Introspective Abilities In Preschool Children

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Abstract—
The main aim of the current research is to examine the existence of young children’s introspective abilities, such as the awareness of the ‘fact’ and the ‘content’ of thought. Fifty children of mean age 5 years were individually tested both at the beginning and at the end of the school-year. Half of them were randomly selected and constituted the experimental group and had an intervention for half-an-hour for twenty weeks, which gave emphasis to the use and instruction of a number of internal-state words and other metacognitive activities. At the end of the intervention, the experimental group scored statistically higher in the metacognitive ability of introspection, and especially in children’s accuracy in referring to the content of thought.

Keywords / Index Terms:
Introspective abilities, preschool children

INTROSPECTIVE ABILITIES IN PRESCHOOL CHILDREN

INTRODUCTION

Introspection in young children refers to children’s ability to notice and reflect on their own mental states and experiences and attribute such states and experience to others; that is, to their ability to develop a theory of mind. In recent years, the phrase "theory of mind" has been used to refer to a specific cognitive capacity: the ability to attribute mental states-beliefs, intentions, desires, pretending, knowledge, etc.- to oneself and others. This ability enables one to understand that mental states can be the cause of -and thus be used to explain and predict-others' behavior.

“Introspection is an instance of reflective consciousness because it consists of reflecting on, and perhaps also verbally reporting on, primary-conscious mental events construed as mental events by the reflecting person” ( [15], p.741).

Young Children’s Introspective Abilities

Within the literature of “theory of mind” there have been many studies trying to investigate young children’s ability to introspect

Flavell et al. [15], p.75 identify four levels of response to the introspective tasks:

1. Although the nature of the task ensured that the participants had in fact been thinking during the time period under inquiry, when asked, they do not report having done any thinking.

2. The subject errrs by reporting thoughts that had not in reality occurred during this period.

3. The subject accurately reports object or events that he or she had in fact been thinking about. However, the report is construed by the subject as a factual report of the external objects or events encountered during this period or something similar, rather than as an introspective, consciously reflective type report of thoughts concerning them.

4. Level 4 is the same as level 3, with the crucial difference that the subject thinks of what he or she is doing as reporting mental activity concerning the task objects and events rather than just reporting the presence of the objects and events themselves. Thus, level 4 is in fact what is considered to introspection, whereas level 3 is not.

However, findings from a study by Estes, Wellman and Wolley [10] seemed to provide evidence that children’s ability to provide such reports must be slowly acquired through socialisation. In their study, Estes et al [10] asked children to form a mental image (“make a picture in your head”) of a familiar object such as a pair of scissors. Children were then asked whether they could transform this mental image through thought alone. For example, children were asked, “Just by thinking real hard, without moving your hands, can you make them (i.e., the scissors) open and close?” It is notable that
children were easily able to adopt and utilise the ‘picture in the head’ metaphor to refer to their images.

Estes ([10] p. 541) in a review of a research program, states:

“... around 4 years of age, children.... have at least a rudimentary capacity for introspection. In response to adult instructions and questioning, they can take their own thoughts (in the form of mental images) as objects of reflection and discussion. And by 5 years of age, some children spontaneously use mental rotation and have conscious access to this mental process.”

These findings seem to suggest two important points: that 3 and 4-year-olds could provide introspective reports on their own thought processes and that they can learn something about those thought processes (such as imagining an object in motion) from introspection.

To an objection that introspection is by large a conventional system of discourse [25], Estes replies that “young children can refer to and discuss their own mental states using novel terminology, and before they have had much opportunity to learn the conventions and language of introspection” ([10], p.84). Similarly, in a study by Gopnik and Slaughter [17] preschool children appeared to be able to introspect. In their study, 3 and 4-year-olds first entertained one mental state, such as a belief that there were crayons inside a crayon box. Then the state was changed (i.e., they discovered that there was something else in the box), and they were asked what they had thought was in the box before it was opened. The 4-year-olds could report their earlier belief, but the 3-year-olds could not, although they could report some of their earlier mental states that were later changed, such as pretenses and perceptions.

The above findings and conclusions, however, did not support Flavell’s et al [14], [15] findings according to whom “pre-schoolers tend to be very poor at recalling or reconstructing both the fact and the content of their own thinking, even in situations designed to facilitate introspection. In contrast, children of 7 or 8 years of age proved to be much better than 5-year-olds at such introspection tasks” ([15], p. 82).

In particular, Flavell et al [15] found that 5-year-olds were poor at reporting what they had been thinking of or what they had been thinking about, despite some good efforts on the part of the experimenters to make the process of thinking clearer to the children. The authors suggest that the pre-school children in Gopnik and Slaughter’s [17] study, who appeared to introspect, might not have remembered what they had thought but what they had said. However this might not be the case, since in an earlier study [16] children were not asked to say what they had thought but, nevertheless, 4 and 5-year-olds were able to report their earlier beliefs.

In an attempt to explain these discrepancies in children’s introspective studies, Harris [19] focused on a distinction made by Flavell and his colleagues, concerning the two levels of introspection:

“On the one hand, children might report what they have, in fact, been thinking about, but construe their report as a factual report of the external objects or events encountered.... rather than as introspective, reflective consciousness-type report of thoughts concerning them”. On the other hand, children can construe what they are doing as “reporting the presence of the objects and events themselves” (p. 75).

Flavell and his colleagues emphasise that it is only the latter type of report that amounts to genuine introspection. However, Harris [19] argues, we cannot deny a genuine introspection in Estes et al [10] children’s reports since children, explicitly recognised that such transformations could not be applied to real things; only to the imagined ones.

Harris [19] suggests two possibilities that might account for the discrepancy in children’s introspective studies: One concerns the nature of the introspected process and the other the way in which the dialogue between experimenter and child is conducted. As far as the first one is concerned, Harris believes that children’s capacity for genuine introspection might vary with the type of cognitive process under consideration. This assumption, however, needs further investigation. As far as the second one is concerned, Harris claims that “children’s ability to engage in a dialogue about the past is certainly worthy of study in its own right, but it may not reveal at all that children can remember about the past”(p. 101). In fact, in a study by Harris and Foley in [42] there was evidence about pre-school age children’s difficulty in memory tests.

Astington [2] suggested that the 4 and 5-year-olds in Gopnik and Astington’s [16] study might be able to report their earlier beliefs; but it might also be true that children of this age, as Flavell et al argue, are not very good at introspecting/reporting their thoughts, but more able to introspect the content of their mental states.

Young Children’s Understanding of the Stream of Consciousness

Another interesting aspect of children’s theory of mind is their understanding of the continuous flow of thinking in human brain, the so-called “stream of consciousness”. According to Flavell et al. [15] “conscious mental events (ideas, perceptions, images, and feelings) normally follow one another more or less continuously in a person who is awake. They form a kind of ‘stream of consciousness’ with first one conscious mental event happening, then another, then another” (p.26). Similarly, adults generally agree that the mind, when conscious, is always active. Thoughts flow
incessantly, one cueing the next. There has been a suggestion, though, that young child even with strong encouragement to the contrary, do contend that thoughts come from time to time, and not in a steady stream. For example, Flavell’s et al. [14] study, led them to the conclusion that “pre-schoolers greatly underestimate the amount of mental activity that goes on in people. They do not realise that people are continually experiencing mental content of one kind or another, the ever-flowing “stream of consciousness”... ([15], p.79). Therefore, Flavell et al. [14] suggest that, unlike older children and adults, young children do not assume that mental activity goes on more or less continuously in a waking person. Moreover, according to Flavell et al ((15) 3-5 year-olds can be quite good at inferring that another person is thinking when given abundant evidence of it (i.e., of the fact of thinking), but quite poor at inferring what the person is thinking about (i.e., the content of thinking). The effort therefore, in this study, (see Test 1 in the Method section) has been to examine children’s awareness of the stream of consciousness in a range of situations, including both active and non-active situations.

The distinction between active and non-active task was purposeful, aiming to ascertain the correctness of the assumption made by Flavell et al. [14], [15] that preschoolers “are apt to believe that a person who is doing nothing overtly may also be doing nothing covertly” [15], p.32). Trying to test further this assumption we modified Flavell’s et al. [15] study 7, (see Test 2 in the Method section) adding some more ‘active’ situations, such as “playing ball”, to contrast them with others ‘less active’, such as ‘standing’ or ‘sitting’.

More specifically, according to Flavell and his collaborators [15] only 47% of 4-yr-old children attributed mental activity to a person being in a neutral situation [15] and similar findings [14] where 4-yr-olds attributed mental activity at the percentages of 43%, 38% and 47% to a person in a ‘Wait’ situation.

However, not all researchers agree with Flavell’s et al. [15] underestimation of preschoolers’ introspection abilities. For example, Estes, Wellman & Wolley [10] and Gopnik and Slaughter [17] agree that pre-school children (3-and 4-yr-olds) appear to be able to introspect. These findings seem more consistent with Louca-Papaleontiou, E.’s study [24] study where children’s introspective abilities were not so low as Flavell et al. [15] suggest. In this study, children’s introspection ability, and especially their awareness of the fact and their accuracy in referring to the content of thought has been enhanced by a specific intervention, which involved many metacognitive and linguistic experiences and gave emphasis to the frequent use and instruction of internal-state words (such as perceptual, physiological, emotional & affective, volition and ability, cognitive and moral). These findings showing that children were more aware of their own thinking than of other people’s thinking seem compatible to the simulation theory, according to which, “one has access to one’s own state and can then apply it to the other person”.

More specifically, Harris [18] argues that children imagine themselves in the other person’s situation and assume that the other person would have the same mental states that they noticed themselves having while taking the person’s role.

Further research may confirm or contradict the above findings. The purpose of this study, as it is shown below, fills in this effort to investigate the nature and the degree of preschoolers’ introspective abilities, and aims at contributing to the development of these skills. Though, such an effort, i.e., to develop young children’s introspective abilities, should not be considered as an easy task, it is worth bearing in mind Harris’ [19] words: “Young children are gradually acquiring an understanding of the causal connectedness of the stream of consciousness” and “there is a sharp improvement during the pre-school and early school years in children’s introspective abilities” (p. 102). If, therefore, we take advantage of this natural advance in children’s development and reinforce it with an intervention programmes, we might achieve the above aim, at least to a certain extent.

Furthermore, this study is based on Vygotsky’s theory, which greatly supported the use of language as a means of developing both language and thinking. That is, the current study pursues to develop young children’s metacognitive ability of introspection through an intervention programme, which systematically uses metacognitive language.

The acquisition of mental terms, or words that refer to mental processes or states, has aroused interest as it can be taken as indicating an understanding of mental state, reflecting the development of the concept of mind in children [22]. The understanding of mental terms has also been studied for an insight into the young children’s reasoning [26]. Finally, mental state words are obviously crucial for communicating mental states and by this facilitating the metacognitive processes.

What is, perhaps, more important about mental state words is their relationship with metacognition, that is, their role in children’s knowledge about, or awareness of mental states and processes and their ability to ‘monitor’ these processes.

There are many different ways in which language acquisition may be involved in theory of mind, though the nature of the relationship between the two is not clear, in spite of the large body of research (e.g. [5],[6], [6]; [27],[7], [8]).

So, some researchers have argued that the development of ToM is a socially mediated process, something that requires social interaction with other people [20],[33], [34].

Others propose that it is exposure to conversation about mental states in particular, rather than language in general, that is relevant in the development of theory of mind. Olson [29] for example, has argued that theory of mind development requires a language for talking about the mind, based on the
sentence of mental-state terms such as “think and know”, while others have argued that the relation between theory of mind, in particular false belief understanding, and language can be found at the syntactic level [7], [8].

Performance on any cognitive task reflects at least two factors: competence (i.e. the conceptual understanding required to solve the problem) and performance (other cognitive skills required to access and express understanding, e.g. memory, attention and language). The idea that the child has developed a conceptual understanding of the mind, but still does not pass the theory of mind tests because performance might be masked by linguistic complexity and pragmatic features of the linguistic instruction of the task has been referred to as a “weak” hypothesis about the role of language in ToM development. Language is seen as simply one of several possible performance variables that may constrain or limit the child’s task performance. These performance variables are what Siegal and Varley [39] call scaffolding. According to this theory language acquisition plays no fundamental or causal role in the conceptual changes taking place in the child’s ToM: at best it has an indirect or peripheral effect through its impact on performance. Even when the language of the task does not itself involve an understanding of complex language about the mind, the child’s language skills can be a major constraint on their performance.

Some researchers find it unlikely that this association between language and theory of mind is simply due to the linguistic demands of the task and offer a “stronger” version of the hypothesis, a theory that imputes a much more significant role to language development. Astington and Jenkins [5] presented results suggesting that language plays a fundamental role in the development of theory of mind. A longitudinal study showed that earlier language ability predicted later theory of mind performance, but earlier theory of mind did not predict later language ability. As already mentioned, de Villiers and de Villiers [7] also put forward the idea that language development provides children with the resources needed to promote false belief understanding, i.e. that language development has an effect on the child’s competence (conceptual understanding) rather than simply having an effect on the child’s performance on a certain test.

Yet another view on the way that language might facilitate social cognition and development of a theory of mind is that language focuses attention on mental explanations of behaviour. It is possible that access to language about mental events scaffolds the child’s understanding in a more expedient way than observation of social interaction alone. Human children do not need to learn simply through observation because the people around them structure that understanding through talk [7]. This view proposes that ToM is mediated by talk within the family, which also involves the idea that communicative fluency is what engenders the social relationships necessary to build a ToM. In the extreme, language could merely highlight pretence, desire, and false belief without explicitly representing them.

There are also those who promote the view that cognitive development leads the way, with a conceptual understanding of mental states emerging out of the interaction between maturing cognitive capacities and social awareness from interaction with others. Conceptual understandings of the mind might develop first and serve as the basis on which language will map [7]. More cognitive theories of ToM development have differently stressed innate modules and the role of maturation [23], the cognitive development of different levels of representation [34] or more general cognitive skills such as working memory [30] and executive functions [37]. More social theories have stressed the child’s active participation in social interaction and the interpersonal context as the basis for the emergence of both concepts about other minds and language about the mind [21].

In addition to this, mental-state words are crucial for communicating about mental states to others, so it is also likely that they play a role in thinking about them, as well.

Though metacognition cannot be equated with the use of mental state words, it seems possible that when a person uses a mental state word to make a statement or pose a question about some mental states or processes, this necessarily constitutes awareness of or knowledge about a mental state or process. Thus, any literal use of a mental state word by definition involves on the part of the speaker an act of metacognition.

Language about mental words plays two roles, then, in metacognition. First, it allows us to gain access to our mental states, to monitor and transform them. “Language plays an important role in metacognition, because it is a tool for monitoring” ([38], p. 342). Second, discussions of the behaviour of others may provide information about the situations and behavioural cues by which to judge that others are engaged in cognitive processes. In other words, the terminology used to describe mental states can be used to gain access to these states and monitor them; but also, this very terminology can be a subject of reflection and enable a person to understand and interrelate aspects of mental functioning to one another [31].

As Olson & Torrance [31] note “as children work out distinctions appropriate to language, they are at the same time working out concepts for thinking about the world” (p.157).

Moreover, the use of language concerning mental-state words is necessary and integral to explicit description and modelling for the development of metacognitive skills at schools. This explicit description of principles and strategies,
such as planning, monitoring and correcting the child’s performance, may be especially important for metacognitive development, where the skills to be learned are not directly observable. In fact, instructional programs which include explicit modelling of metacognitive skills and a gradual transfer of responsibility to the students have proven to be very effective at increasing comprehension and learning (cf. [32]). This description and modelling would of course be very hard, if at all possible, without the use of mental-state language.


For example, helping children to express in language what they think and feel it will help also them become more aware of their thoughts and feelings. This is already an implicit form of metacognitive training.

Moreover, the use of imaginative words and children's involvement in construction and discussion of ‘pictures in the head’ may prove to be a good way to promote metacognitive development. Talking explicitly about mental images would be one natural way to exercise the imagination and give early childhood education a more metacognitive flavour.

It seems, therefore, that language plays a crucial mediator role in the development of metacognition in general (and introspection more specifically), and for this purpose the intervention programme of this study is heavily based on metacognitive and mental-state language.

Let us turn now to examine more specifically, which the aims of the present study are:

THE PRESENT STUDY

Aims:
The basic aim of this study was to investigate preschool children’s metacognitive ability of introspection:
First, to test their ability to realize that thinking is a continuous process that occurs all the time.
Second, to investigate their ability to be aware of the content of one’s own and other people’s thought, when given some external cues.
Third, to evaluate whether a specific training in metacognitive language could improve young children’s ability to introspect.

Method
The Population

The study took place at a public nursery school in a village in Cyprus. The population of the village was 5,500 inhabitants, all of whom were Greek Cypriots. This nursery school offered 4 classes, while most public nursery schools in the country offer only one class. This study necessitated two equivalent groups of students, which were conveniently offered in two of the classes of the current nursery school.

Participants

The sample represents two out of the four classes of the above nursery school, with twenty-five children aged 4.5-5.5 years old in each class. (The other two classes consist of children of younger age, and therefore were not included in this study as the comparison of the groups could not be made). In each classroom we had 12 boys and 13 girls. The children had been distributed between classes randomly from the beginning of the year (for the two preschool classrooms of the school), thus ensuring that the groups (classes) were equivalent. Teachers divided the children’s birth certificates into two groups (boys and girls) and all the certificates were listed chronologically depending on the children’s date of birth n. Teachers then took turns in selecting the certificates one by one from the random pile, and thus divided randomly the children in two groups. Both of the teachers were graduates of the Pedagogical Academy and had four years of studies in pedagogical courses altogether.

Moreover, in order to further ensure the two groups’ equivalence a) we examined all children’s socioeconomic status, by gathering information about the parents (fathers) job / education and b) administer all 50 with the “British Ability Scale I” (BAS) number version Short Term Memory: Recall of Digits. What was found was that most of the parents of both groups had only elementary school education and worked in occupations, which were manual, clerical, or in the service sector. As far as the ‘BAS Test’ is concerned, it was found that in both the experimental and control group, most of the children have “2” or “3” as a digit-span in their short-term memory test, giving us a further evidence of the equivalence of the two groups.

Procedure

One of the two classes was designated the Experimental group and the other as the Control group. Both groups had an initial test, the pre-test at the beginning of the academic year in October, and a final test, the post-test at the end of the academic year in May.

The pre- and post- tests each consisted of 2 specific tests, which dealt with children’s ‘introspection ability, an important aspect of young children’s “theory of mind”.'
The children were tested individually in the headmistress’s office and called by alphabetical order of their surnames. The experimental group participated in intervention strategies involving lessons directed at improving introspection ability.

**The Intervention**

The Intervention took place for thirty minutes weekly for six months, between the pre-test (in October) and the post-test (in May). It consisted of half-hour lessons with the Experimental group, once a week, for twenty weeks. This intervention programme aimed at giving children experiences related to language and metacognition, which, in turn, might have led to further development of the linguistic and metacognitive abilities of the children.

The programme which included stories, creative drama, cognitive games, use of internal state language, etc, gave emphasis on children’s expression and analysis of their own and other people’s thoughts and emotions and also tried to help children behave and act in an imaginary situation, based on their ability to distinguish the real from the imaginary world.

For example, during the lessons 1-3 (see Appendix B for the Intervention), where three different stories were narrated and analyzed, the researcher used to ask the children the following questions: What did actor ‘A’ feel in the story? Why? What did actor ‘B’ think? Why? What is s/he going to do next? Why? What does actor ‘C’ believe? Why? All these questions aimed to stimulate children’s metacognitive thinking and metacognitive language.

In lesson 4, there was a discussion about internal-states, and more specifically the children were encouraged to talk about their dreams and distinguish ‘dream’ from ‘reality’. Other lessons that encouraged the discussion of internal-state terms were the lessons 15, 17 and 19. Using pictures or talking about personal experiences, the children had the chance to talk about thoughts and express emotions, using terms like feel, happy, sad, anger, believe, etc. Similarly, in lessons 5 and 8, children talked about thoughts and emotions through the creation of their own stories (based on pictures) and psychological projection (when justifying their opinions). More opportunities for the children to talk and express their feelings and emotions were available during lesson 10, in which they played the game “Can you Guess What I’m Feeling?” In this occasion the children, not only expressed what they or their friends felt, but they also had the opportunity to justify those feelings.

In lessons 6, 9, 11, 13, 14 & 16 the children played creative stories, developing their imagination (when travelling, for example to the rainbow) and distinguish again ‘imagination’ from ‘reality’.

In lessons 7, 12, 18 and 20 the emphasis was given on the use of cognitive verbs, such as think (1 & 2) guess and know.

[In Greek the verb ‘think’ has two meanings:

Think\(^1\) means “this is my opinion”

Think\(^2\) means “something is going on in my mind” or “my mind is working”.

For example, we might say “I think\(^1\) movie ‘a’ is better than movie ‘b’”.

As far as Think\(^2\) is concerned, we might say “I’m thinking\(^2\) of not taking any courses for my studies this semester, in order to have a break”].

In these lessons, children were encouraged to play some games (for example trying to guess what the experimenter was thinking of) using those cognitive verbs and responding to them appropriately. In this way, children were helped, not only to clarify the meaning of those mental verbs, but also to broaden their thinking being in different cognitive situations.

**The two tests**

The two introspective tests are modification of tests developed by Flavell, J.H. [13] and Flavell, J.H. Green, F. & Flavell, E. [15] and they are described in detail in terms of aim, content, and instrument application in Appendix A.

A more brief presentation of their aim and justification, however, appears below:

**TEST 1: A Boy Thinking in Different Situations**

**Aim**

The test aimed to examine whether preschool children have some introspective abilities and whether they can realise that a person’s mind “is working”, that is, a person is thinking\(^*\) during different situations, as well as having a concept of the thought content.

**Justification of the Test:** There is some evidence that adults tend to believe that something thought – like is going on in the mind of a conscious person virtually all the time (Flavell et al, 1993, 1995). The question arises as to whether young children also understand that mental activity goes on virtually all the time in a conscious individual.

In Flavell’s et al. (1995) study, the experimenter told the children “I’ll be showing you some pictures of people and asking you whether there is anything going on in their minds

\(^*\) Note: ‘Think’ here, in Test 1, has the ‘think\(^2\)’ type of the verb, i.e., something goes on in one’s mind” or that “the mind is working”.

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or not. Maybe there will be, and maybe there won’t be” (p.29).

After that, the children were shown each one of the nine drawings at a time, individually. Only the back of each character’s head was shown. Further, the object which the character was supposed to deal with, was not depicted, and another distractor was included in the drawing instead. The authors assumed that children not truly understanding the relation of current input to thought might false alarm to these destructor objects, saying incorrectly that the character was thinking about them. For example, in the “Reading” task, the wording was as follows: “Cynthia is reading a book about insects. Her shoes are under her chair. While Cynthia is reading, do you think anything is going in her mind or not?”

However, this type of presentation was considered to be rather misleading, that’s why it was not repeated in the case of this study, but in the way described in Appendix A.

TEST 2: The children thinking during an Active and a Non-Active Task

Aim

This test also examined young children’s introspection abilities and more specifically their realisation of the function and the content of their own thought both during an active and a non-active task.

Justification of the Test

As in Test 1 the basic question, here, is whether young children understand that mental activity goes on virtually all the time in a conscious individual.

Moreover, this test aims to investigate the assumption made by Flavell et al. (1993, 1995) that preschoolers “are apt to believe that a person who is doing nothing overtly may also be doing nothing covertly” 1995, p.32).

In addition, Test 2 attempts to investigate children’s introspection of their own thoughts, as a supplement to Test 1, which examines children’s awareness of other people being in a process of thinking.

For reliability statistics kappa and Pearson correlation were used. For ratings which were categorical the kappa statistic was used. For ratings along a continuous scale with an approximate normal distribution, the Pearson product-moment correlation was used.

More specifically, for Test 1b, kappa was found to be K=75.6%, while for test 2b, it reached the value of K=100%. In this case, both the researcher and the examiner gave the same grades.

Results

Test 1: A Boy Thinking in Different Situations

The results in terms of relevant answers to the question “What is the boy thinking?” are shown in Table 1a in Appendix C.

The experimental group gave more relevant answers in both pre-test and post-test than the control group, but the experimental group appeared to have improved in the post-test while the control group did not.

Test 2: Children Thinking During an Active and a Non-Active Task

The results in terms of relevant answers to the question “What were you thinking about?” are shown in Table 1b (Appendix C).

While most children in the experimental group gave relevant answers concerning the content of their thought, most of the control group children did not. There seems to be little difference between active and non-active tasks or between pre-test and post-test.

Both tests 1 and 2 are concerned with the child’s ability to think about the content of thought. In order to get a clearer
view of the pattern concerning children’s introspection ability, the results of these tests are combined and the two tests are examined as a whole. In both tests, the aim is to evaluate the child’s levels of awareness concerning thinking (is X thinking?) as well as the content of thinking (what is X thinking?). The answers in both cases can be coded as either relevant (correct) or irrelevant (incorrect).

It was hypothesized that the intervention (which, gave great emphasis on the use of metacognitive language and metacognitive thinking) had some effect on the experimental group, as far as the “what” questions are concerned, in terms of the child’s ability of the children to introspect about the content of his/her thought. The hypothesis implies that the intervention will produce more improvement for the experimental group. This requires the examination of results of the experimental and control groups during the pre-test and post-test. One approach is to compare the sum of all positive changes (i.e., improvements) from pre- to post-test, across all ‘what’ questions administered in tests 1 and 2 between the experimental and control groups, with the use of t-test for independent samples. The experimental group (mean=2.84, sd= 2.78, n=25) apparently showed more improvement that the control group (mean= 1.54, sd= 1.59, n=25). The t-test revealed these differences as statistically significant (t: 2.02, df=47, p<.025, 1-tailed), thus supporting the conclusion that the experimental group had a better overall improvement in all “what” questions of tests 1 and 2 than the control group.

Another approach is to use the sum of the scores for tests 1 and 2. The sum of the answers to “What is X thinking?” question, across tests 1 and 2, has the advantage that it produces a score for each child representing the sum of a range of responses, rather than a specific response, and, therefore, might be regarded as more representative of the child’s overall abilities.

Table 3 (Appendix C) shows the total scores of relevant answers, for tests 1 and 2 during pre- and post-test for both groups (experimental and control).

In this table (3) appears that the experimental group scored higher than the control group during both pre- and the post-test. In addition, this group showed a greater improvement from the pre-test to the post-test than the control group. The question remains whether these differences are statistically significant. In particular, we are concerned if the apparent greater improvement in the experimental group remains significant after allowing for pre-test differences.

The comparison of the experimental and the control groups during pre-test poses a certain difficulty as the total scores for tests 1 and 2, for both experimental and control groups, show a distinct negative skew and do not approximate normal distributions.

One way to overcome this problem is to transform the variable into an approximation for a normal distribution. The transformation arcsine was used to provide approximate normal distributions for these data as recommended by Stevens [40]. This data was then used in a multiple linear regression.

In the regression of post-test scores regressed against pre-test scores and group (experimental or control), the model accounted for 24% of the variance in post-test scores (adjusted $R^2$) and was statistically significant ($F (2,46)= 8.55, p<0.001$). The coefficients of this regression model are shown in table 5c (Appendix C).

The statistical analysis reveals that the post-test scores are significantly predicted by the pre-test scores (beta=0.23; t=1.83, p<.05) and by the group (experimental or control) (beta=0.43; t=3.36, p<.005). This group effect occurs while allowing for the effect of the pre-test scores. This result indicates that the experimental group showed greater improvement than the control group between pre-test and post-test and that this may be due to the experimental intervention administered.

As assumption is therefore made that the intervention had some effect on the Experimental group, at least as far as the ‘what’ questions are concerned, that is, the ability of the children to introspect about the content of thought.

To get a clearer view of the pattern observed concerning children’s introspection ability, the results of tests 1 and 2 are combined and the two tests are considered together.

In both tests the aim is to evaluate children’s awareness of the fact of thinking (is X thinking?) and the content of thinking (what is X thinking?). The answers in both cases can be coded as either relevant (correct) or irrelevant (incorrect).

The sum of the answers across tests 1 and 2, has the advantage that it produces a score for each child that represents the sum of a range of responses, rather than a specific response, and hence might be regarded as more representative of the child’s overall abilities.

So, in table 3, the total scores of relevant answers for tests 1 and 2 are shown for a) the pre- and b) the post-test for both groups (experimental and control).

The comparison of the experimental and the control group at the pre-test has a difficulty, for the reason that the total scores for tests 1 and 2 for the two tests are not normally distributed, and, therefore, the use of parametric statistics would not be appropriate, and the non-parametric Mann-Whitney U test is used instead.

However, the Mann-Whitney U test, yielded no significant difference when used to compare the total scores of the
experimental and control group at pre-test. Hence the differences in means was not sufficient to abandon the hypothesis that the children are delivered from the same population at pre-test.

As the two groups do not appear to differ in a statistically significant degree, the total scores at post-test can be compared as a way of testing hypothesis 4, i.e., that the intervention has an effect.

In table 4, the experimental and the control group are compared at post-test with the use of Mann-Whitney U Test.

Since the differences between the groups were not statistically significant at the pre-test, this result indicates that the intervention has produced an improvement in the experimental group over and above the effect of maturation.

However, the conclusion just mentioned, i.e., that the intervention has a positive effect on the performance of the experimental group, is based on the results of a non-parametric test (Mann Whitney U test) which compares the results at pre-test and post-test separately. This happens because there is not yet a non-parametric test available, which will simultaneously test for differences between pre-test and post-test and allow for the pre-test differences in making the post-test comparison.

So, although the pre-test difference between the experimental group and the control group is not statistically significant, there is still a difference in their means which may influence the post-test difference; that is, the post-test difference may not be entirely due to the intervention.

There is a parametric method of statistical analysis, which can largely overcome this problem. This is the ‘Multiple Linear Regression’ (see Table 5). However, regression should only be used with data where the dependent variable and continuous independent variable meet the requirements for parametric tests. The total scores on tests 1 and 2 for experimental and control groups at pre-test and at post-test, all show a distinct negative skew and do not approximate normal distributions. Therefore they transgress a fundamental requirement for parametric tests. One way to overcome this problem would be to transform the variable into a form, which does approximate a normal distribution. For this purpose, one of Stevens’ (1992) several methods is adopted. The total score for the think and what questions in tests 1 and 2 are transformed by the function arcsin√(variable/100). This produces distributions that approximate normal distributions and therefore parametric statistics can be used.

The regression is shown as two steps. In the first step the post-test sum (posttest1+2) is regressed against the pre-test sum (pre-test1+2). In the second step the post-test sum is regressed against the pre-test sum and the group (experimental versus control). In this way the effect of the group (experimental vs. control) can be seen have accounted for the pre-test scores. The increase in the variance accounted for from step 1 to step 2 is a measure of the effect of the group variable having allowed for pre-test scores. The large increase in the variance explained by adding the group variable to the regression model and the statistically significant effect of the group variable is strong evidence that the group variable is producing a significant effect upon post-test scores after allowing for the pre-test scores. The experimental group shows larger post-test scores than the control group and hence this is evidence for the significant improvement in scores as a result of the experimental treatment.

DISCUSSION AND CONCLUSIONS

The results of this study indicate that the majority of five-year-old children are aware of the fact that people (including themselves) are thinking continuously, and also give more relevant than irrelevant answers concerning the content of thought. Commenting on three- and four-year-old children’s introspective abilities Flavell et al. [15] stated that “preschoolers tend to be very poor at recalling or reconstructing both the fact and the content of their own thinking, even in situations designed to facilitate introspection” This discrepancy may reflect the age difference of the children of the two studies. Nevertheless, not all researchers agree with Flavell’s et al. [15] underestimation of preschoolers’ introspection abilities. A study by Estes, Wellman & Wolley [10] suggests that three-and four-yr-olds can provide reports on their own thought processes and Gopnik and Slaughter [17] agree that pre-school children (three and four-yr-olds) appear to be able to introspect. These findings seem more consistent with the present study where children’s introspective abilities were not as poor as Flavell et al. suggested in their previous studies, and this finding might be the main contribution of this study in the literature of children’s thinking.

Results also indicate that a an intervention involving metacognitive language and other metacognitive experiences (e.g. role playing) can enhance young children’s metacognitive abilities, especially their degree of introspection. The present study has shown that the intervention had an effect on children’s introspective ability by making successful inferences about the content of their own and other peoples’ thought. This superiority of the experimental group vs. the control group is attributed to the experimental intervention, since the two groups were selected randomly from the same population and, controlling for pre-test scores, had no effect on the superior performance of the intervention group in the post-test.
However, the question that arises has to do with what has caused this apparent enhancement in young children’s introspective ability? Though it is difficult to identify exactly which part of the experimental intervention has contributed to the improvement of children’s introspective ability, it is likely that the continuous reference about people’s thoughts and feelings made during the administering of the experimental intervention, and the inferences children often made about one’s content of thought, led to this result. In addition, the use of internal-state words, which children used at every lesson during the 20-week intervention, was a contributing factor. The frequent use of internal-state words draws attention to aspects of daily experience and broadens children’s understanding of how the mind works, thus enabling them to make more successful inferences about its content. Especially the use of cognitive or mental-state words [such as know, think (2 words in Greek), guess, remember, forget and so on], also known as metacognitive language, deepens children’s metacognitive understanding and positively influences their introspection ability. This finding is consistent with Vygotsky’s theory about the critical role language plays in modelling and monitoring cognitive abilities. The educational implication is that the frequent reference by both teacher and students, of both the fact and content of thought, as well as of the metacognitive language employed, tends to improve children’s introspective abilities and promotes their metacognition.

The present study has attempted to design the tests by using contexts and materials that were familiar to young children thus producing as much of a natural nursery-school setting as possible. Such tasks included puppet-show dialogues, story-telling, creative drama, use of illustrations like the ones used in nursery schools, games with toys, etc. Moreover, the fact that the researcher has been a nursery-school teacher facilitated our efforts to use tasks and methods familiar to young children. In addition, the researcher devoted some time before the research started, to get to know the children, so that her presence would not pose any difficulties. All these factors facilitated the research process and led to the creation of a natural-like setting, which enabled the children to behave and feel at ease. On the other hand, in our effort to enhance children’s metacognitive and linguistic abilities to a greater extent, the administered tasks were made to differ from the everyday activities of a typical nursery class. For this purpose, the material selected, (i.e., story content, pictures and tasks) was such as to stimulate children’s metacognitive language and metacognitive thinking. To avoid possible overlapping with activities in the control group, the researcher came to an agreement with the teacher of this group not to use the same kind of materials with the experimental group. There are, however, some methodological shortcomings of the study. For example, the small sample size limits the power of the study. Additionally, though the experimenter did spend some time discussing and interacting with the control group, this interaction was not to the same extent as that of the experimental group. In future research, it might be preferable for the experimenter to spend equal time with all groups, not only through discussions, but also by playing some neutral games that would result in equivalent relationships with all participants.

In conclusion, attention can be drawn to the fact that the experimental group was found to be superior to the control group in questions concerning the fact and content of thinking and this was partly due to the experimental intervention administered. Though, we can not clarify, which part of the intervention was responsible for these improvements, it is likely that the component of metacognitive and internal-state language, the frequent use of internal-state words through discussions and relevant activities can not only enhance children’s metacognitive language, but also broaden and deepen their thinking with a more metacognitive flavour.

**FINAL CONCLUSION**

*In sum, it seems that children’s introspective abilities were not found as poor as Flavell et al. [13], [15] suggested in their previous studies, and this finding might be the main contribution of this study in the literature of children’s thinking.*

**REFERENCES**

Olson, D. (Eds.), Developing Theories of Mind. Cambridge: Cambridge University Press.


Appendix A: The Two Tests

A. Test 1: A Boy Thinking in Different Situations

a) Aim
The test aimed at examining whether pre-school children have some introspective abilities and whether they can realize that a person’s mind “is working”, that is, a person is thinking during different situations, as well as having a concept of the thought content.

b) Content and Instruments
The test involved showing seven pictures of a boy in seven different situations: reading, listening to music, standing, playing with a ball, sitting, watching T.V. and sleeping.

While a picture was shown to a child, the experimenter gave a short commentary concerning the picture. The seven pictures and commentaries were arranged as a story. After each picture and commentary (e.g., reading, playing, etc.) the child was asked two questions:

a. Is the boy thinking in this case?
And if the answer was “yes” the researcher went on asking:
What is he thinking about?
In the pre-test, the seven pictures were presented as a story, as follows:

One day, Peter, the boy of our story, came back from school, chose a book with stories and started reading one of them.

Picture 1: Now that Peter is reading the book, is he thinking? (and if the answer was “yes”) What is he thinking about? Then, after finishing his story, Peter sat down and listened to some music.

Picture 2: Now that Peter is listening to music, is he thinking? (and if the answer was “yes”) What is he thinking about? After listening to the music, Peter stood by a wall and rested upon it.

Picture 3: Now that Peter is standing, is he thinking? (and if the answer was “yes”) What is he thinking about? Soon afterwards, he decided to play with his ball.

Picture 4: Now that Peter is playing with his ball, is he thinking? (and if the answer was “yes”) What is he thinking about? After playing enough with his ball, Peter felt tired and sat on the stairs to rest.

Picture 5: Now that Peter is sitting, is he thinking? (and if the answer was “yes”) What is he thinking about? Later, Peter went into the house, switched on the T.V. and watched a children’s programme.

Picture 6: Now that Peter is watching T.V., is he thinking? (and if the answer was “yes”) What is he thinking about? Finally, Peter felt sleepy and went to bed, lay down and fell asleep.

Picture 7: Now that Peter is sleeping, is he thinking? (and if the answer was “yes”) What is he thinking about?

In the post-test, the pictures of the boy in different situations were used again in the same order and the same questions were asked. However, the story was slightly altered to maintain the interest of the children, such as:

“Once upon a time there was a boy called George who had his birthday party. Many of his friends visited him, brought him nice presents such as clothes, toys, books, etc., played with him, ate some cakes and had fun. When the children left, George, took a story book that a friend of his had brought him and started reading it.

Picture 1: Now that George is reading his book is he thinking? (and if “yes”) What is he thinking about? Then George took another present his friends brought him, a tape with nursery rhymes, put it in the tape-recorder and listened to some songs.

Picture 2: Now that George is listening to the music, is he thinking? (and if “yes”) What is he thinking about? After listening to music, George stood and lay against a wall.

Picture 3: Now that George is standing is he thinking? (and if “yes”) What is he thinking about? A few minutes later, George remembered another birthday present a colorful ball, and decided to play with it.

Picture 4: Now that George is playing with his ball, is he thinking? (and if “yes”) What is he thinking about? He then got tired, and decided to sit somewhere and rest.

Picture 5: Now that George is sitting on
the stairs, is he thinking? (and if “yes”) What is he thinking about? It was getting dark, however, and George decided to go home and watch a children’s programme on T.V.

Picture 6: Now that George is watching T.V. is he thinking? (and if “yes”) What is he thinking about? Soon afterwards, George felt sleepy and, as he was tired after his birthday party, he went to bed.

Picture 7: Now that George is sleeping, is he thinking? (and if “yes”) What is he thinking about?

The above stories examined children’s thinking on the function and content of another person’s thinking.

c) Answer - Coding

For statistical analysis the answer “yes” to the question “Is he thinking?” was coded as 1. (aware) while the answer “no”, was coded as 2. (not aware).

To the question “What is he thinking about?” answers were coded into five categories:

1. No question (Since the answer to the previous question was “no”).
2. Silence.
3. I do not know.
4. Something irrelevant to the story, e.g. “His cousin”.
5. Something relevant to the story, e.g. “His birthday”.

Test 2: Children Thinking During an Active and a Non-Active Task

d) Aim

This test examined young children’s introspection abilities in terms of their thinking about the function and content of their own thought both during an active and a non-active task.

e) Content and Instruments

In both the pre and post-test children were asked to get engaged in an active task (pre-test: make a puzzle; post-test: draw in an “Etch A Sketch”) and a non-active task (pre-test: look at a picture; post-test: look at a poster).

While working with the active task, they were asked to sit on chair “1”, and, when given the non-active task, they were asked to sit on chair “2”. After dealing with both tasks for 2-3 minutes, each child was asked the following questions:

A1: Were you thinking of anything while you were sitting on chair “1”? (And if the answer was “yes”), A2: What were you thinking about?

B1: Were you thinking of anything while you were sitting on chair “2”? (And if the answer was “yes”) B2: What were you thinking about?

The questions aimed at establishing not only whether the children realized that they think during both active and non-active tasks, but also, whether they can recall any thoughts they made during those tasks, relevant or irrelevant to the situation.

f) Answer - Coding

For statistical analysis purposes, the answer “yes” to the question “Were you thinking anything while you were sitting on chair1/2?” was coded as 1 (aware), while the answer “no” (not aware) was coded as 2.

To the question “What were you thinking about?” there were again, as in test 1., five codes for the answers:

1. No question (Since the answer to the previous question was “no”).
2. Silence.
3. I do not know.
4. Something irrelevant to the story, e.g. “His cousin”.
5. Something relevant to the story, e.g. “His birthday”.

Appendix B. The Intervention

The programme which included stories, creative drama, cognitive games, use of internal state language, etc, gave emphasis on children’s expression and analysis of their own and other people’s thoughts and emotions and also tried to help children behave and act in an imaginary situation, based on their ability to distinguish the real from the imaginary world.

In short, the topics of the twenty lessons can be summarized by the following titles:

Lesson 1: Analysis of a story: “Alice and the Brave Dog”.
Lesson 2: Analysis of a story: “The Naughty Little Duck”.
Lesson 3: Analysis of story: “The Stork’s Trip”.
Lesson 4: Discussion about internal-states: “Talking About our Dreams…”
Lesson 5: Creation of a story based on pictures: “Black Kitten Gets Lost”.
Lesson 6: Creative Drama: “The Convention of Mice”.
Lesson 7: Cognitive Game: “I’m Thinking of Something That (i.e.) has four Legs. Can you Find it?”. Lessons 8: Creation of a story based on pictures: “Dad Forgets his Dinner”.
Lesson 9: Creative Drama: “A Trip to the Rainbow”.
Lesson 10: Expression of Emotions: “Can you Guess What I’m Feeling?”
Lesson 11: Creative Drama: “The Chocolate Island”.
Lesson 13: An Imaginary Game: “Travelling with our imagination”.
Lesson 14: Creative Drama: “Little Red Riding Hood’s Friends are in Danger”.
Lesson 15: Talking about Internal-States: “Experience and
Feelings from a Trip”.
Lesson 16: Creative Drama: “The Adventures of a Turtle” (Environmental Education).
Lesson 17: Talking About Internal States by Using Pictures-A
Lesson 18: Games With the Cognitive Verb “Know”.
Lesson 19: Talking About Internal States by Using Pictures-B
Lesson 20: Games with the Cognitive Verb “Think”(1&2).
**APPENDIX C - TABLES**

**Table 1a:** A Boy Thinking in Different Situations  
“What is the boy thinking”? (Relevant Answers)

<table>
<thead>
<tr>
<th>Variables</th>
<th>K-S</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>what thinking while playing</td>
<td>1.604</td>
<td>1.604</td>
<td>.012</td>
</tr>
<tr>
<td>what thinking while watching</td>
<td>1.604</td>
<td>1.604</td>
<td>.012</td>
</tr>
</tbody>
</table>

**Table 1b:** Themselves Thinking During an Active and a Non-Active Task  
“What were you thinking about”? (Relevant Answers)

<table>
<thead>
<tr>
<th>Variables</th>
<th>K-S</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>what thinking during active</td>
<td>1.639</td>
<td>1.639</td>
<td>.009</td>
</tr>
<tr>
<td>what thinking during not active</td>
<td>1.639</td>
<td>1.639</td>
<td>.009</td>
</tr>
</tbody>
</table>

**Table 2:** Comparison of all the improvements across all ‘what’ questions (SWHAT) between Experimental and Control group with t-test for independent samples

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental (SWHAT)</td>
<td>25</td>
<td>2.8400</td>
<td>2.779</td>
<td>.556</td>
</tr>
<tr>
<td>Control (SWHAT)</td>
<td>24</td>
<td>1.5417</td>
<td>1.587</td>
<td>.324</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t value</th>
<th>df</th>
<th>(1-tailed) p</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.02</td>
<td>47</td>
<td>.025</td>
</tr>
</tbody>
</table>

**Table 3:** Relevant answers for tests 1 and 2  
for the experimental and control group

<table>
<thead>
<tr>
<th>Test</th>
<th>A. Experimental</th>
<th>Control</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Test</td>
<td>Mean</td>
<td>Sd</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>11.40</td>
<td>5.65</td>
<td>9.13</td>
</tr>
<tr>
<td>Post-Test</td>
<td>14.0</td>
<td>3.97</td>
<td>9.33</td>
</tr>
</tbody>
</table>
Table 4: Comparison of the total scores of tests 1 and 2 at the post-test for the experimental and control group with the Mann-Whitney U test (TSEC)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
<th>Mann-Whitney U</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>25</td>
<td>31.80</td>
<td>795.00</td>
<td>130.000</td>
<td>-3.414</td>
<td>.001</td>
</tr>
<tr>
<td>Control</td>
<td>24</td>
<td>17.92</td>
<td>430.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TSEC: Total Scores for tests 1 and 2 at the post-test for Experimental & Control Group.

Table 5: Multiple Linear Regression of the dependent variable sum of tests 1 and 2 at the post-test (POST-TEST) as a function the independent variables:

a) sum of tests 1 and 2 at pre-test (PRE-TEST) and
b) group (experimental or control).

Table 5a: Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.521</td>
<td>.271</td>
<td>.239</td>
<td>7.457E-02</td>
</tr>
</tbody>
</table>

Table 5 indicates that the independent variables account for 27% of the variance of the dependent variable. The level of significance for this relation is shown at Table 5b.

Table 5b: ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 REGRESSION</td>
<td>9.509E-02</td>
<td>2</td>
<td>4.754E-02</td>
<td>8.550</td>
<td>.001a</td>
</tr>
<tr>
<td>Residual</td>
<td>.256</td>
<td>46</td>
<td>5.561E-03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>.351</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), group (PRE - TEST)
b. Dependent Variable: POST - TEST

The last column of Table 5b. indicates that the independent variables predict a significant amount of the variance of the dependent variable (p<.001).

Table 5c. shows the significance of each one of the two dependent variables (i.e. PRE - TEST and group) separately.
### Table 5.c: Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardised Coefficients</th>
<th>Standardised Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>.254</td>
<td>.029</td>
<td>8.646</td>
<td>.000</td>
</tr>
<tr>
<td>S1 @ 2 PRE</td>
<td>.161</td>
<td>.088</td>
<td>.233</td>
<td>1.826</td>
</tr>
<tr>
<td>group</td>
<td>7.253E-02</td>
<td>.022</td>
<td>.428</td>
<td>3.356</td>
</tr>
</tbody>
</table>

PRE - TEST = Sum of relevant answers to *think* and *what* questions in tests 1 and 2 at the pre-test.
POST – TEST = Sum of relevant answers to *think* and *what* questions in tests 1 and 2 at the post-test.
group = Experimental or Control group.