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Achievement in Chemistry: A Comparative Study of Students from Different Instructional Mediums

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ABSTRACT: This study examines the academic performance of students in chemistry at the higher secondary level. The objective is to analyse the notable differences in chemistry achievement between Tamil Medium and English Medium students in the Cuddalore district of Tamilnadu. The survey involved randomly selecting 50 students from each medium and using an achievement test developed by the investigator. The collected data was analysed using independent samples t-test and ANOVA. The study findings revealed a significant difference in chemistry achievement between Tamil Medium and English Medium students, which suggests the medium of instruction plays a vital role in achievement in chemistry.

KEYWORDS: Achievement in Chemistry, Higher secondary level, Achievement test.

I. INTRODUCTION

This study examines the academic performance of higher secondary school students in chemistry, with a precise focus on the effect of the language of instruction (Mandler et al., 2012). In Tamil Nadu, where both Tamil and English are commonly used as a medium of instruction, understanding how these languages impact students' performance in chemistry can offer valuable insights for educators, policymakers, and curriculum developers.

Chemistry is a subject that involves both theoretical concepts and practical applications, which can be challenging for students. The language of instruction can affect students' understanding of complex scientific terms and concepts and therefore influence their academic performance (Metz, S. (2016). This study aims to examine the differences in chemistry achievement between students who were instructed in Tamil and those who were instructed in English in the Cuddalore district. The goal of this research is to compare the academic performance of students from both language mediums to identify any significant differences. The ultimate objective is to contribute to a better understanding of how language impacts learning outcomes in the field of science education.

II. REVIEW OF LITERATURE

Schaerexamined the influence of the language of instruction on students' academic performance in science subjects. He emphasized that students who were taught in their native language tend to achieve better results in complex subjects because they have a better understanding of scientific terminology. Additionally, he pointed out that switching to a second language as the medium of instruction can present considerable challenges, especially in grasping subject-specific jargon **(Schaer, 2021)**.

Nguyen explores the impact of the language of instruction on science learning outcomes in secondary education. The results indicate that students who were taught in their native language demonstrate better comprehension and retention of scientific concepts compared to those instructed in a second language. The study underscores the importance of implementing customized instructional approaches to address language barriers in science education**(Nguyen, 2022)**.

Patel explored the same issue through the STEM fields and provided evidence that students who were proficient in the language of instruction tended to achieve higher academic outcomes in science and mathematics. The study suggests that effective teaching strategies and support systems are crucial for students learning a second language**(Patel, 2023)**.

III. SIGNIFICANCE OF THE STUDY

This research aims to fill the research gap in the existing review of literature:

➢ Limited research has been done on how the language of instruction influences academic performance, particularly in core science subjects such as chemistry in the context of Tamilnadu.
➢ Many studies on the medium of instruction and academic performance are often conducted at a national or statewide level, with limited focus on specific districts or regions.
➢ There is a lack of empirical studies that quantitatively compare the academic performance of students in Tamil Medium versus English Medium in a specific subject, such as chemistry.

By addressing these gaps, this study would contribute to the existing body of knowledge and would provide practical insights that could help improve educational strategies in the Cuddalore district and those districts thatexhibitsimilar contexts.

IV. OBJECTIVE OF THE STUDY

The objective of the study is to find the significant difference between the students of English medium and Tamil medium in their achievement in Chemistry.

Hypotheses of the study
➢ There is nosignificant difference between the students of English medium and Tamil medium in their achievement in Chemistry.
➢ There is no significant difference between the means of instructional mediums.

V. METHODOLOGY

To conduct this study, the survey method has been used.
Procedure for Sampling
The sample comprised 100 higher secondary first-year chemistry learning students, with 50 students from English medium schools and 50 from Tamil medium schools from the district of Cuddalore, Tamilnadu through stratified random sampling method.

Tools used
To investigate student achievement in Chemistry at the high school level, a questionnaire was formed in English and Tamil by the investigator from the 11th standard chemistry syllabus which was already learned by the students.

Statistical Techniques used
For data interpretation independent samples t-test and ANOVA were used through JASP.

Data Analysis
Hypothesis 1: There does not exist a significant difference between the students of English medium and Tamil medium in their achievement in Chemistry.

Table 1: t-values for English and Tamil medium students

Sl. No	Group	N	M	SD	t-value	p-value	Remarks
1	English Medium	50	49.60	8.76	2.67	0.009	Significant
2	Tamil Medium	50	54.47	9.39			

From Table 1 the t-value of 2.669 indicates the difference between the means of the two groups and the p-value of 0.009 concludes that the observed difference between the means is statistically significant at a 0.01 level of
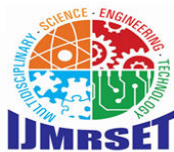
significance. Thus, the null hypothesis can be rejected and significantdifferences can be observed between the students of English medium and Tamil medium schools.

Hypothesis 2: There is no significant difference between the means of instructional mediums.

Table 2: ANOVA Achievement in Chemistry

Cases	Sum of Squares	df	Mean Square	F	P
Group of study	98.819	2	49.410	0.588	0.557
Medium of instruction	488.965	1	488.965	5.820	0.018
Group of study ✳ Medium	84.623	2	42.312	0.504	0.606
Residuals	7813.555	93	84.017		

From Table 2 it is observed that for the group of study, the f value is 0.588 and the p value is 0.557 which is insignificant. The F value for the Medium of instruction is 5.82 and the corresponding p-value is 0.018 which is significant at 0.05 level of significance. The F value for the Group of study and the medium of instruction is 0.54 and 0.606 which is insignificant at the 0.05 level of significance. From the above table values the null hypothesis is rejected and there exists a significant difference between the means of instructional mediums.

VI. RESULTS AND DISCUSSION

The results of the independent t-test indicate a statistically significant difference in the academic achievements in chemistry between students from English medium and Tamil medium schools. This emphasizes the impact of the instructional medium on learning outcomes. With a t-value of 2.669 and a p-value of 0.009, it is apparent that students' performance is significantly influenced by the language in which they were taught.

Recent studies are examining the impact of English Medium Instruction on student achievement, particularly in regions where English is not the native language. A study conducted in 2023(Han, 2023) pointed out that while using English as a medium of instruction can enhance global competence and English proficiency, it can also place additional cognitive demands on students, especially in complex subjects like chemistry. This could lead to lower academic performance compared to students learning in their native language, as they may struggle to comprehend the content and become proficient in the language.

Based on research by Pun (2023), English Medium Instruction can foster a more competitive academic environment. However, students often require advanced language proficiency and cognitive strategies to excel. This poses a particular challenge for students primarily exposed to English within an educational setting, which is likely the case for many students transitioning from Tamil medium schools to English Medium.

VII. EDUCATIONAL IMPLICATIONS

The observed difference in chemistry achievement between Tamil Medium and English Medium students suggests that the medium of instruction plays a crucial role in academic success, particularly in subjects that require a strong understanding of complex concepts, such as chemistry. Hence:

➢ Educators and curriculum developers should consider integrating bilingual approaches or providing increased support for students in English Medium instruction. This support could include additional language support and the use of bilingual resources to ensure that students who are learning in a non-native language medium can fully understand the subject matter.

➢ The study highlights the necessity of specialized training for teachers in English Medium Instruction settings.

➢ Schools in regions with diverse linguistic backgrounds should be equipped with the necessary resources to support both Tamil Medium and English Medium instruction. This includes access to quality textbooks, teaching aids, and language support programs tailored to the specific needs of each medium.

VIII. RECOMMENDATIONS

Based on the study's findings, the following recommendations are proposed:

➢ Need to focus research on developing and implementing bilingual education programs in schools to bridge the gap between Tamil Medium and English Medium students.

➢ Additional research should be conducted to explore the long-term effects of the medium of instruction on academic achievement across different subjects and educational levels. This research should also consider the socioeconomic and cultural factors that may influence students' performance.

➢ Educational policymakers should consider revising language policies to promote equity in education. This might involve offering more flexible language options in exams and classroom instruction or providing professional development opportunities for teachers to better support multilingual students.

IX. CONCLUSION

The findings add to the increasing evidence indicating that while English Medium instruction can provide certain benefits, it also poses significant challenges, especially in regions where English is not the main language. As educational policies continue to develop, it's important to strike a balance between the need for global competencies and the cognitive demands placed on students. This will ensure that instructional practices effectively support all learners.

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