Assessment of Students' Achievement in Life Science through Different Evaluation Strategies: Examining the Influence of Teacher Competence and Teaching Effectiveness

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ABSTRACT

In the present paper efforts were made to study the assessment of achievement through different evaluation strategies. Twenty-one secondary schools of four boards of Birbhum and Burdwan districts of West Bengal were selected through stratified random sampling technique. The Boards were: West Bengal Board of Secondary Education (W.B.B.SE), Visva Bharati(V.B), Indian Certificate of Secondary Education (I.C.S.E) and Central Board of Secondary Education (C.B.S.E). A total of 564 students from Class VIII participated in the study. All the Life-Science teachers were also taken as sample. Tools used were standardised tests (i) 'Teacher Competence Scale' developed by Passi & Lalitha, 7-point scale, (ii a) A standardised 'Teacher Effectiveness Scale' by U. Kulsum, a 5-point scale and a self-assessment questionnaire, (b) Observation Schedule to measure the teaching effectiveness, (iii) An achievement test for Class VIII (Pre-test in Life Science). Statistics used were Mean, S.D., t-value, One-way ANOVA and Interaction analysis. The role of teacher competence and teaching effectiveness in high achievement (in Life-Science) irrespective of the different evaluation strategies used were examined. The study gave indications about the relative suitability of these strategies used in measuring the students' performances in Life science subject.

Keywords: *Evaluation, Students' achievement, Evaluation strategies, Teacher competency, Teaching effectiveness.*

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Introduction

Teaching is a unique professional, rational, and humane activity in which one creatively and imaginatively uses himself and his knowledge to promote the learning and welfare of others. It consists of four phases — a curriculum-planning phase, instructing phase, a measuring phase, and an evaluating phase. To sensibly create a curriculum for teaching, one must have the understanding of the goals of education and a clear formulation of specific objectives. One must also select subject matter appropriately to achieve these ends. Actual instruction involves creating, using, and modifying instructional strategies and tactics in the classroom. In this way the teacher can help his/her pupils to acquire skills in different subject areas. The teacher's task here is two-fold — to offer skills in his subject discipline and also to use various ways and means to aid his pupils to learn how to employ their own talents to acquire the skills that the teacher wishes them to acquire. In this context, the teacher's personal qualities, educational qualification, professional training and the place that he/she occupies in the school as well as in the community assume significance (Secondary Education Commission, pp. 1952-53).

For knowing the outcome of students' learning, evaluation must be done with as much care as possible. Without evaluation we really don't know how much the students have learned. Needless to mention that evaluation has to be very comprehensive in a system of education which aims at the many-sided development of the personality of a child. This study focusses on achievement in Life Science subject and different evaluation strategies used for assessment, such as — i) written test, ii) Oral test, iii) Project work. In view of the importance of the Science subject in the school curriculum and the typical pattern of assessment applied using the paper-pencil test only, the study intended to find out the relative suitability of the three most common strategies used for evaluation of the students in Life Science subject and also on the role of assessment by different measures and the teacher. The need and significance of this study was to identify which evaluation strategies were most appropriate and also the impact of teachers' competency and teaching effectiveness irrespective of the evaluation strategies on students' achievement in Life Science subject. The districts of Birbhum and Burdwan in West Bengal were considered to be a relatively unexplored area. The three major evaluation strategies (oral, written, project) were undertaken to evaluate the students'

performances in Life Science subject in schools under the four boards of the State of West Bengal (i.e., V.B., W.B.B.S.E, I.C.S.E. and C.B.S.E).

Research studies have been done related to this field to enhance the quality of education in the school in different parts of the world. The study by Wright, Horn, Sandra, Sanders and William (1997), found that the teacher effects are dominant factors affecting student academic gain and that the classroom context variables of heterogeneity among students and class sizes have relatively little influence on academic gain. Further, Ding, Cody, Sherman, Helene (2006), also in their study, found a relationship between teacher effectiveness and students' achievement as measured by test scores and suggested that direct causal relationship among teacher preparation, teacher quality and student achievement. It stressed that test scores correlate to the quality of teaching effectiveness as policy makers and public and private funding agencies believe. Mohalik (2008) found that there is impact of ISTE on teacher effectiveness of English teachers and achievement of their students. Regarding evaluation, Raizada, (2000) highlighted the importance of evaluation in the teaching-learning process (which is an in-built component and determines the learner's progress in achieving the course objectives) and Sreekanth (2006) emphasised the necessity of more varied modes of assessment beyond one examination hall paper-pencil test. Suggestions for including oral testing and group work evaluation were also offered. Similarly, Sharma (2007) focussed on 'Alternate Assessment Procedures', about the importance of assessment technique to evaluate students' knowledge (and suggested that flawed technique may have a serious repercussion on the child's psyche and their overall development). Vijayan (2014) also emphasised on the administration of peer-assessment, self-assessment and quiz as classroom assessment strategies in an integrated way which helped the teacher to get a clear idea about the level of performance of individual students in a particular topic and thus to make assessment as an integral part of teaching learning process. As conventional mode of pupil assessment is still being practiced but new assessment techniques have been developed on the line of the recommendations of various education commissions. The NCF-2005 also recommends flexibility in pupil assessment and makes it as an integral part of teaching learning process, which is possible with the help of a competent

and effective teacher. Therefore, the investigator after analysing the different studies found out the necessity of her study.

Scope of the Study

This study was done only in selected schools of Birbhum and Burdwan districts of West Bengal State. Such study has a large scope taking into consideration different dimensions and a variety of clientele groups. This study can be done, taking larger samples from a wider population to gain more insight into the problem area. It can be done in other states and their schools. Comparative studies can be done to compare the findings of different regions and it can be carried out taking any other school subject in the syllabus of secondary education than Life Science only. Different evaluation strategies can be applied for assessment of the subject concerned.

Objectives of the Study

The objectives of the present investigation were:

i. To find out the effect of teachers competencies on students' achievements in Life Science.
ii. To study the effect of teaching effectiveness on the students' achievements in Life Science.
iii. To assess the students' achievement in Life Science subject through different strategies of evaluation.
iv. To find out the interaction effect of teacher competence and teaching effectiveness on students' achievement in Life Science as measured through different evaluation strategies.

Hypotheses

The following hypotheses were formulated for the study:

i. There is positive effect of teacher competency upon students' achievement in Life Science irrespective of strategies of evaluation.
ii. There is positive effect of teaching effectiveness upon students' achievement in Life Science irrespective of the strategies of evaluation.
iii. The interaction effect of teacher competence and teaching effectiveness on students' achievement in Life Science as measured through three different strategies of evaluation is significant.

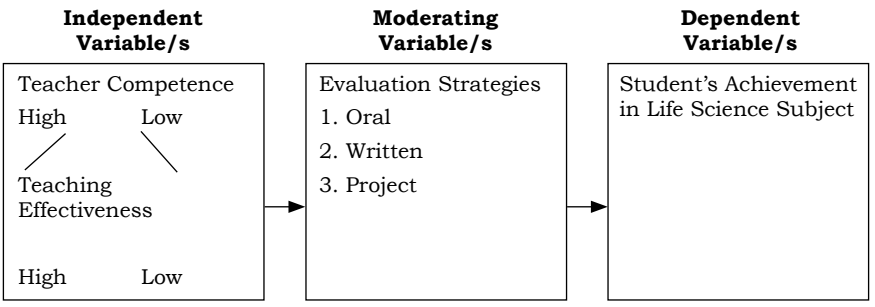
Method

Research Design: Employing a 2x2 factorial design in this experimental research, subjects were randomly assigned to one of the two categories of teachers under high and low teacher competence and teachers with high and low teaching effectiveness.

The Variables in the Study were —

1. Teacher Competency _____ Independent variable/s: High & Low
2. Teaching Effectiveness _____ Independent variable/s: High & Low
3. Different Evaluation Strategies — Moderating Variable
4. Students' Achievement in Life Science subject — Dependent variable

CONCEPTUAL MODEL



Population of the Study

The students of Class VIII of the schools of Birbhum and Burdwan districts of W. B.B.S.E, CBSE, ICSE, and V.B boards and their Life Science teachers constituted the population.

Sample and Sampling

Twenty-one (21) urban secondary schools of Birbhum and Burdwan districts were selected through stratified random sampling. The students of Class VIII of these schools participated in the study. Simple random sampling technique was used for the selection of subjects in the study. Life Science teachers teaching in Class VIII of these schools were also included in this study. Four boards under West Bengal state were taken for the study; they were W.B.B.S.E, V.B, I.C.S.E. and C.B.S.E. First of all, the schools under

W.B.B.S.E, I.C.S.E. and C.B.S.E. in each of the two districts under study (Birbhum and Burdwan) were enlisted separately. Then from among six (6) lists of schools (three (3) in Birbhum and three (3) in Burdwan schools were selected randomly though random sampling technique was resorted to in selecting the schools in each stratum, ultimately schools under each of the above-mentioned boards were selected according to their availability in the districts). Nineteen (19) schools under above-mentioned three boards were taken for the present study. As there are only two schools under Visva-Bharati (Birbhum district), those two were included in the study.

Thirty-five (35) teachers of Life Science from the twenty-one (21) schools were included in the present study. All the Life Science teachers in the selected schools were taken for the study; no sampling was done in selection of teachers.

Total 564 students were selected as the student-sample for the present study. Selection was done by administering a Pre-test in Life Science subject (with the help of Life Science teachers) for Class VII to test the previous knowledge of the students gained in Life Science. The results of pre-test were used to classify the students according to merit. The cut-off marks were decided to be 30 out of the total marks 50 as the criteria for selection. The students obtaining 30 and above were taken as the sample-students of the present study (this was done to equate the students of Class VIII in respect of merit).

Tools Used

The tools used were—

1. General Teaching Competency Scale (GTCS) by Passi and Lalitha (1994) was used to measure the teaching competency in five major areas on a 7-point scale. The areas were — i.e., (i) Planning (Pre-instructional), (ii) Presentation (Instructional), (iii) Closing, (iv) Evaluation and (v) Managerial.
2. 'Teacher Effectiveness Scale' by Kulsum (2000) was used to measure the teaching effectiveness in five major areas on a 5-point scale and a self-assessment questionnaire.
3. An Observation Schedule also developed to assess the teaching effectiveness. It was standardised. Validity and reliability were tested. It is a 5-point scale and covers nine areas of teachers' classroom skill during teaching.

4. An achievement test for testing the previous knowledge of the students of Class VIII in Life Science (Pre-test in Life-.Science).
5. Three types of tests for evaluating selected students' achievement in Life Science (after a specified period of teaching-learning) following three different strategies (Post-test in Life Science). Reliability and validity were established. Expert opinions were taken regarding the content of the tests.

Data Analysis and Interpretation

The first and second hypotheses were tested to find out the effect of the two independent variables on the students' achievement scores evaluated through different evaluation strategies (separately). This was done with the help of Analysis of variance (one-way ANOVA). The third hypothesis was framed to find out the impact of the Interaction effect of the two Independent variables, i.e., teacher competency and teaching effectiveness on the Students' Achievement (dependent variable), measured through three strategies of Evaluation with the help of two-way Analysis of Variance.

Results

Table 1 shows the result of Analysis of variance concerning the impact of teacher competence in relation to the strategies of evaluation. The mean achievement scores of Group 1 students (i.e., students taught by teachers with high competence) was not significantly higher than the mean achievement scores of Group 2 students (i.e., students taught by teachers with low competence) irrespective of strategies of evaluation. However, in case of project work only, there was a significant difference between the means of students taught by teachers with high and low competence which indicates that students under teacher with high competency achieve better than students taught by teachers with low competency.

Table 1

Analysis of Variance Showing the Effect of Teaching Competence on Students' Achievements in Life Science

Strategy	Competence of Teacher	N	Mean	Variance	'f' value
Written Test	High	267	23.1124	80.55124	1.202574
	Low	100	22.02	49.71677	(df= 1,365)

Project Work	High Low	267 100	24.2622 21.25	65.58514 55.96717	10.48158* (df= 1,365)
Oral Test	High Low	267 100	36.3894 36.2	15.29132 21.37374	0.154235 (df= 1,365)

**P<.05*

The results related with hypothesis 2, regarding positive impact of teaching effectiveness upon students' achievement in Life Science subject irrespective of the strategies of evaluation are given in Table 2. The mean achievement scores of Group 1 students (i.e., students taught by teachers with high teaching effectiveness) was higher than the mean achievement scores of Group 2 students (i.e., students taught by teachers with low teaching effectiveness) irrespective of strategies of evaluation. Table 2 shows significance of f-values in case of strategies S1, S2, and S3 with regard to teachers with high and low teaching effectiveness (at 0.05 level of significance).

Table 2

ANOVA-Single factor Table of 'F' value for High and Low Teaching Effectiveness

Strategy	N	Mean	Variance	'f' value
S1 Gr 1 Gr 2	51 467	27 23.04069	83.52 67.0992	10.49305*
S2 Gr1 Gr2	51 467	27.19608 23.52891	68.32078 61.85914	9.895594*
S3 Gr 1 Gr 2	51 467	38.29412 36.51178	15.61176 19.62808	7.592037*

**P<.05*

S1 = Written test, S2= Project test, S3= Oral Test

G1= High teacher effectiveness, G2= Low teacher effectiveness

As there are significant mean differences between the means of Group 1 and Group 2 when evaluated through all three strategies (S1,S2,S3), it can be inferred that students under teachers with high teaching effectiveness achieve better than students under teachers with low teaching effectiveness irrespective of the strategies of evaluation.

The results related to hypothesis 3, (Table 3) are that the Interaction effect of teacher competence and teaching effectiveness on students' achievement as measured through three different strategies

of evaluation is significant. The null hypothesis H03 is that the interaction effect of teacher competence and teaching effectiveness on students' achievement as measured through three different strategies of evaluation is not significant. The consequences are that the mean achievement scores of students in Life Science subject taught by teachers having both high teacher competence and high teaching effectiveness and students taught by teachers having both low teacher competence and low teaching effectiveness are significantly different as measured through all three strategies of evaluation.

Statistics Applied— Two-way ANOVA with interaction. (f-Statistic at 0.5 level of significance).

Table 3

Interaction Analysis (T/Comp.*T/ Effec) (From- R Prog.)

Strategy	Source of variation	Df	Sum of squares	f
S1	Competence	1	56	0.860
	Effectiveness	1	886	13.642*
	Competence X Effectiveness	1	1,761	1760.58**
	Residual	510	33,138	-------
S2	Competence	1	2,591.3	44.4003**
	Effectiveness	1	338.2	5.7953 *
	Competence X Effectiveness	1	153.1	2.6234
	Residual	510	29,765.1	-------
S3	Competence	1	75.218	4.0295
	Effectiveness	1	122.185	6.5456*
	Competence X Effectiveness	1	281.273	15.0682**
	Residual	510	9,594.7	--------

**P<.05 **P<.01*

Where,

S1=Strategy 1 of evaluation; written test; S2= Strategy2 of evaluation; Project test; S 3 =Strategy 3 of evaluation; Oral test

It is evident from the Table3 that the Interaction effect of Competence and Effectiveness on students' achievement in case of S1strategy is highly significant, as the value of 'f' ratio for df (1,510)

is 1760.58 (with $p<0.01$) which is much higher than the table value at .01 level of significance.

The Interaction effect of Competence and Effectiveness on students' achievement in case of S2 is not statistically significant, as the value of 'f' ratio for df (1,510) is 2.6234 which is lesser than the table value at 0.5 level of significance.

The Interaction effect of Competence and Effectiveness on students' achievement in case of S3 is highly significant, as the value of 'f' ratio for df (1,510) is 15.0682(with $p<.0001$) which is much higher than the table value at 0.5 level of significance.

Thus, it may be interpreted that, the Interaction effect of Competence and Effectiveness on students' achievement is statistically significant in case of Written and Oral tests but not in case of Project test. Thus it can be said that $H0_3$ is retained; in other words, and H3 is rejected.

Further attempts have been made to verify the achievement scores of the students studying in schools, under each of the four boards (V.B, W.B.B.S.C., I.C.S.E. and C.B.S.E) separately. The investigator intended also to judge the relative effectiveness (suitability) of three strategies for evaluating the students' achievement in Life Science subject by finding out the difference in the achievement scores of the students undergoing tests following each of the three strategies. The evaluation strategies have been taken as the moderating variable in this study. Obtained data were analysed through't' test, so that significance of difference between students' Mean Ach. Scores through any two evaluation strategies were found out. Similar results were found from the analysis of data that there are significant differences in students' achievement scores in Life Science as evaluated through Project test and Oral test and also as evaluated through Written test and Oral test.

In each of the cases the mean achievement scores of Oral test was found to be greater than those of Project test and Written test under the four boards mentioned V.B., I.C.S.E., C.B.S.E. and W.B. Boards, (mean for S3 Oral is 34.56 and value of 't' is 22.02 in case of V.B. Board, value of mean for S3 in the case of I.C.S.E. is 36.06, value of mean for S3 in the case of C.B.S.E. is 35.94, in case of W.B. Board, the mean for S3 oral is 37.75), indicating the fact that students' performance is probably better when evaluated through Oral test; in other words Oral strategy of students' performance as expressed through the achievement scores taken into consideration

is probably a better strategy for evaluating students' performances in Life Science subject for Class VIII.

Major Findings of the Studies

On the basis of analysis, the following findings were made—

i. As already known and established, the achievement of students do differ significantly in Life Science subject when taught by high or low competent teachers and by teachers with high teaching effectiveness and low teaching effectiveness. There is a substantial positive relationship between teacher competence and teaching effectiveness as found through the research study (product-moment correlation)

ii. The findings in this study indicate the fact that the students taught by teachers with high/low teacher competency do not achieve better in S1 (written) and S3 (oral) strategy but in case of S2 (project) strategy there is significant mean difference between the means of Group 1 and Group 2 which indicates that students under teachers with high teacher competency achieve better than students under teachers with low teacher competency in case of project test.

iii. Findings also indicate that there are significant mean differences in achievement scores of students as evaluated through S1(written), S2(project) and S3(oral), between Group 1 and Group 2 which indicates that students' under teachers with high teaching effectiveness achieve better than students' under teachers with low teaching effectiveness in case of all evaluation strategies used.

iv. The findings indicate that the interaction effect of teacher competence and teaching effectiveness on students' achievement is highly significant. Interaction analysis is found highly significant (at .001 level of significance).

Conclusion

Quality of learning in schools depends on the quality of teachers. The crucial role played by the teacher in bringing about meaningful educational change and thus the importance of teachers is recognised in educational reform. The teacher is the key to educational quality. Excellent curricula, materials, infrastructure and administration will not improve the quality of education if the quality of teaching is poor. These teachers are of the challenge

of the broader social contexts in which they teach, have a clear sense of identity and believe that they can make a difference in the achievement of their pupils.

The study investigated the students' achievement measured through different evaluation strategies which act as moderating variables and found that the achievement measured in Life Science subject was better by the Oral strategy in Class VIII of the schools under all the four boards mentioned (V.B., I.C.S.E., C.B.S.E. and W.B. boards taken for the study). Students' achievement in Life Science subject was found better under highly competent teachers with high teaching effectiveness. To conclude there is the need to view assessment as an aspect of learning and it should be emphasised as an integral part of the teaching-learning process and can be used to improve learning. NCF-2005 has focussed its attention on the role assessment might play in the promotion of learning and has recommended continuous comprehensive assessment suggesting flexibility in the assessment procedures and to be used constructively to measure learning outcomes and subsequently raise standards. The results indicate the Oral strategy used was better for the assessment of students in Life Science subject for Class VIII of selected schools in Birbhum and Burdwan districts of West Bengal; therefore, Oral tests should be introduced and encouraged in schools of all the four boards mentioned. This study will be valuable regarding considering the importance of assessment of students through different evaluation strategies.

Educational Implications

In this context, the major educational implications based on the findings of the present study are as follows—

1. High teacher competency and high teaching effectiveness have significant positive impact on students' achievement in Life Science and have to be nurtured among the teachers of Life Science by teachers training programme. As teacher competency and teaching effectiveness are positively correlated shown by research; it is obvious that teacher competency factors are related to teaching effectiveness.
2. Findings of the present research show that the achievement of Life Science in Class VIII is better evaluated through the Oral strategy. Hence, Oral test should be given due importance in evaluation of students' achievement in Life Science at least in lower secondary stage/upper primary stage of school education.

3. In case of interaction effect it is clear that both teacher competency and teaching effectiveness variables have effect on students' achievement as measured through written and oral tests. Thus, it can be said that teacher competency and teaching effectiveness jointly affect the students' achievement as reflected through their achievement scores when two popular strategies of evaluation (written and oral) are followed. So school management should work on the direction to recruit trained teachers who are competent enough to teach effectively and also are well versed in evaluating students' achievement in Life Science through different strategies.
4. Oral test/oral strategy as an evaluation technique for assessing students in the concerned subject should be introduced in the upper primary section of V.B., C.B.S.E. and I.C.S.E. board schools to improve the students' spontaneity in answering questions and also student's critical thinking.

Suggestions for Further Research

This study claims no completeness due to a critical problem that the findings of this study are valid for a particular region of West Bengal only and it was done in selected schools of Birbhum and Burdwan districts.

This study could be done; taking larger samples from a wider population to gain more insight into the study and it could be done in schools of other states. A comparative study could also be done to compare the findings of different regions. Further, it was not possible for the investigator to consider all variables that might account for the students' achievement in Life Science subject; only qualities of teachers, were taken into account. Other conducive factors behind high achievement of the students in Life Science might be there. Though the students were equated according to their merit, some other factors like parental awareness and care for their wards' education, infrastructure of the schools, were not strictly controlled. Similarly studies can be carried out taking any other school subject in the syllabus of Secondary education.

A longitudinal study of observation of the teachers' behaviour can be done to find out their impact on students' achievement in different subjects of the school curriculum. This study can help the teacher to make assessment an important part of teaching and learning. It also helps teacher-educators in discovering

ways in which teachers should be trained to teach effectively so as to improve the achievement of students in all subjects of the curriculum.

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