

Role of Mother Tongue (L1) in Developing Mental Abilities of Junior College Students  
Studying in Science Faculty – A Comparative Study.

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**Role of Mother Tongue (L1) in Developing Mental Abilities of Junior College  
Students Studying in Science Faculty – A Comparative Study.**

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**Abstract**

The students' mental abilities depend on various factors—like *hereditary, environment, physical, psychological, mother tongue (L1), etc.* Language is very important for the comprehension of any subject matter. It is found that much of the learning and thinking of the subject matter makes use of language; hence it is the need to know the relevance of language in the course of teaching and learning. Researchers have observed that perception, memory, thinking, problem-solving, and mental processes are all intertwined with language in recent studies. All of these helps in understanding scientific concepts and principles in science. Since the child's mother tongue (L1) is well developed, it is easy to understand scientific concepts and principles in his mother tongue (L1). Similarly, education becomes more valuable when the intellectual capacities are open to receiving, acting, transferring, and integrating; thus, most research findings suggest that medium instruction must be the mother tongue (L1) in the classroom. Mental abilities are mostly related to the cognitive aspects of the learners; therefore, in this research, mental abilities are considered the achievements of students.

The present study studied the achievements in the physics subject of students with mother tongue (L1) and second language (L2) as an instructional medium using the standardized test prepared by D.N. Sansanwal and Anuradha Joshi. The sampling method used in the research was stratified random sampling and the sample taken in the study was 1147. The research findings show that the difference between the achievements in the physics subject of students with mother tongue (L1) and second language (L2) as an instructional medium was statistically

significant,  $U=146247.500$ ,  $p=.001$ ,  $r=.009$ . Students' achievement in physics subject with mother tongue (L1) ( $M = 598.15$ ) as a medium of instruction is higher than students' achievement in physics subject with a second language (L2) ( $M=544.15$ ). The effect size is  $r = .009$ ; therefore, the effect size is small.

**Key Words:** Mental Abilities, Achievements in Physics,

Introduction:

Language is the means of communication, and there is a positive correlation between language and children's mental abilities. In psychology, various researches have been done on language development and children's cognitive skills. In this research, psychologists have found that the language helps children comprehend the subject matter concepts in science, understanding scientific laws and principles. In recent studies, it has been found that children develop scientific knowledge grasps science concepts better when the medium of instructions is the mother tongue (L1).

As cited in (Victor Lee and Prajna Das Gupta, 1995), Using one's native language as a medium of education also aids children in developing concepts and categorization. As cited in (Victor Lee and Prajna Das Gupta, 1995), Children between three and ten years old have their mother tongue (L1) as their first language. Because they speak it better and are well developed among young children, therefore medium of instruction in the schools should be mother tongue (L1). Language is the most common way for people to communicate with one another. in its spoken, written, and gestured forms. Language allows people to express their ideas, thoughts, feelings, and opinions. Similarly, laws, principles, formulae, and concepts in science and mathematics are expressed through the medium of language and symbols. As cited in (Victor Lee and Prajna Das Gupta, 1995), since language is intertwined with perception, memory, thinking, problem-solving, and other mental processes, it is an important topic of study in cognitive psychology.

Review Of Related Literature

Psycholinguistics:

As cited in (Shelia M. Kennison and Rachel H. Messer, n.d.), Psycholinguistics is the umbrella term for various mental processes involved in speech acquiring, processing, and cognition. According to a large body of recent psycholinguistic research, linguistic improvement and cognitive development are linked. Empirical studies on linguistic and cognitive development

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relationships are remarkably important in educational programs and theoretical frameworks on mental function. (K. Ramasamy, M. S. Thirumalai, 2016). Learners in science must memorize and apply various formulas, label diagrams, weigh chemicals, and operate microscopes. However, there has been a significant shift toward a constructivist approach to science education in recent years. This method emphasizes the abstract nature of science, including the high-level mental functions' ability to interpret and communicate these ideas.

### Language and Science:

The researcher discovered from various theories and psychological principles that language aids cognition and that solving problems requires comprehension of the subject and scientific principles, dependent on the child's vocabulary. Because the child's mother tongue (L1) is well developed, he can easily understand scientific concepts and principles in his native language. As a result, when the mother tongue (L1) is used as an instructional medium, instruction becomes more impactful because the cognitive faculties are prepared to sense, act, disburse, and amalgamate.

### Language and thought:

(Piaget's, n.d.), explained the onset of language in the second year by pointing to the completion of general sensorimotor development and symbolic functions at this age. Language does not appear earlier because it creates a relatively broad set of processes that include schema, visual images, illustration, convincing people, and the spoken language. Thus, language is a byproduct of this sensational period of cognitive development.

According to Vygotsky, during the social interactions with adults and peers, the main purpose of the interaction is language development. As it is mastered, it is 'internalized' to assist the thought process and internalize the speech and dialogue: it is mostly because of the result of language and not the other way around.

### Mental ability and Medium of Instruction:

According to (Shende 2015), there is a positive correlation between the mother tongue (L1) and the instructional medium. As cited in (Chandresan Manjula, 2007), the students who have their mother tongue (L1), Kannada, and those whose medium of instruction is English, were compared. And it has been found that the Kannada speaking students were significantly

superior in oral intellect and achievement, while the English-speaking students were significantly superior in non-verbal intelligence. However, several studies discovered that educating the child in a language other than his mother tongue (L1) has either a positive or negative effect on his cognition.

As cited in (Chandresan Manjula, 2007), In a pilot test with grade eight students in Mysore city schools, English medium pupils outperformed the pupils with Kannada medium of instruction on measures of non-verbal intellectual capacity and the spoken creative expression. Moreover, when the class-related standards were controlled, there was little difference among these two faculties.

As cited by (Khatoon n.d.-b), Gandhiji strongly supported the view of mental development through mother tongue (L1), which was based on sound pedagogical principles. He mentions that for the development of a child, mothers' milk is essential in the same way the mother tongue (L1) is also crucial for developing a man's mind. In children, the ability to comprehend and manipulate their mother tongue (L1) is well developed, and the cognition reflects the linguistic environment and culture to which he is exposed. Children speak fluently in their native language and score better in science subjects (Savile-Troike, n.d.). When the second language (L2) is used in schools early, it stunts learners' development, thus inhibiting their cognitive/academic abilities. Further, it also promotes negative attitudes toward their mother tongue (L1) and results in low achievement in concepts such as mathematics and science.

As cited in (Assistant, 2013), The education commission was an outspoken supporter of the principle of teaching in one's native language. This principle was highlighted in the commission's three-language formula, also included in our National Policy on Education. However, only a broader definition of Mother's tongue has been used for inclusion in the school curriculum, including only languages spoken in the regions recognized in the VIII schedule of constitutions. Suppose the mother tongue (L1) is defined as the first language child says when born. In that case, there will be a distinction between the mother tongue (L1) and the regional language used as an instruction language in the classroom. Anand (1971) discovered that among the Kannada and English medium students, the former was better in achievement and verbal intelligence, while the latter was significantly superior in non-verbal intelligence (K. Ramasamy, n.d.).

As observed by (Skutnabb-Kangas et al., 2009), A child cannot learn a second language (L2) properly unless his mother tongue (L1) is used as the instructional medium, according to their

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findings from a study of 700 Finnish immigrant children. Forcing second language (L-2) placements in areas where the mother tongue (L1) has low-status results in double semi-bilingualism, in which both languages is not proficiently acquired.

Their study (Pritimayee Senapati, Nirlipta Patnaik, 2012) investigates the effect of instruction medium on cognitive process development. They had gathered a sample of 80 children, 40 from grade Four (aged 8-9 years) and 40 from grade VI (aged 10-11 years). Twenty students were enrolled in English medium school in each age group, but the other 20 were in an Odia (Indian local language) medium school. All of the children in the study were given two tests each of preparation, recognition, concurrent, and consecutive processing.

The statistical analysis was performed using two (medium of instruction) by two (grade) Analyses of Variance. The results indicated a significant effect of medium of instruction for almost all measures of cognitive processes, indicating that English medium school children outperformed their Odia medium counterparts. As evidenced by significant main effects of grade, mental processes were developmentally sensitive.

As observed by (Noormohamadi, 2008), Intellectual development, or the emergence of extremely sophisticated aspects or levels of achievement, rationale, logic, and reason, is a continuous reflective process, collaboration, and interpersonal interactions that begin in the infant stage and, in some cases, persisted well into adult lives. Language is a primary method in all aspects of society in this process.

Need and significance of the study:

The researcher is a lecturer in a reputed teacher training institute. The daily experience of working with the pupil teachers and the students of schools observed at the time of practice teaching provided a rich source of possible research problems on the effect of an instructional medium on the mental ability in the students' science. Hence it was the felt need that mother tongue (L1) should be the medium of education of the children.

Objectives of the study:

To compare the mental ability of the junior college *male* and female students in the physics subject.

*Hypothesis:*

There is no significant difference between the mental ability of XI standard boys and girls in the physics subjects.

*Definitions and Operational Definitions:*

*1. Mental ability – the ability of a child to learn or retain knowledge, solve problems through reflective thinking, analysis, synthesis application, etc. (Thinking Skills - Analytical, Critical and Creative Thinking, n.d.).*

1. Higher Mental ability in science:

As cited in (Dandekar 1971), the Bloom taxonomy consists of the cognitive domain comprising six classes, namely knowledge, comprehension, application, analysis, synthesis, and evaluation. Blooms considered categories such as application, analysis, synthesis, and evaluation as the higher mental abilities. Language helps in comprehending the laws and facts in science. It is found that much of the learning and thinking of the subject matter makes use of language, and thus the mental ability of students who did their schooling through their mother tongue (L1) is better.

A standardized test prepared by D.N.Sansanwal and Anuradha Joshi is administered to XI STD students to find their mental ability in science. The *marks scored* by them would be the *mental ability* of the students.

Operational Definitions

1. *Junior college students:* students who are studying in grade XI student.
2. *Mother tongue (L1):* the language first learned by a child; a native language. First language: the first language somebody knows as a child at home.
3. *Second language (L2):* is A language spoken by students other than their mother tongue (L1).
4. *Science students:* Students of Junior college / (10+2, Level) who opted for the science (Physics, Chemistry, and Biology) subjects.

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Method:

- 1) A standardized test prepared by D. N. Sansanwal and Anuradha Joshi is administered to XI STD students for finding the mental ability in science, and the *marks scored* by them would be the *mental ability* of the students. The tool used is a standardized tool of proved validity and reliability; hence it may be presumed to provide dependable measures of the abilities in the questions.
- 2) To assess the XI standard students in terms of Mental ability, i.e., at four levels— application, analysis, synthesis, and evaluation.
- 3) Four hundred students belonging to three media, Urdu, Marathi, and English, were taken as a sample.
- 4) Equal numbers of students were added from each medium.
- 5) An equal number of *Schools / Jr Colleges* and samples are selected from English, Marathi, and Urdu medium schools.
- 6) In this research, 1200 sample is used for each school from the cities based on stratified random sampling.

Analysis of Data:

Table 1 - Test of Normality

<i>Normality Tests</i>							
	Language Type	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Achievement in Physics	Mother Tongue (L1)	.076	758	.000	.983	758	.000
	Second Language (L2)	.093	389	.000	.977	389	.000

a. Lilliefors Significance Correction

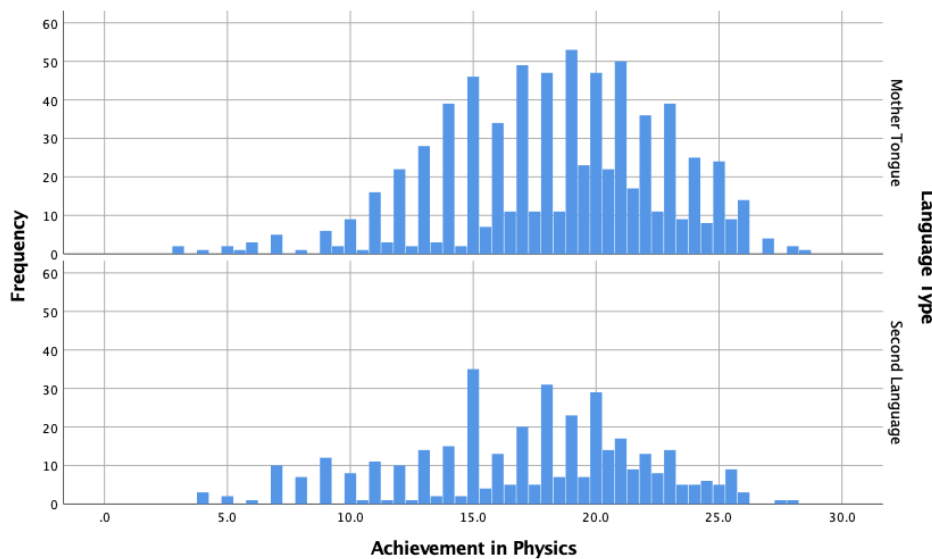
The normality of data for students' achievements with mother tongue (L1) and second language (L2) as an instructional medium was assessed using the Shapiro-Wilk test. As shown in table-1, the Shapiro-Wilk test shows that the scores are not normally distributed; the *p-value* is less than .05; therefore, the null hypothesis for normality is rejected.

Table 2 - Test of Homogeneity of Variance

<i>Homogeneity Test of Variance</i>					
		Levene Statistic	df1	df2	Sig.
Achievement in Physics	Mean	5.305	1	1145	.021
	Median	4.190	1	1145	.041
	Median and with adjusted df	4.190	1	1132.617	.041
	trimmed mean	5.163	1	1145	.023

The *Homogeneity of Variance* of data for the achievements of students with mother tongue (L1) and second language (L2) as an instructional medium was assessed, by using the was evaluated, by using the Levene test. As shown in table-2, the Levene test shows that the groups are not homogeneous. The *p-value* is less than .05; therefore, the null hypothesis for *Homogeneity of Variance* is rejected. In the below figure 1, the distribution of the two groups is not the same.

Figure 1 - Similarity of Groups





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The Mann-Whitney U test is used to analyze two samples that are likely to be originated from the same underlying population; therefore, in this research, the Man Whitney U test is used to analyze data.

Table 3 - Mean Rank

<i>Ranks</i>				
	Language Type	N	Mean Rank	Sum of Ranks
Achievement in Physics	Mother Tongue (L1)	758	598.15	453395.50
	Second Language (L2)	389	526.95	204982.50
	Total	1147		

Table 4 - Man Whitney U Test

<i>Test Statistics<sup>a</sup></i>	
	Achievement in Physics
Mann-Whitney U	129127.500
Wilcoxon W	204982.500
Z	-3.450
Asymp. Sig. (2-tailed)	.001
a. Grouping Variable: Language Type	

### Results

The sample size is 1147; therefore, the asymptotic significance is used for the hypothesis testing. In this study, the null hypothesis is "there is no significant difference between the mental ability of XI standard boys and girls in the physics subjects ."The significance value

(2-tailed) is .001; therefore, the null hypothesis is rejected. Thus the data analysis shows a significant difference between the achievements in the physics subject of students with mother tongue (L1) and second language (L2) as an instructional medium. The analysis of the Mann-Whitney U-Test shows that the difference between the achievements in the physics subject of students with mother tongue (L1) and second language (L2) as an instructional medium was statistically significant,  $U=146247.500$ ,  $p=.001$ ,  $r=.009$ . Students' achievement in physics subject with mother tongue (L1) ( $M = 598.15$ ) as a medium of instruction is higher than students' achievement in physics subject with a second language (L2) ( $M=544.15$ ) as a medium of instruction. The effect size value is  $r =.009$ , which is a small effect.

### Discussions and Conclusion

Language of children helps incomprehension of the concepts and laws in Physics, and most of the children's thought processes depend on children's linguistic abilities. Since children's mother tongue (L1) is well developed, they memorize the scientific concepts and better perceive the scientific phenomenon when the medium of instruction is in their mother tongue (L1). In most research, it has been observed that mental abilities are mostly related to cognitive aspects of learners; therefore, in this research, students' achievements are considered mental abilities. The research analysis shows a significant difference in the achievements in physics subjects among students with the medium of instruction as a mother tongue (L1) and second language (L2),  $U=146247.500$ ,  $p=.001$ ,  $r=.009$ . The data analysis shows that students' achievement in physics subjects with mother tongue (L1) ( $M = 598.15$ ) as a medium of instruction is higher than the achievement of students in physics subjects with a second language (L2) ( $M=544.15$ ) as a medium of instruction. The effect size is  $r =.009$ ; therefore, it is a small effect. Thus, the findings show that the students whose medium of instruction is mother tongue (L1) than their mental abilities are higher. Therefore, their achievements in physics are better than those whose medium of instruction is a second language (L2) or other than the mother tongue (L1).

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