# Exploring Factors Responsible for Low Achievement in Science at Secondary Level in Odisha

**Srutirupa Panda**
Lecturer in Education, Nabakrushna College of Teacher Education, Angul, Odisha, India

## Abstract

Science is one of the compulsory and demanding fields of school education that provided sufficient systematic logical knowledge and experience related to matter of living as well as non living world. Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. These days science has significant vocational and educational value. However it is observed that that achievement level of students in science subject at secondary level is not satisfactory due to various reasons which are not only serving as serious barriers to adequate science education in the country but also for the obstruction of national development and prosperity in terms of future citizen's proper understanding in science. Therefore it is necessary to undertake one action research to find out the factors responsible for student's poor achievement in science. The present study tried to significant factors contributing for the low achievement of students at secondary level by constructing one tool i.e. Interview Schedule to map the factors causing low achievement in science at secondary level. The finding suggested that maximum percentage (81.66%) of students confirmed low quality of science teaching as a significant factor for their low achievement in science where as 66.66 percentage of students supported faulty teaching method for this same problem. Average percentage of students confirmed that Curriculum and instructional materials (53.33%), Psychological factors (43.33%), are the barrier categories that providing factors for low achievement in science. However, only 35 % as well as 30% students have approved infrastructural and socioeconomic factors for their low achievement in science respectively. The paper also suggested that by improving content knowledge and pedagogical competency of science teachers in terms of in-service and pre service teacher education, this serious problem from science education can be removed.

**KEYWORDS:** Exploring Factors, Science at Secondary Level, Odisha

## Introduction

Now a days Science in school education has attained a significant and compulsory place because of its wide application in daily life as well as for providing vast scope at vocational field. Science is an active, energetic, broad field of knowledge and experience that made people to acquire suitable skills and competencies to adopt the changing world and to change the world in a favorable direction. Not only the individual but also the whole nation and human civilization have been taking advantages of Science for personal and collective growth and development. Learning Science is one of the challenging tasks undertaken by the individual student. With this respect the role of science teacher in the society is crucial as they are having the great responsibility to teach science in an effective way so that nation can get competent man power in the field of Science and Technology. To accomplish this challenging task, science teachers not only need to develop and implement appropriate Science

pedagogy and to demonstrate successful pedagogical competency in classrooms but also has to find out the cause behind the low achievement of students in science by conducting action research. In this context the demand of constructing a tool to assess and map the factors responsible for poor achievement of science learner has recently been felt for conducting research in the field of science education.

The purpose of the paper is to construct one tool, administer that in on students and to explore the factors responsible for poor achievement in science in secondary schools of orissa.

**Sensing and Defining the Problem**

Comparing the international data of National Sample Survey for India by Riboud, Savchenko and Tan (2006), and Barrow and Lee (2004) international data on education, for China it was found that in 2004, the secondary educational attainment of China is 46% where as the same in India is only 16%. According to Geeta Gandhi Kingdon (2007) learning achievement, in India, at secondary level is seriously low. Kin Bing Wu and Amit Dar from World Bank (2006) while studying "Secondary Education India Investing in Future" have reported low enrollment and achievement at secondary level. They have pointed out that sample of students from Orissa state have got lower achievement under Third International Mathematics and Science Study (TIMSS) indicating lower quality of secondary education of India at international level. According to them, too much emphasis on rote learning and insufficient development of conceptual understanding and higher order thinking are two possible reasons for this low achievement. In addition to this it is also found that in orissa the poor achievement in science as well as failure in science subject is more frequent. Students perform achieve lower marks in several test conducted at secondary level. This situation in orissa demands to conduct one study that could explore the factors responsible for low achievement of students in science at secondary level.

Thus the problem can be stated as ***Factors responsible for low achievement of students in science at secondary level.***

**Research Questions**

1. What are the major factors responsible for low achievement of students in Science?
2. How are the factors influencing learner's achievements in science?
3. How can the factors responsible for poor achievement be removed?

**Objectives of the Study**

Objectives of the study are:

- To construct one tool to identify the factors responsible for low achievement in science in secondary schools.
- To implement the tool and collect and analyze the data.
- Explore the factors accountable for low achievement in science.
- To suggest remediation for controlling the factors responsible for low achievement in science at secondary level.

## Significance of the Study

The significance of this study is that it will provide insight into why students attain lower proficiency levels in science compared to the other content areas when taking the achievement test. Recognizing deficiencies in our educational process will allow recommendations to be made as to how to attain a level of higher performance in science at secondary level.

## Review of Literature

Becker and Aloe (2008) conducted a study on *Teacher Science Knowledge and Student Science Achievement* They found that, first, that the amount of evidence on the relationship of science teacher knowledge to student outcomes in science is not extensive, and is not of very high quality. (2) The co relational studies reveal that, on average, teacher knowledge in science has a slight positive correlation with student science achievement. However, literature suggests that the relation of teachers' content knowledge to science achievement is weak, and provides a very poor basis for claiming that science subject-matter knowledge is among the "most important" attributes of highly qualified teachers. James Keith Palme (2009) conducted a study on "factors that contribute to low achievement on the science portion of the ohio high school graduation test". The study emphasized the literature and reveals some interesting points that shows there exists a serious lack of time and effort spent in preparing students for taking tests like the Ohio Graduation Test in elementary and middle schools. . The 2000 National Survey of Science and Mathematics Education, NSSME, (Weis et. al., 2001) was a survey taken of 5,765 science and mathematics teachers in schools across the United States to assess how well prepared science and mathematics teachers are, and to determine what barriers exist to "effective and equitable science and mathematics education." . The importance of positive parental support and involvement in science learning is discussed by Van Voorhis (2003). In this study, a body of sixth and eighth grade students was broken into two groups with one group completing interactive homework (parent involved) and the other group completing non-interactive homework (no parental involvement) for the eighteen-week study. The interactive group returned more homework assignments and students were more accurate. The interactive group also earned higher report card grades. Granted, this is a limited study. However, it does provide interesting support for the correlation between a student achievement levels in science and the amount of parental involvement that exists. In review of the first research question, the literature has revealed that the major factors that appear to be affecting student performance in science on the Ohio Graduation Test are: 1) lack of instructional time spent on science education through elementary school and middle school; 2) lack of teacher preparedness, either in educational background, experience, or by improper assignment; 3) attitudinal beliefs relating to culture and socioeconomic status that hinder high achievement in science, and 4) lack of parental involvement in science education. A recent literature review on student diversity and science education (Lee & Luykx, in press) discusses a number of issues that should be considered in addressing student achievement gaps in science. These can be grouped as follows:

### *Curriculum Materials and Instructional Strategies*

Appropriate curricula, materials, and pedagogy can decrease science achievement gaps. The culture of Western science is foreign to many students. Most current classroom science materials are not culturally relevant to non-mainstream students and do not adequately represent cultural diversity. Science instruction may reinforce power structures that privilege mainstream students, and other students may actively resist the approaches being used. This is exacerbated by teacher expectations that are lower for non-mainstream students. All students, including those from low income families, English language learners, and specialneeds backgrounds as well as those with limited science experience, can engage in scientific inquiry, reasoning, and argumentation. Science teachers must learn to base instruction on content drawn from students' everyday knowledge and scientific practices. Science assessments may become more valid and equitable by making them relevant to student and community knowledge and experiences so that students can demonstrate what they know. Certain assessment formats are more equitable than others.

### *Teacher Quality*

Much of the variation in student achievement in science is attributable to teacher characteristics. Teachers need not come from the same racial/ethnic backgrounds as their students in order to teach effectively, but they must understand and respect their students' backgrounds. Science teachers must earn their students' respect before they can offer content information. Science teachers need to engage in reform-oriented practices themselves in order to be able to provide effective science instruction for their students.

### *Other Interventions*

A variety of other interventions can affect science achievement. At the school level, restructuring efforts, such as reducing tracking, can narrow science achievement gaps, Family support, including homework supervision, learning materials and resources, and parent's educational background, influences children's achievement, attitudes, and aspirations in science.

## Methodology

Typically, action research is undertaken in a school setting. It is a reflective process that allows for inquiry and discussion as components of the "research." Often, action research is a collaborative activity among colleagues searching for solutions to everyday, real problems experienced in schools, or looking for ways to improve instruction and increase student achievement. Rather than dealing with the theoretical, action research allows practitioners to address those concerns that are closest to them, ones over which they can exhibit some influence and make change. Practitioners are responsible for making more and more decisions in the operations of schools, and they are being held publicly accountable for student achievement results. The process of action research assists educators in assessing needs, documenting the steps of inquiry, analyzing data, and making informed decisions that can lead to desired outcomes. Current study is a kind of action research where researcher tried to find the factors responsible for low achievement among learners.

**Sample**

The action research was conducted by investigators in three Govt. schools of Angul district of Orissa. For the present study total 60 students of Class IX were taken as sample who has secured less than 50 % in science subject in their previous achievement test.

**Tool**

For the present study one interview schedule tool was constructed to find out the factors influencing low achievement of learners in science positively. Basing on the above review of literature as well as through critical observations the following factors are suspected as the significant factors responsible for the poor achievement of the learners. Those are as follows:

- Curriculum and Instructional Material
- Teaching Method
- Quality of Teacher
- Psychological Factors
- Socio Economical Factors.

The interview consists of total 33 items which are distributed among six major prospective factors and represent them.

**Table-1: Details of criteria and Indicators of Interview Schedule**

| Criteria | Indicators | Remark/ Additionl Statements |
|---|---|---|
| **1.Curriculum and Instructional Material** | 1. Do you feel science chapters are difficult? | Yes/No |
| | 2. Do you think scientific activities and experiments are not interesting? | Yes/No |
| | 3. Is your Science book attractive? | Yes/No |
| | 4. Does your teacher show pictures, charts, diagrams, models in science class? | Yes/No |
| | 5. Have you never seen scientific apparatus and materials? | Yes/No |
| **2.Teaching Method** | 6. Does your teacher give you opportunity to share your view during science class? | Yes/No |
| | 7. Do you get opportunity to observe objects during science class? | Yes/No |
| | 8. Do you perform experiments in science class? | Yes/No |
| | 9. Do you visit outside to learn science with or with out your teacher and friends during science class? | Yes/No |
| | 10. Does your teacher assign projects and activities to you for learning new concept in science? | Yes/No |
| **3.Quality of Teaching** | 11. Has your science teacher good knowledge of science content. | Yes/No |
| | 12. Does your science teacher give latest knowledge in science? | Yes/No |

| | | |
|---|---|---|
| | 13. Does your science teacher refer other books except science text book? | Yes/No |
| | 14. Could your science teacher resolve your doubts and queries correctly? | Yes/No<br>Yes/No |
| | 15. Does your science teacher performs scientific experimentation and demonstration? | Yes/No |
| | 16.Does your science teacher gives examples while teaching? | Yes/No |
| | 17. Does your science teacher explain very fast so that I could not understand? | Yes/No |
| | 18. Does your science teacher use low cost no cost teaching material? | Yes/No |
| | 19. Can you understand teacher's black board work in science class? | Yes/No |
| | 20. Does your science teacher draw diagram on black board? | |
| | 21. Does your science teacher frequently ask you difficult questions what you can not understand? | |
| **4. Psychological Factors** | 22. Do you feel science is boring? | Yes/No |
| | 23. Do you fear science? | Yes/No |
| | 24. Do you think science is not different from other subject in having some specific qualities? | Yes/No |
| | 25. Do you examine every fact while learning science with out accepting it what is written in book? | Yes/No |
| | 26. Do you want to take science as a subject in my future higher study? | Yes/No |
| **Criteria** | **Indicators** | **Scale Value** |
| **5.Socio Economical Factors** | 27. Do you get cooperation from your parents to learn and understand scientific concepts? | Yes/No |
| | 28. Do you get help from your family and neighbors in preparing scientific projects and participate in science fair? | Yes/No |
| | 29. Do you have sufficient money to purchase some extra books, related to science? | Yes/No |
| | 30. Do you participate in science fair as I don't have money to purchase material for constructing models. | |
| **6. Infrastructural Barrier** | 31. Does your school lacks in laboratory and laboratory equipments? | Yes/No |
| | 32. Does your school library has several interesting books related to science are available? | Yes/No |
| | 33. Are you satisfied with all the infrastructure of school? | Yes/No |
| | | Yes/No |

**Administration of Tool and Collection of Data:**Researchers have administered the interview schedule to each f the student and tried to find out the cause behind their poor performance. Student has to respond in 'yes' or 'no' and further explanation for each response was collected which was recorded and documented

**Analysis and Interpretation of Data**

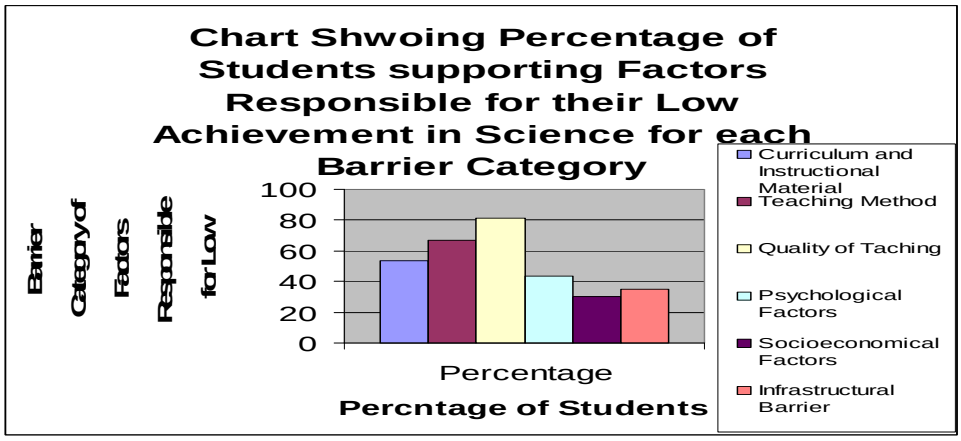
The data are collected from 60 students and analyzed according to their response towards the interview question. The responses are analyzed qualitatively by putting inductive and deductive approach as well as by utilizing percentage technique. The analysis is done using percentage.

***Table: 3 Number and Percentage of students suggesting for each Factor***

| Category | Number of Students supporting Factor Responsible for their Low Achievement in Science for each Category | Percentage of Students supporting Factor Responsible for their Low Achievement in Science for each Category |
|---|---|---|
| Curriculum and Instructional Material | 32 | 53.33 |
| Teaching Method | 40 | 66.66 |
| Quality of Teaching | 49 | 81.66 |
| Psychological Factors | 26 | 43.33 |
| Socioeconomic Factors | 18 | 30 |
| Infrastructure Barrier | 21 | 35 |

Data are collected from reach student who has secured less than 50 % marks in science at secondary level from class IX. Some students have responded more than one factors strongly for their low achievement. It is found that maximum number and percentage (81.66) of students suggest low quality of teaching in science. According to them they are not able to understand as well as not satisfied with the teacher's teaching in classroom. They are not convinced with the quality of teaching inside the classroom. Maximum percentages of students have agreed that science teacher does not clear their doubt appropriately. Further science class is not attractive as well. Science teacher does not use experiment, activity, teaching aids frequently in the class. Many students are not satisfied with the black board work of the science teacher. Some of them are confused with the scientific diagram drawn by the teacher.About 66.66 % of responses of students suggested that the method used in science class is not adequate,. Method adopted by the teacher is monotonous and unattractive.. Teaching Methods such as demonstration cum discussion, observation, enquiry, discovery, and project are not adopted in science class. In addition to this 53.33 % of students response suggested that inappropriate curricular and instructional materials are used in the science class. Maximum students have responded that science text book is not

attractive and it is complex one. Further students have reported that teaching learning materials are old one, unattractive, complex, type. Again 43.33 %of responses of science students confirm one undesirable fear, lack of interest, attitude towards science subject. Many students have suggested that science s not different from other subject and it is not special as well unique. Lack of scientific attitude was observed among them. So some psychological factors also contribute for their low achievement. Further only 35% of students are not satisfied with the infrastructures related to science teaching and learning,. According to them unavailability of reference books, as well as lack of equipments, chemicals, apparatus, laboratory made them unable to understand scientific facts, principle correctly. At last minimum percentage (30%) of students confirmed socioeconomic problems as a barrier for their high achievement in science. Maximum of them were girls who are not getting time to learn science due to household work load at home. However some students belonging to very poor back ground have strongly blamed socio economical factors for their low achievement in science.




## Findings, Suggestion, Conclusion

Findings of the study are as follows:

- Maximum percentage (81.66%) of students confirmed low quality of science teaching as a significant factor for their low achievement in science where as
- Second maximum percentage (66.66%) of students supported faulty teaching method for this same problem.
- Average percentage of students confirmed that Curriculum and instructional materials (53.33%), Psychological factors (43.33%), are the barrier categories that providing factors for low achievement in science.
- Minimum percentage of students responded i.e. only 35 % as well as 30% that infrastructural and socioeconomic barrier category contributed significant factor for their low achievement in science respectively.

It is evident from the above analysis that maximum percentage of low achiever stated supported low quality of teaching and inadequate method of teaching as the most significant barrier category in their low achievement in science. In this

regard it is very important to raise the quality of teaching science at secondary level which is nothing but a demand from the quality science education. In this context there arises a strong need to design, construct tools to map teaching competency of science teacher to explore the factors related to good science teaching. In addition to this it is also significant to find out what is the level of content knowledge of science teacher's in secondary schools in the state. There is a need of further research to solve this terrific problem related to low achievement in science. There are various causes that are affecting the achievement of the lower secondary school students in Odisha. Poor quality of physical, human, financial recourses may be considered for this setback. Inappropriate number of infrastructure material, teaching learning material, school building, hostel. Laboratory, library facility or lack of adequate number of human resources such as teacher, laboratory staffs may be responsible for this problem. In addition to this poor quality of teaching is suspected as one of the major significant cause of this problem. As education is propagated to the students by one of the most important stakeholder of this system, role of the teacher and his/ her relation to the low achievement problem can not be overlooked. Teacher is the pillar of the education system that carries out main responsibility of teaching in classroom and motivates students to achieve well. Thus among the various areas of quality improvement in education, one of the most significant areas is developing the quality of teachers as teachers occupy an unchallengeable position in educational process. They play versatile role in all-round development of the personality of children during their study in secondary school. Many observers look to the nation's teaching force as a source of national shortcomings in student math and science achievement. A recent review of the research on teacher quality conducted over the last 20 years revealed that, among those who teach math and science, having a major in the subject taught has a significant positive impact on student achievement. (Jeffrey J. Kuenzi 2008).Thus secondary school teacher should act as a competent architect of building effective human personalities for the country. .In this context, the absolute role of the science teacher is incontrovertible. Because, in recent times the subject Science is considered as an active, energetic, broad field of knowledge and experience. In secondary school education, it has attained an imperative and compulsory place because of its wide application in daily life as well as for providing vast scope to follow livelihood. Science has made people to acquire suitable skills and competencies to adapt the vast changing world. To make students obtain worth knowledge, understanding, and skill in such a noteworthy subject field the role of the science teacher is very essential as well as significant. Science teachers provide a framework to help children to think in scientific ways. Science teacher also creates an environment in which learners learn scientifically and develops understanding over content, acquire reasoning power, nurture problem solving capacity plus critical thinking as well as widen students' mental horizon in propagating scientific attitude and scientific temperament. In this concern, science teachers need to develop some qualities such as good content knowledge and pedagogical competency to carry out such an important task of teaching science effectively to students. For this purpose appropriate in service and pre service teacher education and training programs should be provided to the science teachers So that students would be able to achieve maximum score in the achievement test.

**References**

Chapin, J.R. (2006). The Achievement Gap in Social Studies and Science Starts Early: Evidence from the Early Childhood Longitudinal Study, Social Studies, v97 n6 p231-238.

Lee, V.E. & Burkman, D.T. (2002). Inequality at the starting gate: Social background differences in achievement as children begin school. Washington, DC: Economic Policy Institute.

Palmer, J.K., (2009) Factors that Contribute to Low Achievement on the Science portion of the Ohio High School Graduation Test: A Master's Seminar Paper Presented to The Faculty of the College of Education Ohio University.

Smith, F.M., & Hausafus, C.O. (1998). Relationship of Family Support and Ethnic Minority Students' Achievement in Science and Mathematics. Science Education, v82, issue 1, 111-125.