

A Comparative Study of Achievement of Students in the Components of Curricular Content of Science at Elementary Level

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Abstract

The study was about 'A comparative study of Achievement of Students in the Components of Curricular Content of science at Elementary Level'. The objectives of the study were to analyze the achievement level of students in different components of curricular content at elementary level in the Subject of General Science and to compare the achievement level of boys and girls in the Subject of General Science at elementary level. To determine the statistical relationship between the achievement of different components of curricular content at elementary level in the subject of General Science, an achievement test comprising 40 items was developed. Statistical techniques mean, median, mode, standard deviation, frequencies, percentage were used. For comparing the responses of different groups, t-test and Pearson 'r' was applied. Students of 8th class whom appeared in annual examination 2015 of Tehsil Chichawatni, District Sahiwal were selected as a sample; sample consisted on both the Govt. girls and Govt. boys' schools of urban and rural areas. Through this study, it was found that the highest mean score of students was in the part of Biology. It was also found that the difference of means in parts of Biology, Chemistry, Physics, Geology and Astronomy shows the better performance of female sample group. As the achievement of girl's students was better than the boy's students. So, it is recommended that boy's school teachers may change their teaching strategy or take other relevant steps to increase boy's achievements in general science at elementary level.

Keywords: Achievement test, elementary, general science, comparative, analysis

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Introduction

Twenty first century is considered as century of science. People in modern society are living in scientific environment which is increasingly dependent on scientific knowledge and technology. Thus science has become an integral part of human life and living. People use science on every day basis to make decisions on emerging issues such as balance food, clothing, health, home construction, environment protection, purchase and use of home appliances, travel, communication, population growth (Osborne et al,2003).In addition, the expanding economy in era of globalization demands a work force that is adequately educated in science education. In order to understand these issues and develop informed opinion we as a society need to have basic understanding of the laws, principles and theories of science. Therefore it is necessary that students must learn concepts, progress and developments of science and technology. It is important to develop knowledge and ability among the students needed for effective participation in a scientifically complex society .Science provides students with hands-on opportunities for exploring and understanding their world. Science provides understanding of their environment by observing, measuring, exploring, evaluating, ordering, classifying, comparing, predicting, thinking critically and logically (Barnett & Hodson 2001).Added value of science includes learning to live in changing world, and developing new vocabulary of science language. Basic science skills are often referred to as science literacy which can be defined as “The knowledge and understanding of scientific concepts and process required for personal decision making, participation in civic and cultural affairs, and economic productivity” Giannoukos & Armaos, (2015); Klein, (2006). Science literacy can be called as scientific, or scientific and technological, literacy (Hand, 2003; Holbrook, 2005). Science curriculum and text books of different grades at elementary level is an integration of concepts related to biology, chemistry, physics, geology, oceanography and astronomy. When students learn science at elementary level they learn concepts of science in varied forms. It is matter of concern for researchers that to see the performance of students in different concepts of science, which synthesis the course of study of science, as science at primary level is integration of different concepts from major subjects i.e. biology, chemistry, physics (Kural, & Kocakulah, 2016).

Assessment play a central role in determining extent to which science related concepts has developed and how much students have learned. Norris & Phillips, (2003). Assessment provide basis to teacher to know weakness and strengths of students in different areas of a subject, it also provide feedback to student and their parents about his/her learning Pintrich, (2002). Assessment of students of achievement is an integral part of teaching learning process. Different research studies on science achievement of

students at different grade level revealed that science achievement varies in different concepts of science. Campbell, (1994) quoted National Assessment of Educational Progress (NAEP, 1969) in USA reported descriptive information about students' achievement in subject areas including science for national sample for grade 4, 8 and 12 and determined the extent to which students across the nation achieved science content standard. A study on International science and mathematics on a vast sample of half a million students of 41 countries was conducted by TIMSS. The study provides information about students' performance in science and mathematics for each country, as well as comparisons among the countries (Osborne & Freyberg 1985; Raizen, & Michelsohn, 1994).

A study on achievement at Grade 4 and at Grade 8 students of different subjects i.e. Language Mathematics, Science, Social Studies was conducted a sample based in all 35 districts of Punjab by PEAS. Provincial report on assessment of students learning 2007 reveals that one of aim of students learning assessment was monitoring the education system to make it aligned with work wide emerging trends by analyzing the existing state of affairs and suggesting measures to improve the system. UNESCO report on learning achievement in primary schools of Pakistan: A Quest for quality education reported results science achievement of students at different grades level. In 1983, Primary Education Project (PEP) conducted the study to collect data on achievement in science from 3,300 students of 4grade. The data was collected from a representative sample of schools in NWFP (now Khyber Pukhtoonkhawa), Punjab and Sindh. The average percentage scores of students in science for the three provinces were 16.9, 20.1 and 25.9 respectively. BRIDGES project under the Harvard Institute of International Development carried out a study on assessment of primary education during 1988-89. The study collected both quantitative and qualitative data on achievement of students of classes 4 and 5 in Science from about 500 sampled schools across Pakistan and about 11,000 students were tested. The average percentage scores for both classes in Science were 29 and 33 respectively.

Khan, Shah & Ahmad (1999) conducted the research under the umbrella of the Academy of Educational Planning and Management (AEPAM) (1999) with the title *measuring learning achievement at primary level in Pakistan* of grade 4 and 5 students in Science. Data was collected from a sample of 1,411 students of 75 boys' schools and 1,383 students of 70 girls' schools and 2,794 students of grade 5 sampled from 145schools in 28 districts of Pakistan. The results of the study for both 4 and 5 grade revealed that students performed satisfactorily in science. IER under PEP (1995) conducted a study on 8,792 students of grade 3, 4 and 5 in 132 schools of four districts in Punjab. Results show that girls are better in all grades from boys in science subject. The average percent scores of science in grade 3, 4, and 5 were 43, 51 and 51 respectively.

Abiodullah & Akbar (2010) conducted science achievement test on 2582 students of grade 3 & 5 and found that performance of students is not up-to-mark (Mean = 26.1). The above cited studies show that achievement in science at elementary level is a point of focus for Government, funding agencies, researchers and practitioners. Such studies were conducted to find out achievement of students in science and comparison of achievement are made on the basis of gender, Local, grade and subjects. The science at elementary level is a composition of range of concepts from different field of science. A little efforts have been made to find achievement levels of students in different concepts i.e. structure and function of plant, animal, characteristics of life, environment, matter and its characteristics, force and movement, energy, electricity, magnetic and structure of earth of science.

Curriculum plays an important role in the educational system. It is somehow a blueprint which leads the teacher and learner to reach the desired objectives. As a result, curriculum developers have to design it in such a way that it could lead the teacher and the learner to meet the desired learning outcomes. It means curriculum is an ultimate destination for teacher and students.

In history of education, the term 'Curriculum' is defined in many ways by educators. Some use the term in very limited and specific contexts while others attach very broad and general meanings. Alerty and Alerty (1992) define curriculum 'as the sum total of student activities which the school sponsors for the purpose of achieving its objectives. Marsh (2009) also stated that for many students, the school curriculum is a race to be run, a series of obstacles or hurdles (subjects) to be passed.

Four components of curriculum are widely accepted. Objectives, content, teaching methods and evaluation. Objectives serve as the blue print for the development of curriculum. Objectives provide the guideline for the selection of contents. Contents may include facts, concepts and theories. Contents are organized according to scope and sequence. Teaching methods includes the teaching activities of the teacher as well as learning experiences of the pupil. All the contents cannot be taught effectively by one method. Evaluation judges the value or the worth of the curriculum or any components of the curriculum. Objectives, Contents and methods can be evaluated in this process. Every discipline has its curriculum for various educational levels which leads its branches. Natural or physical science is one of them. Science is a core subject in the school curriculum.

In Pakistan, the curriculum of science is developed centrally. At the primary and lower secondary levels, science is compulsory to all while at the upper secondary level, students either take core science or choose science electives. Harlen (1991) is of the view

that science is a major area of human mental and practical activities, which generates knowledge on the basis of important technological application as well as intellectual satisfaction. The general aim of science education is to help develop well-defined abilities in cognitive and affective domains, besides enhancing psychomotor skills. In general science, several sciences are studied. This is also known as integrated science

Components of General Science Curriculum:

Dorn (2015) describes the five components of general science curriculum are :

1. The living world
2. The physical world
3. The material world
4. Earth and the Universe
5. The world of technology

These five components of the general science curriculum are essential. These are interrelated to each other.

Modern trends in general science curriculum development:

Curriculum is not static, it is dynamic. It means curriculum changes with the passage of time. A number of factors are responsible for its change. According to jessy(2008), the modern trends in curriculum development include the following:

- 1) Technology
- 2) Globalization
- 3) Lifelong education
- 4) Vocational education
- 5) Emphasis on conceptual learning
- 6) Self-learning material
- 7) Low cost science materials

Accomplishment of general science curriculum by the learners is assessed by various tools of assessment. Achievement test is one of them because achievements measure the extent to which a person has “achieved” something, acquired certain information, or mastered certain skills usually as result of planned instruction or training.

As for as elementary level is concerned, it is a school for students at their first school years, before they enter secondary education. The exact ages vary by country. Elementary school is usually part of the compulsory education, especially in the Western countries.

The researcher herself is a science teacher and teaching General Science subject from many years at elementary level .During teaching, researcher observed that some students were taking more interest and asking more and more questions from that very part of General Science while some other students were more interested in another part of General Science. So, keeping in mind the importance and attitude of students towards General Science at elementary level, researcher selected this topic. It was necessary to study that to what extent which component of curricular content is according to interest and mental age of students. So, the researcher conducted a study to analyze achievement level of students on different components of curricular content of General Science at elementary level.

Statement of the Problem:

In Pakistan, at elementary level the students are taught General Science as a compulsory Subject. The curricular content of General Science has different components i.e. Biology, Chemistry, physics, Geology, Astronomy. To check interrelationship and achievement of students in specific components and which one component shows the best result at elementary level, the researcher focused her research on “A comparative study of achievement of Science students on component of curricular content at elementary level.”

Objectives of the Study:

This study was based on the following objectives.

1. To analyze the achievement level of students in different components of curricular content at elementary level in the Subject of General Science.
2. To compare the achievement level of boys and girls in the Subject of General Science at elementary level.
3. To compare the achievement level of boys and girls of urban and rural areas in different components of curricular content at elementary level in the subject Of General Science.
4. To determine the statistical relationship between the achievement of different components of curricular content at elementary level in the subject of General Science.

Research Questions:

There were the following questions of this study.

1. What is the achievement level of students in different components of curricular content at elementary level in the Subject of General Science?

2. Is there any difference between achievement level of boys and girls in the Subject of General Science at elementary level?
3. Is there any difference between achievement level of boys and girls of urban and rural areas in different components of curricular content at elementary level in the subject Of General Science?
4. What is the statistical relationship between the achievements of different components of curricular content at elementary level in the subject of General Science?

Tool Validation

The tool was developed in the light of suggestions given by the experts available in the Department of Education, Bahauddin Zakariya University Multan. The tool was applied for pilot study on 20 students of 02 schools and tried to remove the problems faced by the students.

Methodology

Population of the Study

All the Government Schools' students of 8th class participating in the annual examination 2015 of tehsil Chichawatni, district Sahiwal were the population for the present study.

Sample of the Study

The sample of the study is 12 Government schools (06 Government Girls High Schools and 06 Government Boys High Schools) randomly. All the selected schools were sub-organized gender wise. Thus 06 boys and 06 girls schools and further 06 boys into 03 urban and 03 rural schools, and 06 girls schools into 03 urban and 03 rural schools. Finally the scores of achievement test of 25 students from each school were selected as a sample. The total sample size is comprised 300 students as described in the table No.1 below:

Table 1

Sample of the Study

Gender	Government Boys Schools		Government Girls Schools	
	Urban	Rural	Urban	Rural
No. of Schools	03	03	03	03
No. of Students	75	75	75	75

Development of Research Tool

A teacher made objective type achievement test for students was constructed .It was consisted of 40 items from the book of General Science for class 8th. These items the was covered the most of the concepts given in the book. The numbers of MCQs /items relating to each components of curricular content of 8th class general science included in the instrument were as given in Table 1.

Table 2

Sr. No.	Components of Curricular Contents	Item No	Total No. of Items	Marks
1	Biology	1-10	10	10
2	Chemistry	11-20	10	10
3	Physics	21-30	10	10
4	Geology	31-35	5	10
5	Astronomy	36-40	5	10

Administration of the Achievement Test:

The researcher sought permission from administration of each relevant school before the distribution of research tool (achievement test) to students. After a time of one and half hour, the tests were collected from the students for further research work.

Scoring of the Achievement Test

Scores to each option against at MCQ were assigned for the purpose of quantitative analysis. Marks of each part were 10 (total 50 marks).Achievements test were arranged school wise. Scores are tabulated with respect to the component of curricular content of 8th class science.

Data Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) Version 19. Continuous variables like marks in different subjects and total marks were expressed as mean standard deviation, median and mode. Categorical variables like Grades in different subjects were given as frequencies and percentages. Comparison of continuous variables with respect to gender and location of school was done using independent sample T test. Categorical variables are compared on the basis of gender and location of school using Pearson Chi square test.Difference between groups is considered statistically significant if P value is < 0.05.

The data was analyzed on the following basis.

- A) Gender
- B) Location of school

Results

Table 3: Overall Mark in Different Parts of General Science

Table two indicates that the highest mean score of students is in the part of Biology which is 7.45. The largest mean score is in geology which is 5.6. Higher means shows the better performance of students in part of Biology. The highest S.D. of students was in Geology which is 2.46 the lowest S.D. is in Physics i.e. 1.63. Highest S.D. shows the higher spread of scores in part of Geology. The highest Median is 8 in part of Biology shows that most of students got round about 8 marks in Biology. The highest mode value 8 in part of Biology. Chemistry and Astronomy means that most of the students got mark 8 in below mentioned part.

Table 2

Overall Marks in Different Parts of General Science

Marks obtained in	Minimum	Maximum	Mean	SD	Median	Mode
Biology	1.00	10.00	7.45	1.9	8	8
Chemistry	1.00	10.00	6.3	1.95	7	8
Physics	1.00	9.00	5.84	1.63	6	5
Geology	.00	10.00	5.6	2.46	6	6
Astronomy	.00	10.00	6.7	2.4	6	8
Total marks	14.00	47.00	31.95	7.84	31.5	28

Table 4: Marks Grades in Different Parts of Science Subjects

Table 03 indicates that grade A+ is got by greater number of students (32%) in part of Biology. Grade A, C and E are got by greater number of students (29.3%, 28.3% and 16.7%) in part of astronomy. Grade B and F are got by greater number of students (30% and 20%) in part of Geology. Grade D is got by greatest number of students (26.3%) in Physics. And as a whole, mostly students got grade D.

Table 3

Marks Grades in Different Parts of Science Subjects

Subject/ grade	Biology-n(%)	Chemistry-n (%)	Physics-n (%)	Geology-n (%)	Astronomy-n (%)	Total-n (%)
A+	96 (32)	33 (11)	7 (2.3)	27 ((9)	56 (18.7)	12 (4)
A	61 (20.3)	70 (23.3)	47 (15.7)	60 (20)	88 (29.3)	55 (18.3)
B	57 (19)	57 (19)	66 (22)	90 (30)		50 (16.7)
C	39 (13)	41 (13.7)	40 (13.3)	74 (24.7)	85 (28.3)	56 (18.7)
D	23 (7.7)	37 (12.3)	79 (26.3)	49 (16.3)		72 (24)
E	15 (5)	27 (9)	45 (15)	27 (9)	50 (16.7)	37 (12.3)
F	9 (3)	35 (11.7)	16 (5.3)	60 (20)	21 (7)	18 (6)

Table 5: Comparison of Marks in Different Parts of science with respect to Gender

Table 03 indicates that the difference of means in parts of Biology, Chemistry, Physics, Geology and Astronomy shows the better performance of female sample group. High magnitude of S.D. was in parts of Biology, Chemistry & Physics shows the greater spread of scores of male sample group. While in part Geology & Astronomy shows the greater spread of scores of female sample group. As a whole performance of female sample group is better than male sample group. P value in part Chemistry, Physics, Geology & Astronomy is statistically significant i.e. <0.05 .

Table 4

Comparison of Marks in Different Parts of science with respect to Gender

Subjects	Male		Female		P value
	Mean	Std.deviation	Mean	Std.deviation	
Biology	7.3667	2.09639	7.5333	1.70930	0.451
Chemistry	5.7067	2.00518	7.1067	2.70507	< 0.001
Physics	5.2600	1.58614	6.4267	1.46249	< 0.001
Geology	4.5867	2.09245	6.6000	2.39406	< 0.001
Astronomy	6.0533	2.19758	7.3733	2.38718	< 0.001
Total Marks	28.9933	6.92093	34.9133	7.59365	< 0.001

Table 6: Area wise Comparison of Marks in Different Parts of science

Table 5 indicates the comparison of sample group on the basis of area. In Biology part urban student's mean is 7.6733 that is higher from rural students and same in the case Physics, Geology and Astronomy. The higher value of mean shows the better performance of urban sample group in Biology, Physics, Geology and astronomy. While in Chemistry the rural student's mean is higher from urban student's mean that shows the better performance of rural sample group in Chemistry. On the whole urban students sample group showed better performance as compared to rural students.

Table 6

Area wise Comparison of Marks in Different Parts of science

Subjects	Urban		Rural		P value
	Mean	Std.deviation	Mean	Std.deviation	
Biology	7.6733	1.84462	7.2267	1.95639	0.043
Chemistry	6.2267	1.74612	6.3867	2.13877	0.478
Physics	6.23467	1.73780	5.3400	1.34529	< 0.001
Geology	5.8400	2.43597	5.3467	2.46856	0.083
Astronomy	7.2133	2.61022	6.2133	2.02198	< 0.001
Total marks	33.3867	8.28258	30.5200	7.10395	0.001

*. Correlation is significant at the 0.05 level.

**. Correlation is significant at the 0.01 level.

Table 06 shows the correlation of Value with respect to gender. In Biology is 0.04 and 0.045, while Chemistry is 0.31 and 0.00, in Physics is 0.36 and 0.00, in Geology is 0.41 and 0.00, in Astronomy is 0.28 and 0.00 and as whole is 0.38 and 0.00. The value of r and p is statistically significant in part of Chemistry, Physics, Geology and Astronomy which means that the difference is present between the performances of two sample groups.

Table 7
Correlation with Respect to Gender

Gender		Marks	Marks	Marks	Marks	Marks	Total
		obtained in Biology	obtained in Chemistry	obtained in Physics	obtained in Geology	obtained in Astronomy	marks
Gender	Pearson Correlation (r)	0.044	0.308**	.358**	0.410**	0.277**	0.378**
	P-value	0.451	0.000	0.000	0.000	0.000	0.000

*. Correlation is significant at the 0.05 level.

** . Correlation is significant at the 0.01 level.

Table 6 shows the correlation and P.value with respect to location of School that is in Biology is 0.117 and 0.043, in Chemistry is 0.041 and 0.478, in Physics is 0.309 and 0.000, in Geology is 0.100 and 0.083, in Astronomy is 0.210 and 0.000 as a whole is 0.183 and 0.001. The value of r and p are statistically significant in the part of Biology, Physics and Astronomy which means that the difference is present between the performances of two sample groups.

Table 8
Correlation with respect to Area of School

Area of school		Marks	Marks	Marks	Marks	Marks	Total
		obtained in Biology	obtained in Chemistry	obtained in Physics	obtained in Geology	obtained in Astronomy	marks
Area of school	Pearson Correlation (r)	.117*	.041	.309**	.100	.210**	.183**
	P-value	.043	.478	.000	.083	.000	.001

Conclusion and Discussion

The highest mean score of students was in the part of Biology which is 7.45. The largest mean score was in geology which is 5.6. Higher mean shows the better performance of students in part of Biology. The Highest S.D. of students in Geology which was 2.46 the lowest S.D. was in Physics i.e. 1.63. High S.D. shows the higher spread of the scores in part of Geology. The highest median was 8 in part of Biology shows that most of students got round about 8 marks in Biology. The highest mode value was 8 in part of Biology. Chemistry and Astronomy, it means that most of the students got mark 8 in above mentioned parts.

Grade A+ was got by greater number of students (32%) in part of Biology. Grade A, C and E are got by greater number of students (29.3%, 28.3% and 16.7%) in part of astronomy. Grade B and F are got by greater number of students (30% and 20%) in part of Geology. Grade D was got by greatest number of students (26.3%) in Physics. And as a whole, mostly students got grade D.

Grade A+, A & C were got by greater number of total female students (8.0% & 30.7% & 19.3%). While Grade B, D, E & F were got by greater number of total male students (20.0%, 31.3%, 14.0% & 10.7%). P value was statistically significant which means that the difference is present between performances of two sample groups.

Grade A+, A & D were got by greater number of urban students (8.0%, 24.0% & 24.7%) in all subjects. While grade B, C, E & F were got by greater number of rural students (20.7%, 22.7%, 12.7% & 8.0%). P value was statistically significant that the difference was present between the performances of two sample groups.

On the whole achievement of students was better in the part of Biology than other parts i.e. Chemistry, Physics, Geology, and Astronomy.

The achievement of female students was better than male students in almost every part of curricular contents of general science. There was no difference between the achievement of male and female students in part Biology of general science at elementary level. The achievement of urban students was better in parts of Biology, Physics and Astronomy than rural students. In Chemistry and Geology the achievement of rural students was better than urban students.

Recommendation

The results of the study indicated the following recommendations for further researchers:

1. The achievements of students were better in part of Biology as compared to other components of curricular contents. It is recommended that the curricular content of other components of General Science should be revised.
2. The achievements of urban students were better than that of rural students. It may be because of many reasons. It may be lack of student's interest or due to inappropriate teaching method and it may be unavailability of qualified teachers. In this situation, all reasons should be addressed and it is recommended that Govt. should allocate more educational funds and make sure regarding the provision of facilities. Coaching classes may also be arranged for rural areas students.
3. The achievement of girl's students was better than the boy's students. So, it is recommended that boy's school teachers may change their teaching strategy or take other relevant steps to increase boy's achievements in general science at elementary level.

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