ACHIEVEMENT OF STUDENTS IN BIOLOGY IN RELATION TO DEMOGRAPHIC VARIABLES

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The present study is aimed to investigate the achievements in Biology of Class XI students in relation to the demographic variables, i.e. gender, locale, age and caste. A sample of 300 students was randomly selected from six schools of Varanasi city in Uttar Pradesh. For obtaining the data, biology achievement was recorded by self-made achievement test. Statistical analysis was made by calculating mean, standard deviation, t-test and anova. The findings of the study suggest that there is a significant difference in the biology achievement of various caste categories of the students but other demographic variables such as gender, locale and age do not bring in any significant difference in biology achievement of Class XI students at formal operational stage.

Key Words: Achievement, Biology, Formal Operational Stage.

Introduction

Biology is a science in which the curriculum is continuously changed, new knowledge and emerging contents are introduced and they have an enormous impact on our lives. Each new discovery leads to more knowledge and we have to constantly learn new content and theory that develop not only our own understanding of biological concepts but also ways to teach that content to our students.

The quality of teaching and learning biology is a major challenge and concern for educators. General concern about biology achievement has been dominating in the minds of the parents for quite some time. There has always been emphasis on designing innovative instructional techniques that can easily be understood by students. A central and persisting issue is how to provide instructional environments, conditions, methods, and solutions that achieve learning goals for students with different skills and ability levels. In the recent times, there has been upsurge of newer concepts like constructivism dominating the teaching learning process.

However, newer techniques and methods alone cannot produce better learning and achievement. The educator must know crucial factors that affect student learning and build a bridge between goals and student performance. Identifying these factors will help to utilise limited resources including financial resources and time more effectively (Libienski and Gutierrez, 2008). In an effort to understand factors associated with biology achievement, researchers have focused on many factors (Beaton and Dwyer, 2002; Kellaghan and Madaus, 2002; Kifer, 2002). The impact of various demographic, social, economical and educational factors on students' biology achievement continues to be of great interest to the educators and researchers.

For instance, Israel, et al. 2001 concluded that parents' socio-economic status is correlated with a child's educational achievement. Another study by Jensen and Seltzer (2000) showed that factors, such as, individual study, parents' role, and social environment had a significant influence on 'further education' decisions and achievements of young students. A growing body of research provides additional factors which could have an impact on students' achievement such as gender, locale, family structure, parents' educational level, socio-economic status, parents' and students' attitudes toward school, and parents' involvement (Campbell. et al., 2000; Epstein, 1991). Three factors or predictors in biology achievement, are divided into sub factors: Demographic factors (gender, locale, age and caste), instructional factors (teacher competency, instructional strategies and techniques, curriculum, school context and facilities), and individual factors (self-directed learning, arithmetic ability, motivation, etc.).

Need and Significance

Identifying factors that affect achievements in biology is particularly important to effectively educate new generations. It also provides instructional designers better inputs for their design decisions. The curriculum developers and teachers are better equipped to handle students of different performance if they know the factors responsible for the same. As already stated, there have been growing interests in researches which can provide additional factors that could have an impact on students' biology achievement such as, gender, locale, family structure, parents' educational level, socio-economic status, parents' and students' attitudes toward school, and parents' involvement.

Many variables have long been studied as predictors of biology achievement. However, gender issues on biology achievement are studied most frequently by researchers (Keeves and Kotte, 1992; Jones, et al., 2000; Zeidan, 2010). Girls were superior to boys in intelligence and scholastic achievement (Shamshada, 1988). Rani Mohanraj. et al. (2005) reported that boys and girls did not differ significantly in their academic achievement. Singh (2006) in his study on fine arts students revealed that significant differences exist between boys and girls in their achievement in fine arts. Girls scored higher as compared to boys in the subject of fine arts. Swarnalatha and Janaki (2008) in their respective studies found no significant difference in the academic achievement of boys and girls.

In all, from cited studies, gender differences continue to provide contrasting findings. Some studies indicated that boys have higher achievement in particular area than girls whereas others show the reverse of it. However, the factors behind these differences are not clear. Hence, gender difference in biological achievement requires further study, especially within Indian classroom.

Similarly, locale has been another issue which has been presumed to be affecting the achievement of students. Gakhar, et al. (2004) found that rural students have higher academic achievement when compared with urban students. The location is supposed to affect the resources available to the students and thus seemed to be another variable which should be studied.

Further, age has been shown to be another factor in academic achievement. In a study (Stark and Gray, 1999) it was found that boys'

preferences for science topics shifted from biology to physics as the age of students increased, while girls' preference for biology topics was relatively high and less affected by age. This means that research in biology would explore different patterns in attitudes related with gender and/or age than other science courses. In a study, Baram-Tsabari and Yarden (2005) found that children's interest in human biology increases with age.

Lastly, caste is another issue which has been presumed to be affecting the achievement of students. The students from various caste categories have taken for prolonged and extensive studies.

The available body of research literature in the area left the researchers with demographic variables as suitable factors for research and thus an attempt was made to study these factors in the Indian context.

Objectives

The main objectives of this research paper were to study:

1. gender-wise differences in achievement in biology of Class XI students,
2. locale-wise differences in achievement in biology of Class XI students,
3. age-wise differences in achievement in biology of Class XI students, and
4. caste-wise differences in achievement in biology of Class XI students.

Hypotheses

The following were the research hypotheses framed for the study:

H_R1: There is a difference between the achievements in biology of male and female students of Class XI.

H_R2: There is a difference between the achievements in biology of rural and urban students of Class XI.

H_R3: There is a difference between the achievements in biology of different age group of students of Class XI.

H_R4: There is a difference between the achievements in biology of various caste categories of students of Class XI.

Null Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

$H_0$1: There is no significant difference between the achievements in biology of male and female students of Class XI.

$H_0$2: There is no significant difference between the achievements in biology of rural and urban students of Class XI.

$H_0$3: There is no significant difference between the achievements in biology of different age group of students of Class XI.

$H_0$4: There is no significant difference between the achievements in biology of various caste categories of students of Class XI.

Methodology

Method

Descriptive survey method was found the most suitable for testing hypotheses and was thus employed in the present research.

Tool

In order to achieve the objectives of the study, the investigator used an 'Achievement Test in Biology' (ATB), constructed and standardised by the investigator himself. Also a background information sheet was used to collect information on the different demographic variables.

Population

Students belonging to Class XI of biology group of different higher secondary schools affiliated to CBSE and under the administration of either CBSE or Banaras Hindu University of Varanasi city constituted the population of the study.

Sample

The sample of the study consisted of 300 students of Class XI of six different higher secondary schools of Varanasi city affiliated to CBSE and under the administration of either CBSE or Banaras Hindu University. Both the male and female students were included in the sample. The sample was selected by random sampling technique. The age of the students was in the range of 15 to 18 years.

Analysis and Findings

Data was analysed by using descriptive data analysis like mean and standard deviation. 't' test and analysis of variance (ANOVA) were calculated to test the hypotheses.

Effect of Gender on Achievement

To find out the effect of gender on achievement, t-test was used. Mean and S.D. of Class XI male and female students for achievement scores and results of t-test are given in Table 1.

Table 1

Significance of the difference between mean scores of achievement of male/female students

S. No.	Gender	N	Mean	S.D.	t-value	L.S.
1.	Male	202	28.79	7.37	0.818	$p \rightarrow 0.05$
2.	Female	98	28.03	7.62		

From Table 1, it is evident that mean scores of male (28.79) and female (28.03) for the scores on achievement do not differ significantly at 0.05 level ('t' (298) =1.97, $p \leftarrow 0.05$). Therefore, the null hypothesis that there is no significant difference between the achievements of male and female students is not rejected.

It is clear from the above table that gender does not seem to affect students' achievement in biology, a finding that is in accordance with relevant findings about Iranian secondary school students (Soltani and Nasr, 2010). Although Simonneaux, et al. (2005), found in a research that more girls than boys considered science as difficult and have lower achievement. Keeves and Kotte (1992), Jones, et al. (2000), Prokop, et al. (2007) and Usak, et al. (2009) suggested that biology is more popular among girls than among boys and have a higher achievement, but these results are not in accordance with our findings.

Effect of Locale on Achievement

To find out the effect of locale on achievement, t-test was used. Mean and S.D. of Class XI rural /urban students for achievement scores and results of t-test are given in Table 2.

From Table 2, it is evident that mean scores of rural (27.86) and urban (28.87) for the scores on achievement do not differ significantly at 0.05 level ('t' (298) =1.97, p←0.05). Therefore, the null hypothesis that there is no significant difference between achievement of rural and urban students is not rejected.

Thus, from the table it is evident that, there is no influence of locale on achievement in biology of higher secondary school students. But in some studies, it is one of the predictors of student's achievement (Narang, 1987; Ichado, 1998).

Effect of Age on Achievement

Analysis of variance was used to find out the effect of age difference on achievement. Mean and S.D. of Class XI of different age group of students on achievement scores are given in Table 3.

Table 2
Significance of the difference between mean scores of achievement of rural and urban students

S. No.	Locale	N	Mean	S.D.	t-value	L.S.
1.	Rural	97	27.86	7.34	1.10	p→0.05
2.	Urban	203	28.87	7.49		

Table 3
Mean and S.D. of different age group of students on achievement

S. No.	Age (in years)	N	Mean	S.D.
1.	15	42	27.55	7.78
2.	16	81	29.51	7.08
3.	17	149	28.30	7.75
4.	18	28	28.54	6.30

Table 4
ANOVA for the scores on achievement according to age

S. No.	Source of Variation	df	SS	MSS	F-ratio	L.S.
1.	Between age groups	3	125.41	41.80	0.752	p→0.05
2.	Within age groups	296	16445.03	55.56		
	Total	299	16570.44	55.42		

From Table 4, it is evident that the mean score of achievement of different age group of students do not differ significantly at 0.05 level of significance. Hence, the null hypothesis that there is no significant difference among the achievement of 15, 16, 17, and 18 years age group of students is not rejected at 0.05 level of significance.

Thus from the table, it has also been found that age also does not affect students' achievement in biology. Although Spall, et al. (2004) suggested that as the students grow older, they have less positive attitude towards biology and exhibit poor performance. But, this result was not found in this study, since no statistical significant differences were found among the different age groups of students in their achievement scores.

Effect of Caste on Achievement

Analysis of variance was used to find out the effect of caste difference on achievement. Mean and S.D. of different caste categories of Class XI students on achievement scores are given in Table 5.

From Table 6, it is evident that mean score of achievement of different caste categories of students differ significantly at 0.05 level of significance. Hence, the null hypothesis that there is no significant difference among achievement of general, OBC, SC, and ST caste categories of students is rejected at 0.05 level of significance.

From the above table, it is clear that only caste of the students as a demographic variable influence students' achievement in biology at the formal operational stage.

Conclusion

Identifying the demographic factors that possibly affect the biology achievements of students could help instructional designers and instructors to select the best instructional strategies to design the most effective and efficient instruction. From the results of the study, it can be concluded that among various demographic factors, only caste seem to affect the achievement in biology at formal operational stage.

Table 5
Mean and S.D. of different caste categories of students on achievement scores

S. No.	Caste	N	Mean	S.D.
1.	General	153	29.18	7.42
2.	OBC	90	29.04	7.68
3.	SC	39	27	7.41
4.	ST	18	23.94	4.24

Table 6
ANOVA for the scores on achievement according to caste

S. No.	Source of Variation	df	SS	MSS	F-ratio	L.S.
1.	Between caste groups	3	558.79	186.26	3.44	p<0.05
2.	Within caste groups	296	16011.64	54.09		
	Total	299	16570.44	55.42		

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