive skills emerged at the age of 8 to 10 years and
start expanding during the years after. This is in contrary to what they posited that, most likely, metacognitive knowledge and skills already develop during preschool or early-school years at a very basic level, but become more sophisticated and academically oriented whenever formal education requires that explicit utilization of a metacognitive repertoire. This study will thus examine some of the metacognitive abilities that children between the ages of 5 – 7 years and 8 – 13 years may possess and use in the classroom. In the study, comparison will also be made between the two age groups. Muis & Franco (2010) cites Brown et al. (1983), metacognition is divided into two components: Knowledge of cognition and regulation of cognition. Knowledge of cognition refers to the relatively stable information that learners have about their own cognitive processes including knowledge of how they store and retrieve information and regulation of cognition refers to processes of planning activities prior to engaging in a task, monitoring activities during learning, and checking outcomes against set goals. Tchombe (2009), outlined the constituents of metacognitive skills which teachers and pupils are supposed to use. They include: analyzing, explaining, interpreting, monitoring, controlling, reality testing, checking, predicting, making inferences, exploring, coordinating, categorizing, organizing, decision making, establishing links and transition, planning, sustaining and elaborating. This study will look critically at the two components of metacognition that may generate most of the skills listed above.

The Cognitive Monitoring Model

Metacognitive knowledge, metacognitive experiences, goals (or task) and actions (or strategies) are four classes of phenomena that through the actions and interactions among them, it becomes possible to monitor a wide variety of cognitive enterprises (Flavell, 1979).

Metacognitive Knowledge

The metacognitive knowledge is divided into three (3) sub categories.

| PERSON Category |
| Beliefs about individual differences e.g I can learn better by listening than by reading |
| Beliefs about interindividual differences e.g one of my friend is more socially sensitive than another |
| Universals of cognition e.g there are various degrees and kinds of understanding (attention, remembering, communication, problem solving etc), Children could learn that, there are various degrees of understanding, that is if i dont pay attention i will not be able to get the incoming information. |

| TASK Category |
| •Concerns the information available to you during a cognitive enterprise. it could be more or less, well or poorly organised. |

| STRATEGY Category |
| •Strategies likely to be effective in achieving what subgoals and goals? what sort of cognitive undertaking |
Metacognitive Experiences
The metacognitive experiences are likely to occur in situations that stimulate a lot of careful highly conscious thinking; such situations provide many opportunities for thoughts and feelings about your own thinking to arise and in many cases, call for the kind of quality control that metacognitive experiences can help supply (Flavell, 1979).

According to Flavell (1979) metacognitive experiences can

- lead you to establish new goals and revise or abandon old ones
- can affect your metacognitive knowledge base by adding to it, deleting from it or revising it

He further explained that, although metacognitive knowledge can undoubtedly undergo at least some modification without metacognitive experiences, these experiences play a major role in its development during childhood. For example, Lucy’s metacognitive knowledge says that she is weak in mathematics and strong in English language (person category), Lucy may decide to study hard in mathematics (strategy category) to make it more understandable (the process of modifying the metacognitive knowledge by making mathematics as understandable as English language). In this case, metacognitive knowledge is undergoing some modifications without the metacognitive experiences. In another scenario, Lucy is aware that a mathematics examination is coming up, because Lucy knows that she is weak in mathematics (person category and monitoring), as a result of metacognitive experience of the examination, Lucy studies hard (control) to make mathematics understandable so that she can succeed (experience). In this case the metacognitive experience has played a role in the metacognitive knowledge.

The monitoring of mental cognitive abilities in this study is guided by this cognitive monitoring model proposed by Flavell (1979).

Hypothesis:
Metacognitive abilities for class four (8-11 years) are not significantly higher than that for class two (5-7 years).

METHODOLOGY
The study was conducted through classroom observation including an interview that was conducted with the classroom teacher. The study made use of the qualitative method and the approach was naturalistic.

Participants
Through purposive sampling, Government Bilingual Primary school Muea, Buea was chosen as the sample of the study. The study was carried out in the Anglophone section of the school. Class two (CTo) has an enrolment of Forty three children (N=43) with 24 females and 19 males. Most of the children of class two fall between the ages of six (6) and seven (7).In the other hand, class four (CFr) has an enrolment of 65 children (N=65) with 37 females and 28 boys. Most of the children of class four fall between the ages of 8 – 10 years. The CTo classroom had a number of charts which included; number charts, country charts, fruit charts, animal charts, chart with parts of a human body and chart with the letters of the alphabet, all evenly pasted round the walls of the classroom while CFr had just three charts on their walls. Children sit at an average of 3 pupils per bench.

For class two, the class is how ever noisy when the teacher is not teaching but calm a little when the teacher starts instruction. One can also get how noise from the neighboring class one and three influences the attention level in the classroom. Class four is quiet most when an activity is going on in the classroom.

Materials
Observation tool and interview guide were used to identify and compare metacognitive abilities in children. The interview guide was strictly through audio recording.

Table 1: A metacognitive observation tool (designed based on Flavell’s (1979) model of cognitive monitoring) Coded table.
### Item No. | Metacognitive Abilities | Scale: None (1) Few (2) Half (3) Most (4)
--- | --- | ---
1 | The children can distinguish variations of knowledge they possess in the different subjects |  |
2 | Belief about gender differences among the other pupils |  |
3 | Belief about social sensitive differences among the others |  |
4 | Belief about strength in knowledge among the other pupils |  |
5 | Aware that understanding can be varied through; attention; communication, solving problem effectively etc. |  |
6 | Information available about cognitive enterprise. Eg. I have studied well in English than in mathematics. |  |
7 | Aware of different strategies likely to achieve goals or sub goals. Eg. Knowing that to solve a problem that I have forgotten the method, I refer to a text book, see an example already solved, and ask from a teacher or a friend. |  |
8 | Have an awareness of when knowledge can be used for an activity |  |
9 | Can refer to metacognitive knowledge to modify (regulate) |  |
10 | Understand how prepared to present knowledge in an activity |  |

From the table above, Item 1 – 7 consist of the metacognitive knowledge component and item 8, 9 and 10 consist of the metacognitive experience component.

**Interview Questions**
- How can you evaluate children’s attentiveness in your class?
- Do they actually see attention as crucial to their understanding in the classroom?
- Are the children aware or conscious about the varying nature of the responses or knowledge?
- Do they infer knowledge from friends or seek other source to compare with theirs?
- Are they aware of the strategies used to seek for knowledge especially when they have difficulty understanding present issues thought in class?
- Do they enjoy classroom Activities?
- Are they aware that their learning in class is to prepare them to apply in practical situations and assessments are the medium in which their understanding will be tested?

Probing was use to get further details about each interview question.

**Procedure**
After having obtained permission from the head teacher on the first day of the study, we went to class two and started the observation. We introduced ourselves to the teacher of class two and informed her about our observation activity. She then granted us permission to do the observation in her class. First we started by collecting the information related to class. The class two teachers provided us with a detailed class record where we extrapolated the number of the students in class, their ages and gender. Information about the classroom environment and structure were also collected. Through the observation guide, we began observing the classroom activities to identify metacognitive abilities (MA). The observation tool which we call the metacognitive observation tool was design from Flavell’s (1979) model of cognitive monitoring. The responses for the observation were coded (None (1); meaning no child possess the MA, Few (2); meaning few children possess the MA), Half (3); meaning half of children in the class possess the MA, Most (4); meaning most or all of the children in class possess the MA) in order to do inferential analysis (testing the hypothesis) on the SPSS software. An interview was also conducted immediately after the observation and the class teacher was the main respondents. The interview was to get an inside view from the teacher herself about children’s
metacognitive abilities. A quantitative analysis for the observation was done and the student t test for independent sample was use to compare mental cognitive abilities for class two and class four. The same procedure was repeated for class four on the following days.

RESULTS
The study was to identify metacognitive abilities in children for classes two and four. The first days were for class two and the other days for class four.

Observation from a mathematics lesson
The teacher started the lesson by asking the children the date of the day
The teacher asked “what is the date of today?” Children in the class were very anxious to tell the date of the day but most of the children who were pointed to tell the date were boys unfortunately most of them had it wrong just one child was correct to say “the date of today is Monday the 26th of January 2015”. Next, the teacher presented pre-knowledge, that is, counting from 1 to 100 before she could continue teaching the children counts from 101 to 120. During the exercise, children were ask to identify numbers on the board but one child was ask to identify 87 instead the child identified 78. Following the responses from the children and the way the teaching learning process was unfolding, most of the children have a lower meta-level of cognition. The control skill is only visible when the teacher makes belief that a problem they have solved is wrong; they now try to use a particular strategy to correct the problem. One example was that, the teacher asks the children to write 109. A female pupil wrote 10P on the board, the teaching disagreed with the pupil and ask her to correct it. Without anybody telling her the correct responds, she reflected for some moment and wrote 109 (control skill). The children could recognize patterns in numbers, that is, 1, 2, 3 … 10, 11, 12, 13 but are not aware of when to change pattern, for example, when the child follows the pattern 100, 101, 102 to 109, the child will continue with 1010 instead of 110. An assignment was given in class and almost all the children failed to change pattern in numbers when it was need. From the way they write one can see evidence of metacognitive abilities in the children in the way they do cancellation in their books to write a number nicely or correct an answer. This shows that they can think about what they are doing (a cognitive task) and can take any action to modify or correct. Even though it is at a lower level, children at this stage metacognitive knowledge and experience. From the observation children from class four possess a higher level of metacognitive knowledge and experiences.

Interview with Teachers (R-Researcher, T2-Teacher class two and T4-Teacher class Four)
This interview was recorded exclusively through an audio recorder and was later played to write out the responses of the interviewee.
R: How can you evaluate children’s attentiveness in your class?
T2: Those who pay attention are those that are aware of the purpose of their studies. They are very few children in class who actually pay attention. These few are those that have a follow up from the homes. Most of the children in this class do not have a follow up from their homes. We have only about 10 children who can actually concentrate. Look at the class now, you find the few who are actually concentrating on the exercise I have given them.
T4: When I am teaching or a classroom activity is going on, the children are very attentive and participatory. They are only distracted when there is no classroom activity.
R: when you ask questions or give exercises, are the children aware about the correctness of their responses or knowledge they possess?
T2: The children still a lower level of awareness about the correctness of their responses. Even when information is presented as wrong, most of the children will maintain the wrong response as the right one. They are not conscious of the fact that they need to modify or use a strategy to provide the right respond. Only a few can do that, most especially those that have a follow up from their homes.
T4: Sometimes they feel that the procedure is not correct but when they are told that the answer is wrong, they employ varying strategies to have the right answer. Some ask questions from me, some
ask from friends, they sometime go back to previous problems that have been solve rightly to follow the procedure.

R. Do they infer knowledge from friends or seek other source to compare with theirs?
T2: Most of the children do not bother to infer knowledge, when a material is thought today, most of the people forget the following day, only a few remember, those that go back home and their parents make them to study and ask questions.
T4: Yes, they do infer knowledge from different sources.

R: Are they aware of the strategies used to seek for knowledge, especially when they have difficulty understanding present issues thought in class?
T2: Just a few are aware, like I said; the environment has a great role in the way these children respond in class.
T4: The children are quite aware but the limitation they have is lack of textbooks and other didactic materials. And since most of their parents do not care about what they are doing in school, most of the learning is maximize in the classroom.

R: Do they enjoy classroom Activities?
T2: Yes, because most of the time I include play in the learning process. Since they like to play, they actually enjoy and learn in the process, even though they are not aware that they have been conditioned to learn through play.
T4: Yes, they do enjoy classroom activities. It can be seen from the way they are responding during lessons.

R: Are they aware that their learning in class is to prepare them to apply in practical situations and assessments are the medium in which their understanding will be tested?
T2: Very few are aware; most of them don’t even know why they are here. They don’t reflect on what will happen if they are ask to present the knowledge they are learning, most are not even aware that they could use their knowledge obtained in the classroom to apply in practical situations. But from time to time I remind them on the purpose of their learning
T4: Yes, most of them are quite aware.

Testing the null hypothesis (Ho) that; Metacognitive abilities for class four (8-11 years) are not significantly higher than that for class two (5-7 years). The following analyses describe and test the Ho above. The data was initially qualitative but it was later coded and transform into quantitative data in order to make inference about the hypothesis.

**Table 2: group statistics table for classes two and four**

<table>
<thead>
<tr>
<th>Class</th>
<th>No. of Items</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Two</td>
<td>10</td>
<td>2.2000</td>
<td>.63246</td>
</tr>
<tr>
<td>Class Four</td>
<td>10</td>
<td>3.7000</td>
<td>.48305</td>
</tr>
</tbody>
</table>

Table 2 above describes the mean score for all the 10 coded items. The mean score for class two is 2.2000 (SD=.63) which indicates that at an average level, only a few children demonstrate a mature level of metacognitive abilities. The class four mean score is 3.7000 (SD=.48) which indicate that most of the children demonstrate a mature level of metacognitive abilities.

**Table 3: Independent sample test (comparison of the ages; 5-7 years and 8-11 years)**

<table>
<thead>
<tr>
<th>Levene’s Test for Equality of Variances</th>
<th>t-test for equality of Means</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Sig</td>
<td>t</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>.123</td>
<td>.730</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3 presents information that enables us to verify if the means are significantly different. Our interest is at the row that assumes that the variances are assumed equal. Based on the value of $t = -1.734$ and the degree of freedom ($df = 18$) given on the table, the $t$ value calculated falls on the rejection zone of the null hypothesis. Similarly, the calculated significance (sig) value of $< .000$ is less than $\alpha = .05$ and hence we conclude that metacognitive abilities for class four (8-11 years) are significantly higher than that for class two (5-7 years).

**Discussion**

Investigators have recently concluded that, metacognition plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition and various types of self-control and self-instruction (Flavell, 1979). As observed from the study, these mental activities were very prominent in children of class four who are a little older than their junior in class two (less prominent mental abilities). This shows that, the acquisition of metacognitive abilities improves with age. This is in line with what many researchers of cognitive development who argue that, with age, persons become more reflective and self-aware (Vukman, 2012 cites Bakracevic Vukman, 2005; Bakracevic & Demetriou, 2005; Kuhn, 2000). However, from the study, age is not the only factor that influences the acquisition of metacognitive abilities. The social support is an important factor. Findings from the interview revealed that the family plays a greater role in the metacognitive abilities of the children. Children who had better academic support from their parents are aware of their ability to concentrate and its function, use appropriate strategies to solve problems. Nsamenang (2005) posited that the family is regarded as the most basic of all institutions. He also added that, the home or family is the place where the foundation for learning in later life is laid. This statement must not be undermined as it places greater importance in the role of the family and the overall development of the child. Results from this study clearly delineate the influence family has on the development of metacognitive abilities in children. Thus culture and the society is the key for successful integration of the child in school.

**Conclusion**

The results show that metacognitive abilities improve with age within childhood but environmental factors like the family has a great role to play in the acquisition of metacognitive abilities. It was seen that, few of the children in class two who are aware of certain cognitive characteristic had a strong support from their parents while the others who do not show these cognitive abilities in the classroom have little or no support from their parents. It is important to note that education today is highly learner centered, so it is very important to enable children develop metacognitive abilities which are essential for self-regulated learning, problem solving, reasoning etc. Results show that children within these age ranges can actually acquire the higher order thinking effectively if they are provided with support from their homes. As a result of this we therefore recommend the family centered education where the school and home are systematically and actively involved in the total learning of the child. As Nsamenang (2005) puts it, “it would be beneficial if the traditional path of participatory learning in the cultural context (for example the family) or didactic learning in school fused to give children the benefits of each rather than their differing orientations and imperatives literally tearing children apart” p. 251.

**References**


