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Achievement in Science and Attitude towards Science Practical among Secondary School Students of Patna

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Abstract

Practical work is defined as any science teaching and learning activity that involves students, working individually or in small groups, manipulating, and/or observing real objects and materials instead of the virtual world. The teaching of science offers students the ability to access a wealth of knowledge and information, which will contribute to an overall understanding of how and why things work as they do. Science can explain the mechanics and reasons behind the daily functioning of complex systems, ranging from the human body to sophisticated modern methods of transport. Children and students can use this knowledge to understand new concepts, make well-informed decisions, and pursue new interests. Thus, there is a compulsory role of science practicals in science teaching, and it is always important to study its implications on the students' science achievement. The study here has investigated this and found out if there is any relationship between science achievement and attitude towards science practicals. The study has been conducted on 120 students administering the standardized test on attitude towards science practicals. This study used a 30-item science attitude scale adapted from Prokop *et al.* (2007). The findings showed that the differences existed in science achievement based on gender and location of the schools. In contrast, in terms of attitude towards science practicals, the difference only existed based on the schools' area of location. It was also found that there existed a significant relationship between achievement in science and attitude towards science practical among secondary school students of Patna.

Keywords: Attitude towards science practical, Science education, Science practical.

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Introduction

It is commonly assumed that students' attitudes in science influence their learning outcomes, their science course selections, and their future career choice among educators and researchers alike. Thus, changing attitudes should lead to changing behavior (Nieswandt, 2005).

Practical work is defined as any science teaching and learning activity that involves students, working individually or in small groups, manipulating and/or observing real objects and materials instead of the virtual world. This practical work has become a well-established part of India's secondary school science as part of the national curriculum. Indeed, since 1988, the national curriculum has brought about "practical work by order," and current science teaching involves students carrying out practical work within their biology, chemistry, and physics lessons. As is currently practiced, students claim to find practical work an "enjoyable and effective way of learning science." One common theme that emerges from these studies is the need "to arouse and maintain" positive attitudes in students to improve the likelihood of continuing to study science post compulsion. While there are concerns about the decline in the number of students continuing with science, no studies have specifically focused on students' attitudes to practical work within biology, chemistry, and physics.

Background of Study

In contrast to previous studies that have looked at students' attitudes within the broader context of their attitudes to science, they specifically investigate the affective value of practical work in biology, chemistry, and physics, i.e., broader sciences. This study aims to provide insight into secondary school students' attitudes to practical work that will be of use to those involved with classroom teaching and amongst science educators. The importance of students' attitudes to affect their achievement and interest within a particular discipline is positively interrelated. Thus, by researching students' attitudes to practical work, this study will support teachers in supporting their students to achieve in their subject. One of the main issues with previous studies has been the fact that the claims tend to be generic and go a little further than reporting that practical work is seen as enjoyable. Indeed, practical work is rated highly by students in terms of their attitudes to, and enjoyment of, school science. It is explained that while students' attitudes to practical work in science were seen positively, the evidence is currently equivocal, and therefore, this area would be benefited from further research. Therefore, this study aims to separate students' attitudes to science in general from their attitudes to practical work in particular amongst students across the secondary school age range and three sciences.

Further to the gap in the research on students' attitudes to practical work, this study aims to contribute to knowledge on what it really means when students claim to enjoy practical work to investigate the affective reasons for these claims further. Previous studies have reported on the effective value of practical work, claiming that it motivates students, that it is better than writing, or helps support their understanding of theory, but the claims rarely go further to explain why students hold the views they do about practical work. This study aims to understand what practical

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work students feel positive or negative about and why it is the case. To understand why students may find it better than writing or why it helps them understand the theory. A further important reason for undertaking this study is the concern that practical work's potential motivational value is not fully utilized due to a lack of clarity regarding students' attitudes towards it in each of the three sciences. By better understanding students' attitudes to each science, it might be possible to structure the use of practical work better to generate enduring personal interest that would lead to increased uptake in the post compulsion stage of their education. The study focuses on three areas. The first relates to examining students' attitudes to practical work in secondary school science and understanding their attitudes. The second area compares and contrasts students' achievement in science across different gender and other background variables under study. The third and final area investigates the relationship between students' attitudes to practical work and their achievement in science.

Review of Related Literature

The importance of researching students' attitudes towards science has been highlighted by the Organization for Economic Co-operation and Development (OECD) (2010). They believe that a student's "scientific literacy" should include certain attitudes and beliefs that effectively possess and utilize it. It is believed this will benefit the individual, society, and worldwide. Yet the importance of attitudinal research, primarily attitudes towards science, is not a recent science education area (Kim & Song, 2009; Nieswand, 2005; Osborne, 2003).

Radhamonyamma (1988) studied "Evolving instructional techniques appropriate to the development of various scientific skills among secondary school pupils in Kerala." The study found that: (1) The newly evolved method for teaching scientific skills through tested lesson plans was more effective than the traditional method, and (2) The correlations between marks scored in different science subjects were higher for the experimental group than the control group.

Dainton (2006) highlighted the issue regarding scientific attitudes moving away from science and by the mid-1970s and began researching students' attitudes to science. They reported that practical work was important for enhancing attitudes, stimulating interest and enjoyment, and motivating students to learn science.

Korwin and Jones (1990) that hands-on activities can enhance positive attitudes and cognitive growth among the students.

Kim and Song (2009), they separated conventional instruments of an attitude towards science into either intrinsic (related directly to students) and extrinsic (related to social viewpoint). They found intrinsic attitudes towards science, like "school science is easy," influenced students' interest and conceptual understanding. Conversely, finding also showed students' extrinsic attitudes towards science, like "science offers better job opportunities for the future," failed to influence in the same way.

Koballa and Glynn (2007) suggested that students' affective factors consist of two theoretical areas: their attitudes towards science and their interest in science topics. The interest here means a direct causal factor influencing students' learning behavior.

Toplis (2012) found that practical work itself appears to have little impact on motivation influencing continued uptake in science. Therefore, while students may show that positive attributes within the affective domain, they need not hold positive attributes within either of the other two domains.

Significance of Study

The teaching of science offers students the ability to access a wealth of knowledge and information, which will contribute to an overall understanding of how and why things work as they do. Science can explain the mechanics and reasons behind the daily functioning of complex systems, ranging from the human body to sophisticated modern methods of transport. Children and students can use this knowledge to understand new concepts, make well-informed decisions, and pursue new interests. Science also helps to provide tactile or visible proof of many facts we read about in books or see on the television. This helps to increase understanding and helps children and teenagers to retain their information. Many students find science extremely inspiring and interesting. Science instills a sense of intrigue and enables students to develop understanding and form questions based on the knowledge they already have and the insight they wish to gain in the future. Students who excel in science lessons are likely to develop a strong ability to think critically. As it appears in the science education literature, the scientific attitude embodies the adoption of a particular approach to solve problems, assess ideas and information, or make decisions. Using this approach, the evidence is collected and evaluated objectively, so that the individual's idiosyncratic prejudices making the judgment do not intrude. No source of relevant information is rejected before it is fully evaluated, and all available evidence is carefully weighed before the decision is made. However, while it may be obvious that the scientific attitude is important in the professional lives of scientists and that students learning about science should also become aware of the motive power which impels scientists in their work, it is not a simple matter to move on to the conclusion that school students, many of whom do not intend to become scientists, should actually be encouraged to adopt this attitude themselves. Two types of arguments are offered by those who do provide reasons for taking this final step. In the first, it is argued that an effective way of learning about the nature of scientific activity is for the student to act out a scientist's role in the classroom. In this connection, Link (1967) states that every child, not just those who manifest interest or high motivation, must be viewed as a young scientist by the teacher of science. They must experience the mode and the excitement and the frustration of the scientists. The student who enters the role of scientists most fully will be the one who adopts the attitude that also motivates the scientists. Identifying the association between scientific attitude and achievement in science will help identify the level of their interdependence. This study will help in identifying the relationship between achievement in science and scientific attitude towards science practical. Gupta (1985) has clearly shown that scientific achievement has a role in predicting scientific attitude. The study of Marshal Brooks (1975) showed that students with an internal locus of control have high science achievement. Andrea (2004) showed that there is a positive relationship between problem-solving skills and student achievement. No study has been taken up so far in Bihar involving these two variables, *viz.*, scientific attitude and science achievement. Hence, the investigator has taken up an intensive study to determine the existing status of these variables and their interrelationships among the secondary students of Patna.

Statement of Problem

The study was entitled "Achievement in Science and Attitude towards Science Practical among Secondary School Students of Patna."

Objectives of Study

- To study the significant difference in achievement in science between boys and girls of Patna's secondary schools.
- To study the significant difference in achievement in science between urban and rural Patna's secondary school students.
- To study the significant difference in attitude towards science practical between boys and girls of Patna's secondary schools.
- To study the significant difference in attitude towards science practical between Patna's urban and rural secondary school students.
- To study the significant relationship between achievement in science and attitude towards science practical of Patna's secondary school students.

Design of Study

The investigator has adopted a normative survey method for the present study.

Materials and Methods

Tools Used

This study used a 30-item science attitude scale adapted from Prokop *et al.* (2007) to measure students' attitudes toward practical work in science. For the achievement test results, the researcher collected the annual results of students' science subjects.

Sampling Technique of Study

The investigator adopted a stratified random sampling technique for this study. In the present study, the investigator chose 120 secondary school students to study their attitude towards science practicals and their achievement in science. The sample was chosen from government and private schools from different areas (rural and urban) of Patna district.

Results and Findings

H_{01}

There is no significant difference in science achievement between boys and girls of secondary school students of Patna. The details regarding mean, standard deviation, and t values are presented in Table 1.

It is evident from Table 1 that the obtained calculated t value is 11.94. It is greater than the critical value of 2.58 for degrees of freedom of 118 at 0.01 level of significance. Hence, it is significant. The null hypothesis stated is not accepted. From Table 1, it may be concluded that there is a significant difference in science achievement among high school students in terms of gender. It means the achievement of boys' science much better than the achievement of the science of girls. This finding can be seen in Figure 1.

H_{02}

There is no significant difference in achievement in science between urban and rural secondary school students of Patna. The details regarding mean, standard deviation, and t values are presented in Table 2.

It is evident from Table 2 that the obtained calculated t value is 10.86. It is greater than the critical value or tabular value of 2.58 for degrees of freedom of 118 at 0.01 level of significance. Hence, it is a notable significant difference. The null hypothesis stated is not accepted. It is interpreted that there is a significant difference in the achievement in science between high school students having residence in the urban area and those who have a residence in rural areas. Further, it can also be shown in Figure 2.

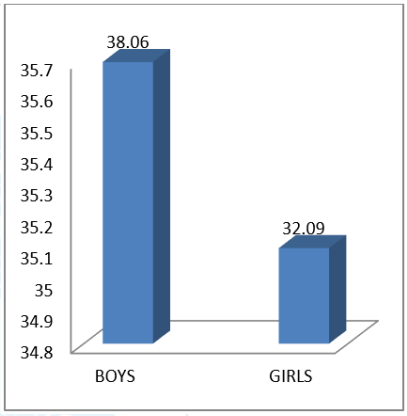

Figure 1: Bar diagram showing mean achievement in science among high school students in terms of gender

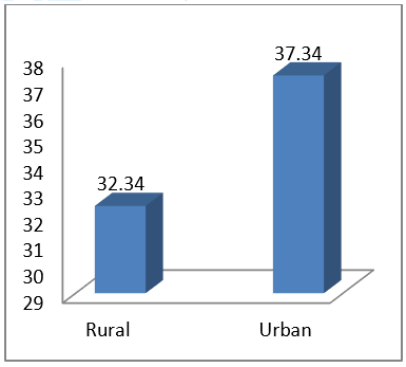

Figure 2: Bar diagram showing mean achievement in science among high school students in terms of residence

Table 1: Mean, standard deviation, and t values for achievement in science among high school students in terms of gender

Groups	*N*	*Mean*	*SD*	*t ratio*	*Remarks*
Boys	60	38.06	2.08	11.94	Significant difference
Girls	60	32.09	1.9		

Table 2: Mean, standard deviation, and t values for achievement in science among high school students in terms of residence

Groups	*N*	*Mean*	*SD*	*t ratio*	*Remarks*
Rural	60	32.34	1.82	10.86	Significant difference
Urban	60	37.34	1.81		

Table 3: Mean, standard deviation, and t values for significance of difference in the attitude of science practical among high school students in terms of gender

Groups	*N*	*Mean*	*SD*	*t ratio*	*Remarks*
Boys	60	53.08	2.18	0.4	Not significant
Girls	60	52.9	1.37		

Table 4: Mean, standard deviation, and t values for significant difference in attitude of science practical among high school students in terms of residence

Groups	*N*	*Mean*	*SD*	*t ratio*	*Remarks*
Urban	60	56.59	2.14	12.01	Significant difference
Rural	60	50.34	1.97		

Table 5: Correlation matrix between achievement in science and attitude towards science practical

	Achievement in science	*Attitude towards science practical*	*Remarks*
Achievement in science	-	0.68	Significant relationship
Attitude towards science practical	0.68	-	

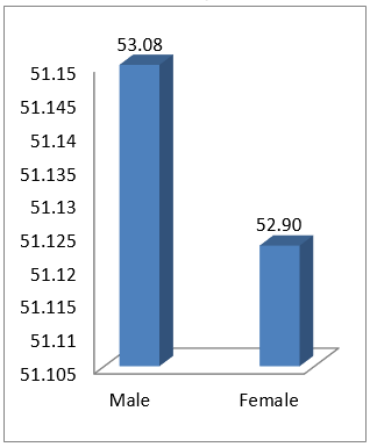

Figure 3: Bar diagram showing mean attitude towards science practical among high school students in terms of gender

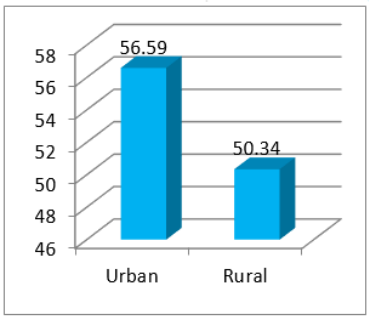

Figure 4: Bar diagram showing mean score of attitude towards science practical among high school students in terms of residence

H_{03}

There is no significant difference in attitude towards science practical between boys and girls of Patna's secondary school students. The details regarding mean, standard deviation, and t values are presented in Table 3.

It is evident from Table 3 that the obtained t value is 0.4. It is lesser than the critical value of 1.98 for degrees of freedom of 118 at 0.05 significance level. Hence, the hypothesis stated as there is no significant difference in the attitude of science practical among high school students in terms of gender is accepted. From Table 3, it may be concluded that there is no significant difference in the attitude of science practical among high school students in terms of gender. This finding has also been shown in Figure 3.

H_{04}

There is no significant difference in attitude towards science practical between Patna's urban and rural secondary school students. The details regarding mean, standard deviation, and t values are presented in Table 4.

It is evident from Table 4 that the obtained t value is 12.01. It is greater than the critical value of 2.58 for degrees of freedom of 118 at 0.01 level of significance. Hence, it is a significant difference. The null hypothesis stated is not accepted, and thus, it is interpreted that there is a significant difference in the attitude of science practical between high school students having residence in the rural area and those who have a residence in the urban area. This finding can also be seen in Figure 4.

H_{05}

There is no significant relationship between achievement in science and attitude towards science practical among Patna's secondary school students. For studying this hypothesis, the correlation of coefficient is computed to determine the degree of relationship between variables. The results of the computed relationship are presented in a matrix form in Table 5.

It is observed from Table 5 that the relationship between achievement in science and attitude towards science practical is substantial (r = 0.68). Hence, the null hypothesis cannot be accepted. Thus, the above findings can be interpreted as a significant relationship between achievement in science and variables, *viz.*, and practical science attitude. It can be interpreted that those who have a high attitude toward science practical do excel in science achievement.

Conclusion

The study findings have a clear vision that the scientific attitude is a major objective of science teaching. It should be cultivated and developed if found low in high school students. The attitude towards science practical has to be taught among the students by designing strategies and activities to develop problem-solving skills among the students. The study of the relationship between attitude towards science practicals and achievement in science may help the science educators make necessary curriculum decisions and guide the pupils in proper lines.

As there is a significant positive relationship between attitude towards practical and achievement in high school students' science, proper steps can be taken to promote them. Conducting science exhibitions at the school, district, and state levels may enhance scientific attitude and create interest in science practicals. Also, conducting talent tests in science in schools and giving rewards to the best achievers may increase science achievement. Encouraging the students to participate in quiz programs in science and mathematics will enable their problem-solving skills and create their interest in a science subject. Starting mathematics and science clubs at school may enhance the scientific attitude, problem-solving skills, attitude towards science practical, and science achievement.

Guidance, counseling, and attribution training should also be provided to develop students' interests in science and in turn, their achievement in science.

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