Instructional Style, Cognitive Processing, and Achievement Behavior Patterns of Schoolchildren: An Empirical Study

Atasi Mohanty¹ and Swati Preeti Das²

Abstract

The objective of the study was to examine the performance characteristics and differences between English and Oriya medium school children on various cognitive processing, reading, academic achievement, and teacher perception measures. The sample consists of 243 schoolchildren, 120 from Grade IV and 123 from Grade VII from three different schools of Cuttack city in Orissa, India. The children were individually administered the Figure-Copying, Raven’s Progressive Matrices, Matching Familiar Figure Task, Serial Recall, Digit-Span, Wechsler’s Intelligence Scale for Children, Block Design, Cloze Reading Comprehension, and Oral Reading tasks. Classroom Achievement scores on different subjects and the teachers’ ratings about their students were also taken. Results revealed that children reading in English medium schools outperformed their Oriya medium counterparts in some cognitive measures such as Figure Copying, MFFT, RPM, and Digit-Span tasks irrespective of levels. However, the children studying in Oriya medium schools scored higher in Reading Comprehension task and commit less error compared with their English medium counterparts. However, in case of academic achievement measures at primary level, the Oriya medium children performed better in social science, whereas the English medium students excelled in first language and mathematics. The teachers of Oriya medium schools also rated their children better in general conduct, motivation, and effort in schoolwork, whereas, at the secondary level, there was no difference between these two groups in academic achievement or teacher perception measures.

Keywords

cognitive processing, reading comprehension, oral reading, academic achievements, teachers’ perception

Introduction

The article 350A of the Indian Constitution states that every state and local authority shall endeavor to provide adequate facilities for instruction in the mother tongue (MT) at the primary stage of education for all children belonging to linguistic minority groups. This has been reiterated in the “Programme of Action” (POA, 1992), which is based on the National Policy on Education (Department of Education, Ministry of Human Resources and Development, Government of India, 1986), as mentioned in a government resolution (Curzon cited in Evans, 2002) inspired by Viceroy Lord Curzon’s statement way back in 1904:

As a general rule the child should not be allowed to learn English as a language (i.e., as a subject) until he has made some progress in the primary stage of instruction and has received a thorough grounding in his mother-tongue. It is equally important that when the teaching of English has begun, it should not be prematurely employed as the medium of instruction in other subjects. (pp. 277-278)

The National Curriculum Framework (NCF; 2005) developed by the National Council of Educational Research and Training (NCERT) also strongly supports the use of mother tongue at the primary stage in addition to promoting multilingualism in the classroom. However, this decision has not been implemented in practice. Rather, the medium of instruction in mother tongue at the primary stage has remained a desirable component in school curricula.

This right (of instructional style/medium) remains completely with the state governments to decide the languages to be used as mediums of instruction or as the subject at the primary stage. In fact, in our government education system, there is no national-level policy on language for education. The

¹Indian Institute of Technology, Kharagpur, India
²Kendriya Vidyalaya, Cuttack, India

Corresponding Author:
Atasi Mohanty, Assistant Professor, Centre for Educational Technology, Indian Institute of Technology, Kharagpur 721302, India.
Email: atasim@cet.iitkgp.ernet.in

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private school system usually has the freedom to adopt any choice of languages for the primary stage. In addition to state official languages, most states have schools with other mediums of instructions too. Subsequently, to address the various demands of regional identity, retaining Hindi as a national link language and to provide a place for English as the language of progress and power, the “three language formula” was evolved and implemented in 1968, but during the last two to three decades, the demand for English medium schools has gradually been increasing. In the present day society, the importance of mother tongue as a medium of instruction is gradually decreasing, and the importance of English is gaining ground. The English language, which is considered the second language for most of us, has now become a part of India’s multilingual culture. In 1981, Pattanayak stated that in India, “English is naturalized in certain of its uses, home-grown in the midst of a multitude of languages, and complementary to a host of languages in the daily routine, and at the most, operates as an important auxiliary”.

However, the role of using mother tongue as medium of instruction, particularly for linguistic minorities, has been emphasized by various studies (e.g., Cummins, 1984; Skutnabb-Kangas, 1984). Even, for an effective educational development of a second culture language of the majority (national language), studies have pleaded for the necessity of promoting the learners’ proficiency in their mother tongue; for example, Muyangwa and Mvakade (1998) found that the pupils taught in mother tongue (Xhosa) performed better in their academic achievement than those taught in English. Ramasamy (2001) says that the balance is in favor of mother tongue, especially for the lower socio-economic group. However, parents prefer English as medium of instruction for the career option of their children. This is also a fact that children who study through their mother tongue get little scope at the national level administrative posts and other national/international jobs. Thus, in a multilingual country like India, one cannot afford to remain monolingual in one’s mother tongue only. One has to learn several languages for economic and social mobility. Hence, bilingual education is emphasized. Studies have also shown that bilingual education promotes cognitive growth, and convergent and divergent thinking, and helps academic performance (e.g., Ben-Zeev, 1977; Cardenas, 1984). Researchers have suggested that bilingualism involves an intense degree of cognitive conflict, which facilitates language learning. Nanda (1991) reports that medium of instruction is crucial for both social and personality development of children. In a comparison of Oriya (mother tongue) and English (second language) medium high school children, he found that English medium school children were better in general cognitive and socio-motivational competencies. The Oriya medium school children were better in personal motivated competence, personality, and personal style. However, in another study in Hong Kong high schools, Marsh, Hau, and Kong (2000) compared the achievements of high school students studying in Chinese (first language) and English (second language) medium of instructions and found the negative effects of English instruction in the achievement of most of the school subjects, that is, history, geography, math, science.

The above review of empirical findings on the medium of instruction influencing the cognitive processing, reading, and academic achievements of children have shown mixed and contradictory results. The impact of mother tongue as medium of instruction vis-à-vis the use of non-mother tongue, particularly English as medium of instruction, has not only created a wide spread debate but also baffled the policy makers all over the country. As a result, there is no uniform standard prescribed for primary and secondary level education in this country. While all the state governments of India are running traditional schools with mother tongue as medium of instruction at primary and secondary levels, the central government (through Central Board of Secondary Examination [CBSE]) and many private organizations (through Indian Certificate for School Education [ICSE]) are running schools in English medium both at the primary and secondary levels. There is a growing trend and craze in the Indian society not only in the urban but also in the semi-urban and urban-slum areas to opt for the English medium schools. Moreover, not many studies have been conducted in this context to compare the performance and achievement differences of students studying in different schooling systems/patterns. These reasons have prompted the present researchers to take up this study and compare the performance characteristics of Oriya and English medium school children in Odisha. Due to the constraints of manpower, time, and other resources, this study has been delimited to the Cuttack city in Odisha, India.

**Objectives**

1. To examine the performance characteristics and differences between English and Oriya medium school children on various cognitive processing and reading measures (both at primary and secondary levels of education).
2. To assess the achievement behavior patterns of English and Oriya medium school children in various academic/school subjects.
3. To find out the grade differences (if any) among these children.

**Method**

**Subjects**

Two Hundred forty-three schoolchildren were selected from three different schools of the Cuttack city in Odisha, India:

1. Ravenshaw Collegiate School (Oriya medium instruction), which follows the traditional state
examination pattern and is managed by the Education Ministry, Government of Odisha, India.

2. Kendriya Vidyalaya (English medium instruction), Cuttack, which follows the CBSE pattern. This school is under the Kendriya Vidyalaya Sangathan, managed by the Ministry of Human Resources Development, Government of India.

3. Stewart School Cuttack (English medium instruction), an English medium missionary school following the ICSE pattern of examination.

The Grades IV and VII children from all these three schools were selected through stratified random technique. From each school, 40 students (20 girls and 20 boys) were drawn from each grade. In total, 120 students from Grade IV and 123 students from Grade VII (60 girls and 60 boys from Grade IV; 63 girls and 60 boys from Grade VII) were selected as the sample. All these three schools had co-education pattern, similar infrastructure, teacher–student ratio, and duly qualified/trained teachers. With regard to the demographic characteristics, the subjects were from service class/business class background and middle-class/upper-middle-class families. But the parents were very much concerned about their children’s education.

Design

The present study was quasi-experimental in nature having two independent variables such as medium of instruction and grade, each having two levels (i.e., English and Oriya, Grades IV and VII) and 22 dependent measures.

Assessment Instruments

Broadly, four types of dependent measures were used to examine the performance characteristics and differences among the children of Oriya and English medium schools. The first category of measure represented the cognitive measures, the second category included the reading measures, and the third and fourth categories of measures represented the academic achievement scores and teachers’ perceptions, respectively.

The following measures were administered individually on all the subjects.

A. Cognitive Measures

Simultaneous Information Processing Tests

1. Figure Copying Task.

The tasks require the child to copy 15 geometrical figures, which are visible to the child at all times, and the difficulty level is increased gradually. Each drawing is scored 0, 1, or 2 according to the degree of correctness of reproduction. Scoring criteria emphasize the maintenance of geometric relation and proportions rather than exact reproduction. The test was used as a good measure of simultaneous processing in children (Das, Naglieri, & Kirby, 1994). The maximum score was 30 and the time taken by the child to complete each drawing was recorded, so that the mean of latency for Figure Copying could be computed.

2. Raven’s Progressive Matrices (RPM).

RPM (Raven, 1983) is a test of intellectual (non-verbal) reasoning for ability consisting of 60 matrices or designs, each having a part that has been removed. The task of the child is to decide the missing part and insert it from six/eight possible alternatives given below. The child has to simultaneously evaluate and search all the six/eight possible alternatives to find out the correct portion. The 60 matrices are grouped into five series, each comprising of 12 metrics having increasing difficulty. The first two series have six possible alternatives, and the rest three series have eight possible alternatives. In this study, this test was used as a good measure of simultaneous processing in children (Das et al., 1994). There was no time limit for this test, and each subject took as much time as he or she required to complete the matrices.

Successive Information Processing Tests

1. Digit-Span (Forward) Task.

The test is similar to the Wechsler’s Intelligence Scale for Children–Revised (WISC-R; Wechsler, 1974) Digit-Span forward subtest. The experimenter reads out the series of digits of increasing length, beginning with three digits, to a maximum of nine digits. The child is required to recall a series of digits, keeping the order of presentation intact. If a child is unable to recall correctly any series of digits, he or she should be given a second series of identical length. In the present study, this task has been adopted as the successive processing measure (Das et al., 1994). The maximum score for Digit-Span (forward) task was 84.

2. Serial Recall Task.

The items of Serial Recall (similar to the WISC-R) were presented individually (taking equal pause in each item) by means of a tape recorder. The subject’s task was to recall a series of words verbally keeping the order of presentation intact. Twelve sets of items, 4 items in each category (having the word length of 4, 5, and 6), which were either acoustically similar (i.e., Amba, Ghara, Gacha, Nuga) or neutral (Jala, Pani, Ghasa, Chuli) were presented in the Oriya language/English language. The Oriya items were translated into the English language for the English medium school.
children (1. Mango, House, Tree, Clothes; 2. Net, Water, Grass, Fire); each series of words were scored taking into account their correct serial position as 1, 2, 3, 4, and so on. The maximum/total score was 60 (Das et al., 1994).

Reflection–Impulsivity Information Processing Test

1. Matching Familiar Figure Task (MFFT).

The MFFT-20, which consists of 20 test items, was developed by Cairns and Cammock (1978). The MFFT 20 is suitable for use with children in primary and secondary grades. This task was used in the present study. Each item consisted of a standard picture of a common object (e.g., a house) and six comparison pictures, one of which was identical to the standard picture; the other five differed from it in a minute and not easily identifiable detail. The task of the child was to select the picture that exactly matches the standard; a maximum of five errors per item were allowed. Latency to first response on each of the items and total number of errors were recorded on all the 20 items. For each individual child, the mean time (to first response) and total number of errors for all 20 items were calculated at the end. This task was used to assess the cognitive processing styles (reflective–impulsive) of the children.

The WISC-R

1. Block Design Task.

The test is used to measure basic potentiality of a child in terms of how the cognitive ability is utilized/organized for successful performance in complex problem solving tasks. WISC-R consists of 12 tests (6 on the verbal scale and 6 on the performance scale) that constituted the Wechsler Intelligence Scale for Children (WISC, 1949). In the present study, the non-verbal performance subtest, Block Design, was taken as a (non-verbal) reasoning task. In this task, there were nine blocks (cubes) colored red on two sides, white on two sides, and (diagonally) partially red/white on two sides. Eleven cards with different designs (bound into a booklet) were there, and the subject’s task was to make identical designs by using these blocks. There was a maximum time limit for each design, and extra bonus points were also given for completing each item before the maximum time limit.

Reading Tests/Tasks

1. Oral Reading Task.

In the present study, the oral reading task consisted of few sentences/a passage from the literature text books (Oriya/English) of respective grades such as IV/VII. Each subject was instructed to read these sentences aloud. The errors made by the subjects were categorized as (a) number of incorrect words, (b) number of words added, (c) number of words omitted, and (d) number of words mispronounced. Time taken and number of errors made in each category were recorded for analysis.

2. CLOZE Reading Comprehension.

This is a CLOZE reading task for measuring the pupils’ comprehension skill. CLOZE procedure is a technique in which words are systematically deleted from a passage and the reader is expected to replace the deleted words while reading it. Stories were taken from the text books of Class IV and VII in case of both English and Oriya medium schools. Every 8th, 9th, or 10th word was deleted so as not to destroy the conceptual base of the story. The deletions were made carefully without hampering the contextual cues. For absolute correct answer (semantically or syntactically), a score of 1 was given, and for unacceptable response/complete failure, no score was given; 1/2 mark was given for partially correct responses.

B. Achievement Measures

The achievement scores were collected from the half-yearly examination reports of the schools in the following subjects: medium of instruction language (MIL) Oriya/English, mathematics, science, social science as well as Grand total. The scores on the above Classroom Achievement Measures gave the idea of children’s knowledge in language, reasoning ability, and general information storage.

C. Teacher Rating Measure

The class teachers of Grades IV and VII were asked to fill in the Kendall and Wilcox’s (1979) Self-Control Rating Scale of child. This rating scale consists of 40 questions in which the class teacher had to assess (on a 7-point rating scale) the child’s general conduct, self-control, behavior, motivation, and effort in schoolwork.

Procedure

All the assessment instruments were individually administered on the sample by the researcher in their respective schools. Because there were several tests and tasks, which required long hours of testing, the tests were administered in two separate sessions. The achievement scores were collected from the half-yearly examination records of all the schools. The Teacher Rating scores of the subjects were given by the respective class teachers.

Results

Out of total 16 cognitive variables, 8 variables showed statistically significant effect for Grade IV Oriya and English medium students (refer Tables 1 and 2). The English medium students took less time to complete the Figure Copying task.
and got more scores than their Oriya medium counterparts. They also committed less error in the MFFT task and scored more in the Digit-Span than their Oriya medium counterparts. However, in the Serial Recall task, the Oriya medium students scored higher than the English medium children. The Oriya medium students’ reading comprehension scores were higher, and they read less number of incorrect words, compared to their English medium counterparts. However, the Oriya medium primary grade children omitted more number of words in the reading passage than their English medium counterparts.

Of the five Academic Achievement variables, three showed statistically significant effect for Grade IV Oriya and English medium students (MIL, mathematics, social science). The English medium students scored better in MIL/first language and mathematics whereas the Oriya medium students scored higher in social science. The teacher perception variables (general conduct, self-control, behavior, motivation, and effort in their studies) showed statistically significant effect, and the Oriya medium students were rated higher by their class teachers as compared with English medium children.

Of the 16 cognitive variables, 8 variables showed statistically significant effect for Grade VII Oriya and English medium students (refer Tables 3 and 4 here). The English medium students took less time to complete the Figure Copying, RPM, and MFFT tasks and scored better in Figure Copying and Digit-Span tasks than their Oriya medium counterparts. The English medium students scored less in Comprehension task and took less time to read the reading passage but read more number of incorrect words than their Oriya medium counterparts. Of the 5 Academic Achievement variables, all showed statistically insignificant effect for Grade VII Oriya and English medium students. The teacher perception variables were also found to be statistically insignificant.

**Discussion and Conclusion**

In the present study, in simultaneous processing measures (Figure Copying, RPM, MFFT, etc.), the primary grade
Table 2. One-Way ANOVA Conducted for Grade IV Children of Oriya Medium and English Medium Schools.

| Variables                                      | F ratio | p value |
|------------------------------------------------|---------|---------|
| Cognitive variables                            |         |         |
| Figure Copying Time (in seconds)               | 20.30   | <.01*   |
| Figure Copying Score                          | 10.13   | <.01*   |
| RPM. Time (in seconds)                         | 2.18    | >.05    |
| RPM. Score                                     | 0.84    | >.05    |
| MFFT-Latency-Mean Time (in seconds)            | 0.63    | >.05    |
| MFFT–Error                                     | 3.98    | <.05*   |
| Serial Recall Score                            | 4.30    | <.05*   |
| Digit-Span Score                               | 10.11   | <.01*   |
| Block Design Score                             | 3.34    | >.05    |
| Reading variables                              |         |         |
| Comprehension Task Time (in seconds)           | 0.06    | >.05    |
| Comprehension Task Score                       | 20.03   | <.01*   |
| Reading Test Time (in seconds)                 | 0.13    | >.05    |
| Incorrect Words Read                           | 26.66   | <.01*   |
| No. of Words Added                             | 0.06    | >.05    |
| No. of Words Omitted                           | 8.96    | <.01*   |
| No. of Words Mispronounced                     | 3.51    | >.05    |
| Academic achievement variables                 |         |         |
| MIL/First Language                             | 37.00   | <.01*   |
| Mathematics                                    | 5.30    | <.05*   |
| Science                                        | 0.30    | >.05    |
| Social Science                                 | 10.05   | <.01*   |
| Total/Global                                   | 2.06    | >.05    |
| Teacher perception variable                    |         |         |
| Teacher Rating                                 | 9.88    | <.01*   |

Note. N = 120; df = 1,118. RPM = Raven’s Progressive Matrices; MFFT = Matching Familiar Figure Task; MIL = medium of instruction language. 

p value *Significant at .05 level = 3.92 and .01 level = 6.84.

children of English medium schools took less time to complete the tasks and scored higher in comparison with their Oriya medium counterparts. The same trend was observed in case of secondary grade. These findings support the earlier report by Anand (1973) that English medium pupils showed higher non-verbal intelligence than their Kannada medium counterparts. Srivastava and Ramaswamy (1986) also reported the same (while comparing the children of Tamil, Malayalam, and English medium schools) and found that secondary grade children of English medium schools scored higher on non-verbal intelligence. More recently in cross-cultural context also, Kirkici (2004) confirmed the view that bilingualism may act as a facilitating trait in many respects, including the bilingual child’s cognitive and linguistic development.

The poor performance of students of Oriya medium schools in the above non-verbal tasks may be due to their non-exposure to such tasks. This fact was confirmed by the children, that they were never exposed to such problem solving tasks, during the course of instruction in the school. From the above findings, it is evident that the secondary level Oriya medium children did not get the scope to improve their non-verbal, problem solving skills, even after 3 more years of schooling. The present findings suggested that the secondary grade children of English medium schools were probably more impulsive and tried to solve the problems as quickly as possible. In contrast, the secondary grade Oriya medium children were found to follow a reflective processing strategy. However, this trend was not found in case of the primary grade children. Probably, they had not developed an analytical style of their own. It is also observed that the students of English medium schools were so much overburdened with their school tasks that they were less interested in performing well in these problem solving tasks. Possibly, this could be the reason why they had adopted an impulsive processing strategy while solving the non-verbal reasoning and simultaneous information processing tasks.

The successive processing tasks (Serial Recall and Digit-Span) in this study involve the integration of stimuli into particular series, where the elements form a chain like progression. The critical aspect of successive processing is that elements must be ordered without surveyability, and elements should be linearly related. Verbal encoding and rehearsal are very much needed, which help in storing information in memory for successive processing. At the time of retrieval in successive processing tasks, the items have to be serially reproduced by the subjects. In the Serial Recall task,
Table 3. The Means and Standard Deviations of Class VII Students of Oriya Medium and English Medium Schools (N = 123).

| Medium of instruction | Oriya | SD | English | SD |
|-----------------------|-------|----|---------|----|
| Cognitive variables   |       |    |         |    |
| Figure Copying Time (in seconds) | 1,875.71 | 573.52 | 1,626.91 | 676.81 |
| Figure Copying Score | 21.67 | 3.39 | 24.33 | 3.59 |
| RPM. Time (in seconds) | 12.50 | 10.57 | 6.70 | 4.35 |
| RPM. Score | 22.95 | 13.24 | 18.24 | 12.31 |
| MFFT-Latency-Mean Time (in seconds) | 25.58 | 12.45 | 20.86 | 8.13 |
| MFFT–Error | 8.14 | 11.68 | 7.77 | 12.95 |
| Serial Recall Score | 50.12 | 8.93 | 51.05 | 6.82 |
| Digit-Span Score | 63.19 | 13.12 | 67.96 | 11.81 |
| Block Design Score | 28.64 | 7.09 | 30.95 | 6.44 |
| Reading variables     |       |    |         |    |
| Comprehension Task Time (in seconds) | 1,014.76 | 430.61 | 887.90 | 342.28 |
| Comprehension Task Score | 26.98 | 6.07 | 22.44 | 7.26 |
| Reading Test Time (in seconds) | 158.10 | 38.93 | 117.73 | 47.01 |
| Incorrect Words Read | 0.79 | 1.20 | 6.48 | 4.80 |
| No. of Words Added | 0.88 | 0.97 | 1.27 | 4.04 |
| No. of Words Omitted | 0.67 | 1.22 | 0.53 | 0.81 |
| No. of Words Mispronounced | 1.81 | 1.81 | 1.90 | 2.16 |
| Academic achievement variables |       |    |         |    |
| MIL/First Language | 45.31 | 14.90 | 51.86 | 18.79 |
| Mathematics | 26.27 | 56.26 | 25.61 | 51.93 |
| Science | 61.86 | 18.03 | 60.40 | 23.49 |
| Social Science | 55.81 | 19.32 | 59.60 | 21.37 |
| Total/Global | 216.17 | 70.40 | 227.74 | 81.48 |
| Teacher perception variable |       |    |         |    |
| Teacher Rating | 137.79 | 61.90 | 134.33 | 31.57 |

Note. RPM = Raven’s Progressive Matrices; MFFT = Matching Familiar Figure Task; MIL = medium of instruction language.

The primary grade children of Oriya medium schools scored significantly higher than their English medium counterparts, but at the secondary level, there was no significant difference between them. From this finding, we could infer that may be, the Oriya medium primary level children are more acquainted with rote learning method, probably because the curriculum emphasizes this skill in the traditional Oriya medium schools. Apart from this, the words in the Serial Recall task might have had a familiar rhythm, which made it easy for them to recall quickly. In the Digit-Span task, the primary grade children of English medium schools scored significantly higher than their Oriya medium counterparts. The same trend was also found at the secondary level. The secondary grade English medium children scored higher than the Oriya medium counterparts. The Digit-Span task is basically a memory task. However, the immediate memory span of the students depend on their habit pattern. From this finding, it may be inferred that the children of English medium schools are more acquainted to numerical pattern than the words used in these tasks. In African Language research also, Ndamba (2008) found that majority of parents as well as participants in his study favored English as the language of instruction in the primary grades, because English is a gateway to success in schools and subsequent employment opportunity. In the present study, in WISC-R Block Design non-verbal reasoning task, the children of English medium schools had higher mean scores compared with their Oriya medium counterparts, both at the primary and secondary levels. In support of this, in a study related to monolingualism, bilingualism, and medium of instruction, Sampath (2005) found that levels of second (Telugu and Tamil) language proficiency do not mediate global intelligence and non-verbal intelligence; rather, when children have a higher level of second language proficiency, they perform better on verbal intelligence. The bilinguals possess an interactive language system, such as when speech is perceived or produced in either language, the two language capabilities influence each other, and a positive transfer takes place when the second language learners utilize knowledge of similar elements from first language (L1) in learning second language (L2) (Jared & Kroll, 2001).
The Reading Comprehension task demands a conceptual analysis of semantic and syntactic cues to fill in the missing details. Researchers (Anderson, Hiebert, Scott, & Wilkinson, 1985) have argued that good comprehension ability depends on proper synthesis of the past information already available to the reader and the subject information available to him or her through the text. Moreover, involvement of the reader, sampling of words from the text, and awareness of the context of reading situation lead to better comprehension of the text (Richeck, List, & Lerner, 1989; Wixson, Peters, Weber, & Roeber, 1987). Here, in the Comprehension task, the Oriya medium children of primary grades achieved statistically significant higher scores in comparison with their English medium counterparts. The same trend was noticed at the secondary level. The secondary grade Oriya medium children took more time to read the passage but made very few reading errors, probably because of their reflective processing strategies. From this, we can assert that attention and cognitive processing strategies are closely interlinked, even in case of oral reading. Research has also shown that attention is a critical factor for translating print into speech and plays a major role in increasing the reading fluency (Radach, Kennedy, & Rayner, 2004; Reynolds & Besner, 2006).

Table 4. One-Way ANOVA Conducted for Grade VII Children of Oriya Medium and English Medium Schools.

| Variables                                      | F Ratio | p value |
|------------------------------------------------|---------|---------|
| Cognitive variables                            |         |         |
| Figure Copying Time (in seconds)               | 4.13    | <.05*   |
| Figure Copying Score                           | 15.85   | <.01*   |
| RPM Time (in seconds)                          | 18.50   | <.01*   |
| RPM Score                                      | 3.85    | >.05    |
| MFFT-Latency-Mean Time (in seconds)            | 6.38    | <.05*   |
| MFFT–Error                                     | 0.72    | >.05    |
| Serial Recall Score                            | 0.41    | >.05    |
| Digit-Span Score                               | 4.19    | <.05*   |
| Block Design Score                             | 3.31    | >.05    |
| Reading variables                              |         |         |
| Comprehension Task Time (in seconds)           | 3.17    | >.05    |
| Comprehension Task Score                       | 12.01   | <.01*   |
| Reading Test Time (in seconds)                  | 22.82   | <.01*   |
| Incorrect Words Read                           | 56.99   | <.01*   |
| No. of Words Added                             | 0.38    | >.05    |
| No. of Words Omitted                           | 0.54    | >.05    |
| No. of Words Mispronounced                     | 0.06    | >.05    |
| Academic achievement variables                 |         |         |
| MIL/First Language                             | 3.85    | >.05    |
| Mathematics                                    | 0.78    | >.05    |
| Science                                        | 0.12    | >.05    |
| Social Science                                 | 0.93    | >.05    |
| Total/Global                                   | 0.61    | >.05    |
| Teacher perception variable                    |         |         |
| Teacher Rating                                 | 0.17    | >.05    |

Note. N = 123; df = 1,121. RPM = Raven’s Progressive Matrices; MFFT = Matching Familiar Figure Task; MIL = medium of instruction language.

p value *Significant at .05 level = 3.92 and .01 level = 6.84.

The English medium counterparts. The secondary grade children of English medium schools took significantly less time to read the passage but read significantly more number of incorrect words compared to their Oriya medium counterparts. The secondary grade Oriya medium children took more time to read the passage but made very few reading errors, probably because of their reflective processing strategies. From this, we can assert that attention and cognitive processing strategies are closely interlinked, even in case of oral reading. Research has also shown that attention is a critical factor for translating print into speech and plays a major role in increasing the reading fluency (Radach, Kennedy, & Rayner, 2004; Reynolds & Besner, 2006).

Of the five Achievement variables (MIL/first language, mathematics, science, social science, and global marks), the English medium children of primary grades got higher grades in MIL/first language and mathematics compared to the Oriya medium counterparts. In support of this, Srivastava and Khatoon (1980) also reported that English medium children got higher scores in first language compared with the Kannada medium counterparts. The primary grade children of Oriya medium schools got significantly higher grades in social science compared with their English medium counterparts.
counterparts. This finding may suggest that the Oriya medium school children are more acquainted with rote learning at the primary level. However, these findings are contrary to the findings of Marsh et al. (2000) who reported that the primary children of Chinese medium schools achieved higher scores in mathematics, science, and social science as compared with their English medium counterparts. Because the classroom Academic Achievement measures are not standardized tools, the difference between the two mediums of instruction might be due to subjectivity and difference in teacher perception variables. At the secondary level, there was no significant difference in all the five achievement measures of the children of Oriya and English medium schools. These data are contrary to the findings reported previously by Basavayya (1980) where it was reported that children of English medium schools are superior to their counterparts in Kannada medium in academic achievement scores. Considerable evidence is also available regarding the finding that executive attention network plays a major role in the acquisition of school subjects such as literacy (Mc Candliss, Beck, Sandak, & Perfetti, 2003) and numeracy, and in a wide variety of other subjects (Posner & Rothbart, 2007).

In the teacher perception variable, the primary grade children of Oriya medium schools were rated significantly higher by their class teachers compared with their English medium counterparts. The teachers of Oriya medium schools perceived that their children exercised more self-control, had more motivation to learn, and put in more efforts, and in general, showed less behavior problems. However, the teachers of English medium schools rated their children to have less self-control, to be impulsive, and to have had more general conduct and behavior problems. It is generally found that the primary level children of Oriya medium schools are more disciplined and are afraid of their teachers. At the secondary level, the teacher perception variable scores were almost similar for the children of both Oriya and English medium schools.

In summary, the major findings of the present study reveal that the students of the English medium schools at both the levels (primary and secondary) were found to be superior in most of the non-verbal cognitive processing tasks. This could be attributed to the reason that the Oriya medium children might not have received enough stimulation to improve their non-verbal problem solving skills, even at the secondary level. Probably, they were not well-exposed to various problem solving tasks, which require different information processing strategies to solve novel tasks. As a result, these children lacked potential skills and aptitude for solving problems beyond their syllabus. Even their parents seem to be more traditional and did not expose them to sufficient extracurricular activities other than the school curriculum.

However, the children of English medium schools were found to be more impatient and impulsive to get over a task, which is not related to their classroom academic achievement—especially at the secondary level. The general trend observed (in case of parents and teachers) is that there is more encouragement and reward for high classroom achievement among children rather than encouraging them for more creative and innovative work beyond the prescribed curriculum. Thus, it is suggested that some reforms in the school curriculum and general set-up of the school environment be made in the traditional schools. The school curriculum must give scope to children to develop creative and problem solving skills. The pedagogy of Oriya medium schools has to be changed from rote learning method to constructive learning. The teaching–learning process should emphasize activity-centered learning and ensure the all-round development of children.

In the reading measures, the Oriya medium children at both the levels have outperformed their English medium counterparts. In this study, because the Oriya medium children are mostly monolinguals, they have a better control over the first language/mother tongue. This is also a well-researched fact that children learn best in their mother tongue as a prelude to and complement of bilingual and multilingual education (Ball, 2010). Fluency and literacy in the mother tongue lay a cognitive and linguistic foundation for learning additional languages. Thus, when children receive formal instruction in their first language throughout primary studies and then gradually shift to academic learning in the second language, they learn the second language quickly. If they continue to have opportunities to develop their first language skills in secondary school, they emerge as fully bilingual/multilingual learners. If, however, they are forced to switch abruptly from their mother tongue to schooling in a second language, their first language acquisition may be attenuated or even lost. This has also happened in the present study. For English medium children, although English was their first language in the school as well as medium of instruction, these children were having either Oriya or Hindi as their mother tongue. They used to speak Oriya or Hindi at home, in the neighborhood, and with their peers/playmates. Therefore, it is very natural that these children performed less well in reading and comprehension tasks in comparison with their Oriya medium counterparts. The probable reason could be that the English medium children were less proficient in both the languages (mother tongue and school language) as they were using these as the substitute not supplementary to each other. Moreover, it is also found that the general attitude toward tasks other than the school tasks was indifference, which resulted in lower level of verbal ability. This aspect was more prominent at the secondary level when they rushed through the reading passage just to finish the task and read on enormous number of incorrect words. Instead of showing an improvement from primary grades, they deteriorated further at the secondary level.

In academic achievement measures, at primary level, the English medium students performed better in the English language and mathematics, whereas the Oriya medium students performed better in social studies. However, at the
secondary level, there was no such significant difference. These achievement tests were not standardized and could not be accepted as error-proof. Many researchers have reported that bilingualism involves an intense degree of cognitive conflict, which facilitates language learning. It is also revealed in the present study that the level of proficiency and exposure matter a lot in determining the cognitive flexibility of children. In tune to this, the present researchers also advocate for improving the language proficiencies in both the first and second languages through more supplementary reading materials, besides the courses in the curriculum, and adopting more innovative as well as problem solving approaches in the teaching–learning process. The school curriculum should be designed to promote equally the children's non-verbal reasoning and higher order cognitive skills.

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**Author Biographies**

Atasi Mohanty is presently a faculty in the Department of Educational Technology, Indian Institute of Technology Kharagpur, a premier institute in India. Her areas of research are educational psychology and teacher education. Till date, she has five doctoral students, 17 years of teaching experience, and many publications to her credit.

Swati Preeti Das is a retired social science teacher in Kendriya Vidyalaya, a central government school in India. She has done her doctoral research in pedagogy of different school education systems in India.