Research on Humanities and Social Sciences
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.6, No.4, 2016

Relationship among Processes of Coding and Planning in Skilled and Unskilled Readers

Dr. Shamita Mahapatra
Reader, Department of Psychology, Ravenshaw University, Cuttack, Odisha, India

Abstract
Fifty skilled readers and fifty unskilled readers matched for intelligence, age, grade and sex were compared for their cognitive competence with respect to the processes of simultaneous and successive coding as well as planning. The results indicated that skilled readers compared to unskilled readers were more proficient in both the processes of coding and the process of planning. Moreover, greater differentiation of the two coding processes form each other and the process of planning from those of coding was noticed at higher level of reading competence. The results are discussed in terms of developmental delays of cognitive functioning in unskilled readers and suggestions are made for amelioration of reading difficulties through enhancement of proficiency in various cognitive processes in these children.
Keywords: Skilled Readers, Unskilled Readers, Cognitive processes, Reading Remediation.

1. Introduction

Reading, as a highly complex activity is dependent on several component processes each of which on its own and in combination with others helps the reader in transform visual graphic information into meaningful units of thought. Children learn to read at an appropriate age. However, all children do not show equal proficiency in the skill, even when all of them behave in an otherwise normal manner with average or above average intelligence. In fact, psychologists argue that intelligence has to do with how individuals process information, not so much with what information they have. This argument has made way for the emergence of the PASS theory of intelligence which explains all intellectual functioning in man including reading in terms of four different but interrelated cognitive processes, namely, planning, attention, simultaneous and successive (PASS) processes. Of these, attention is a basic cognitive process that helps in focusing on relevant information to the exclusion of irrelevant ones. These information are then coded either simultaneously or successively. Planning, on the other hand, helps to organize and use the information as per the demands of the situation so as to reach the goal. The present study, however, focuses only on the processes of coding and planning and their contribution to the reading achievement of children.

Simultaneous and successive coding, the two modes of information integration, and planning, a higher order cognitive function was originally suggested by Luria (1966a, 1966b,1973) on the basis of his observations of different types of cortical lesions and their behavrioral correlates. Simultaneous processing involves the organization of information into a quasispatial scheme, where each unit of information is accessible in relation to other units. This mode of information processing is evidenced in relational thinking, solving arithmetic problems and in understanding logico grammatical, spatial prepositional and comparative constructions (e.g.,'fathers brother' from brother's father', above, below, inside and taller than). Successive processing, on the other hand organizes information into a sequential, temporarily based scheme, where a unit of information is accessible in a linear manner and can be surveyed only in relation to its serial position within the sequence. Successive processing, thus, plays an important role in rote memory, narrative speech, spelling, and perception of syntax. According to Luria simultaneous processing is linked to the occipito-parietal areas of the cortex, whereas, successive processing is linked to the fronto-temporal areas.

The two modes of coding form the basis for the operation of planning, the higher order cognitive process, which in turn also determines the nature of coding Planning underlines such activities as the generation, selection, and execution of plans or strategies, evaluation of one's own behaviour and that of others and the response tendency to act on the basis of such knowledge. Searching and discriminative behaviour captures the planning process at its most fundamental level (Miller, Galanter & Pribram, 1960). Planning is a synthesizer of all intellectual functions and hence, the essence of human intelligence (Das, 1984). Luria has identified the frontal lobe, especially the pre-frontal area, to be the cortical structure responsible for carrying out the planning functions.

From a neuropsychological view point, coding and planning processes aid one another during the early years of life. However, with increasing age and exposure to formal educational experiences, planning tends to emerge as an independent process, differentiating itself form coding, just as does one coding process from the other (Ashman, 1978, Dash & Mahapatra, 1989).

Simultaneous and successive processing as well as planning have been found to have important contribution towards the reading achievement of (Cummins & Das, 1978; Das & Cummins, 1982; Das, Nglieri, Kirby, 1994; Das, Parrila, Papadopoulos, 2000; Dash, 1986; Dash & Dash, 1999; Kirby & Das 1977; Kirby et

al., 1996; Mahapatra, 1990, 2015a,2015b; Mahapatra, Dash, 1999). The results revealed that a cyclical hierarchy of involvement of both simultaneous and successive processes is seen in the entire process of reading. Successive coding involves sequential processing of linguistic input which serves as a prerequisites for deeper level of semantic analysis of the same that involves simultaneous processing. Mastery over the two skills ultimately makes way for emergence of appropriate reading strategies in which planning plays a crucial role. Clearly, deficiencies in processing abilities are associated with reading problems and efficient processing of graphic, phonological, semantic and syntactic information in written languages require certain amount of planning on the part of the reader. However, as far as our knowledge goes, there is no such study that reveals the pattern of relationship among simultaneous, successive, and planning processes in skilled and unskilled readers which would help understand the nature of cognitive functioning of these children.

The present study, therefore, intended to examine the cognitive competence of skilled and unskilled readers, by analyzing the pattern of relationship among simultaneous, successive and planning processes. It was expected that the relationship among simultaneous, successive and planning processes would be higher for unskilled readers and they would be found less competent in these processes in comparison to skilled readers.

2. Method

2.1 *Sample*

A group of 100 Grade 5 children from both the sex groups were selected from a population of 340 children of the same grade, covering two primary and two high schools in the city of Cuttack. Odisha, on the basis of their intelligence and reading Competence as measured by Raven's Coloured Progressive Matrices and Graded Reading Comprehension Test respectively. The children were found to differ from one another with respect to their reading competence, even when all were equipped with normal intelligence, having no neurological, psychiatric or other serious medical problems. Categorizing the children on the basis of their reading competence two distinct groups were obtained: the skilled reader and the unskilled readers, with 50 children in each group. The mean grade level attained in terms of reading competence was 5.9 for skilled readers and 2.9 for unskilled readers. Thus, the skilled readers were about 1 grade above their actual grade whereas, the unskilled readers were about 2 grades below their actual grade in respect their reading competence. The children were from both the sex groups, with a mean ago of 10 years in each group. Moreover, children of both the groups were from same socio-economic status (ranging from medium to high).

2.2 *Tests*

Apart from Raven's Coloured Progressive Matrices and Graded Reading Comprehension Test, which were used to identify skilled and unskilled readers, each subject received six tests designed to tap the processes of simultaneous coding, successive coding and planning. Thus, Figure Memory and Tokens Test were used for measuring simultaneous process, and Digit span and serial Recall were used for measuring successive process. Tests of planning, on the other hand, included Matching Numbers and Planned Composition.

The tests, their administration and scoring procedure are described below.

Raven's Coloured Progressive Matrices (RCPM).

This is a widely used culturally reduced test of intelligence for children aged 5 to 11 years. Consisting of 36 matrices or designs, each having a part which has been removed, the task is to choose the missing part from six possible alternatives. The 36 matrices are grouped into three series; each series comprised of 12 matrices of increasing difficulty. Score on the test corresponds to the total number of correct responses. Hence the maximum possible score on the test is 36.

Graded Reading Comprehension Test. Developed by Mohanty and Sahoo (1985), this test is used for children of grades 1 through 7. The subject is asked to read some stories/paragraphs written in Odia, on each of which some questions are asked. A credit of 1 point is given for each correct answer, with a maximum of 86 points. Testing is discontinued, when the subject fails to answer all the questions of a given story/paragraph.

Figure Memory. This is a marker test of simultaneous processing. The test involves 23 items (3 sample and 20 test items) consisting of simple geometric patterns. The subject is to remember each pattern within a period of 5 seconds and subsequently locate and outline the same as embedded within a more complex pattern. A credit of 1 point is given for each perfect outline, with a maximum of 20 points. Testing is discontinued, when the subject makes four con-secutive errors.

Tokens Test. This too is a marker test of simultaneous processing. Using the concept of shape and colour in various combinations, the subject is required to solve certain problems. Time taken to solve each problem is recorded and a credit of 1 point is given for each correct response, the maximum points being 26. Testing is discontinued with four consecutive errors.

Digit Span. This is a successive marker test and is abstracted directly from the WISC. Digits of increasing length are read out to the subject and the subject is required to recall them in correct serial order. The subject's score is the number of digits in the series of maximum length recalled correctly.

Serial Recall. This too is a marker test of successive processing. The test consists of 12 lists of words, four from each of four-word, five-word and six-word series. After one presentation of each series, the subject is asked to recall it in correct serial order. Score on the test corresponds to the number of words recalled in correct serial position. The maximum possible score on this test is 60.

Matching Numbers. This is a marker test of planning. The test is organized into 3 parts, each consisting of eight rows of numbers. The numbers vary in length across the parts, but each row in each part consists of six numbers, two of which are identical. The subject's task is to find and underline the pair in each row in each part, within a time limit of 2 minutes per part. Score on the test corresponds to the number of pairs identified correctly, the maximum being 24.

Planned Composition. This marker test of planning, requires the subject to write a story after seeing a picture card The picture card used is card No.2 of the Thematic Apperception Test (TAT). The story written by the subject is rated by the Experimenter for organization, expression, and individuality. The Experimenter gives a score between 1 to 7 to indicate his/her evaluation of the story, ranging from poor to good in each of the three criteria. The maximum possible score for this test is 21.

2.3 Procedure

Test administration was carried out following establishment of adequate rapport with the subjects and exposure to a few practice items. All subjects were tested individually in Odia, the native language of the subjects and also the medium of instruction at the schools from where the subjects were selected. The subjects were tested in their respective schools in a separate room provided by the Head Masters of the schools. The tests were administered following the rules given in the test manuals and each subject was tested in two sessions which were one day apart. However, order of the tests was balanced within sessions. The testing for each subject was approximately two hours and the entire testing period ranged over 7 months.

3. Results

Keeping in view the objective, the data of the present study were analyses by means of *t* test and correlational analysis.

The skilled and unskilled readers were selected on the basis of their general intelligence and proficiency in reading. The two group were found to be equipped with average intelligence, whereas, skilled readers were found to be about 1 grade above and unskilled readers, about 2 grades below their actual grade. The coding and planning test were then administered to the two groups. Table 1 presents the means, standard deviations and *t* values reflecting the group differences in respect of these tests.

TABLE 1 Means, Standard Deviations and t Values Reflecting Group Differences on Tests of Simultaneous, Successive and Planning Processes (N=50 in each group)

Test			Group		
			Unskilled Readers	Skilled Readers	*t*
Simultaneous					
	Figure Memory	Mean	9.22	9.92	1.86
		SD	2.00	1.75	
	Tokens Test	Mean	5.14	8.70	4.98**
		SD	3.49	3.65	
Successive					
	Digit Span	Mean	5.30	5.74	2.29*
		SD	1.00	0.91	
	Serial Recall	Mean	35.90	45.18	4.89**
		SD	11.25	7.31	
Planning					
	Matching Numbers	Mean	20.22	21.74	2.71**
		SD	3.27	2.25	
	Planned Composition	Mean	7.26	12.26	7.43**
		SD	2.92	3.76	

*p< .05, **p< .01

It may be seen from Table 1 that mean performance of unskilled readers was lower than that of skilled readers on all the cognitive tests and t values were significant for five of these tests. This suggests that both

simultaneous and successive processing as well as planning have important contribution towards the development of reading skill. The only test on which the two groups did not differ significantly from each other was Figure Memory, a test of simultaneous processing, but this may be explained in terms of difficulty level of the test and the type of the task involved, which was probably least affected by the factor of individual difference in the present study.

The results of correlational analysis are presented in Table 2 and 3, for ascertaining the relationship among simultaneous, successive and planning processes in children at varying levels of reading competence. Table 2 reports intercorrelations among cognitive tests for unskilled readers, whereas, those for skilled readers are reported in Table 3.

Table 2 Intercorrelations Among Cognitive Tests for Unskilled Readers (N = 50)

Test		FM	TT	DS	SR	MN	PC
Figure Memory	(FM)	-	.20	.17	.28*	.03	.34*
Tokens Test	(TT)		-	.24	.28*	.29*	.28*
Digit Span	(DS)			-	.69**	.11	.35*
Serial Recall	(SR)				-	.17	.26
Matching Numbers	(MN)					-	.04
Planned Composition	(PC)						-

*p< .05, **p< .01

Table 3 Intercorrelations Among Cognitive Tests for Skilled Readers (N=50)

Test		FM	TT	DS	SR	MN	PC
Figure Memory	(FM)	-	-.17	.01	-.27	.26	.19
Tokens Test	(TT)		-	.02	.24	.25	.27
Digit Span	(DS)			-	.56**	-.16	.14
Serial Recall	(SR)				-	-.18	.27
Matching Numbers	(MN)					-	.10
Planned Composition	(PC)						-

**p< .01

It can be seen from Table 2 and 3, that neither the correlation between the two simultaneous processing tests, nor that between the two planning tests was significant either for unskilled readers or for skilled readers. This seems to be due to the varying nature of the tests themselves, which mersured different aspects of the same processes studied. On the other hand, the two successive tests, which were basically similar in nature, correlated significantly with each other in both the reading groups.

For unskilled readers out of the four correlations, that the two simultaneous tests had with the two successive tests, two were found to be significant. Thus, both Figure Memory and Tokens Test correlated significantly with serial Recall. For skilled readers, on the other hand, none of these correlations was found to be significant, Moreover, for skilled readers the intercorrelations obtained between simultaneous and successive tests were consistently low in comparison to those obtained for unskilled readers.

So far as the relationship between coding and planning was concerned, four out of eight correlations were found to be significant for unskilled readers. Thus, Figure Memory, a test of simultaneous processing, correlated significantly with planned composition. A test of planning. Whereas, Tokens Test, the other simultaneous test, correlated significantly with both the tests of planning i.e., Matching Numbers as well as Planned Composition. On the other hand, only one of the tests of successive processing, i.e. Digit Span, correlated significantly exclusively with planned composition, the test of planning. For skilled readers, again, none of the correlations between coding and planning was found to be significant. Results of correlational analysis thus suggest greater differentiation of the two coding processes and the process of planning from those of coding at higher level of reading competence.

4. Discussion & Conclusion

The study was carried out with a purpose to assess the cognitive competence of skilled and unskilled readers by analyzing the pattern of relationship among simultaneous, successive and planning processes.

Skilled readers compared to unskilled readers showed greater proficiency in both simultaneous and successive coding as well as planning. With respect to coding and planning functions and reading proficiency, the results are in agreement with those of earlier studies (Cummins & Das, 1978; Das & Cummins, 1982; Das, Naglieri, Kirby, 1994; Das, Parrila, Papadopoulos, 2000; Dash, 1986; Dash & Dash, 1999; Kirby & Das, 1977; Kirby et al., 1996; Mahapatra 1990, 2015a, 2015b; Mahapatra & Dash, 1999).

Simultaneous and successive processes are differentially important for different aspects of reading skill. Because of sequential nature of language and speech, successive process is clearly important. In the reading

process, it helps in the mastery of initial decoding skills. However, higher levels of fluent reading, which require conceptual – linguistic operations, depend more on simultaneous processing. Hence, high levels of both simultaneous and successive processing are necessary for high reading achievement. In fact, successive processing of linguistic input itself may serve as a prerequisite for deeper levels of semantic analysis of the same, involving simultaneous processing. Therefore, among children who experience reading difficulties, initial deficits in successive processing will delay the differentiation of conceptual-linguistic operations from more elementary forms of sequential linguistic processing. Among normal readers, on the other hand, the conceptual-linguistic operations, which depends on simultaneous processing and is necessary for fluent reading, will become independent of successive processing in due course of time. Obviously then, a strong association between the two coding processes will be obtained for unskilled readers, whereas, for skilled readers, the two processers will be found to be independent, as is evident in the present study.

The ultimate level of reading achievement, however, is determined by planning, which involves the ability to use the coded information with the purpose of achieving an objective. In fact, planning and coding are intimately connected with each other because coded information provides content for planning to act on, and conversely all coding involves certain amount of planning. Nevertheless, independence of planning process is inferred from the fact that it accounts for additional variance, over and above that which can be explained by the coding tasks. What is more, functionally organized independent parts of the cortex have been identified for planning and coding. But planning can emerge as an essential and distinct ingredient of intellectual function, only after some mastery over coding has been developed Hence, prior to that coding and planning will not be found to be independent. In fact, in the present study, initial deficit in coding processes itself might have restrained the development of planning process in unskilled readers for which close relationship among the processes was obtained for them.

The findings thus substantiated the hypothesis in that, the relationship among simultaneous, successive and planning processes was higher for unskilled readers and they were less proficient in these processes compared to the skilled readers. It may be concluded then, that poor reading ability was the consequence of developmental delays of cognitive functioning in unskilled readers.

In the school system, rote repetition which is emphasized in earlier grades is gradually replaced by the ability for logical analysis, reasoning, conceptualization and organization. The former of course involves successive processing, but the latter ones involve simultaneous processing and planning. Each cognitive process, therefore, should get differentiated from the other and develop to an extent, so that it can be used effectively as per the demands of the situation. But as deficit in one process may lead to deficits in other processes, the existing gap between the skilled and unskilled readers, may become wider and wider with increasing grade level and complexity of cognitive skills involved in the process of reading. Hence, remedial procedures, which have been tried successfully for improving the performance of children with reading difficulties (Das, 1985; Krywaniuk & Das, 1976; Das, Mishra, & Pool, 1995; Mahapatra et al.,2010) may be followed from the very beginning following an assessment of child's competence in various cognitive processes. Particular emphasis may be given on enhancement of proficiency in each of those processes, in which there is deficit, but which is essential for the child to operate at his or her own grade level, as far as reading is concerned.

One may not expect too much of a remediation programme, but nothing less will be adequate, if one seeks to change the poor reader's habits of thought and action.

References

Ashman, A. (1978). The relationship between Planning and simultaneous and successive synthesis. Ph: D. thesis, University of Alberta, Edmonton, Canada.

Cummins, J.P., & Das, J.P. (1978). Simultaneous and successive synthesis and linguistic processes. International Journal of Psychology, 13, 129-138.

Das, J.P. (1984). Aspects of planning: In J. Kirby (Ed.), Cognitive strategies and educational performance (pp.13.31), New York: Academic Press.

Das, J.P. (1985). Remedial training. For the amelioration of cognitive deficits in children. In A.F. Ashman & R.S. Laura (Eds.), The education and training of the mentally retarded. London : Croom Helm, 215-244.

Das, J.P, & Cummins. J.P. (1982). Language processing and reading disability. In K.D. Gaddow & I. Hialer (Eds), Advances in learning disabilities, I. Green which, Conn. : JAI Press.

Das, J.P., Kirby, J.R., & Jarman, R.F. (1975). Simultaneous and successive synthesis : An alternative model for cognitive abilities. Psychological Bulletin, 82,87-103.

Das, J.P., Kirby, J.R., & Jarman, R.F. (1979). Simultaneous and successive cognitive processes. New York : Academic Press.

Das, J.P., Mishra, R.K., & Pool, J.E., (1995). An experiment on cognitive remediation of word-reading difficulty. Journal of Learning Disabilities, 28, 66-79.

Das, J.P., Naglieri, J.A., & Kirby, J.R. (1994. Assessment of cognitive processes; The PASS theory of intelligence. Boston, MA: Allyn and Bacon.

Das, J.P., Parrila, R.K., & Papadopoulos, T.C., (2000). Cognitive education and reading disability. In A.Kozulin, & Y. Raud (Eds.), Experience of mediated learning: An impact ofFewrstein's theory in education and psychology (PP.274-291). Elmsford, NY: Pergamon.

Dash, M. (1986), Coding and planning of skilled and less skilled readers. Unpublished M. Phil, Dissertation, Utkal University, Bhubaneswar, Orissa.

Dash, M., & Dash, U.N., (1990). Information processing correlates of reading. In U.N. Dash and Uday Jain (Eds.), Perspectives on Psychology and Social Development. New Delhi: Concept Publishing Company.

Dash, U.N., & Mahapatra, S. (1989). Development and differentiation of simultaneous, successive and planning processes. Psychological Studies, 34 (2). 75-83.

Kirby. J.R. & Das, J.P. (1977), Reading achievement, IQ, and simultaneous successive processing Journal of Educational Psychology. 69, 564-570.

Kirby, J.R., Booth, C.A., Dash, J.P., (1996). Cognitive processes and IQ in reading disability. The Journal of Special Education, 29: 442-56.

Krywaniuk, L.W. & Das, J.P. (1976). Cognitive strategies in native children : Analysis and intervention. Alberta Journal of Educational Research, 22 271-280.

Luria, A.R. (1966a). Human brain and psychological processes. New York : Harper & Row.

Luria, A.R. (1966b). Higher cortical functions in man, New York : Basic, Books.

Luria, A.R. (1973). The Working brain:An introduction to neuropsychology. Harmondsworth. Penguin.

Mahapatra, S. (1990). Reading behavior in children with epilepsy. Psychological Studies, 35 (3), 170-178.

Mahapatra, S. (2015a). Attention in relation to coding and planning in reading. Journal of Education and Practice, Vol. 6, No. 1, 43-50.

Mahapatra, S. (2015b). Reading difficulties in children : The role of language and cognitive processes. IOSR Journal of Humanities and Social Science. Vol. 20, issue 2, Ver. IV, PP 10-18.

Mahapatra, S., Das, J.P., Stack-Cutler, H., &Parrila, R. (2010). Remediating reading comprehension difficulties : A cognitive processing approach. Reading Psychology, 31:5,428-453.

Mahapatra, S., & Dash, U.N., (1999). Reading achievement in relation to PASS processes. In U.N. Dash and U. Jain (Eds.), Perspectives on Psychology and Social Development (pp. 282-303). New Delhi, India : Concept Publishing Company.

Miller, G.A., Galanter, E., & Pribram, K.H. (Eds.) (1960). Plans and structure of behavior. Holt, Rinehart and Winston, Inc.

Mohanty. A.K. & Sahoo, R.N. (1985). Graded Reading Comprehension Test, Department of Psychology, Utkal University, Bhubaneswar, Orissa.