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An Evaluative Study of Chemistry Curriculum at Higher Secondary School Level in Pakistan

Abdur Rashid [*]

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Abstract: *The research was conducted to evaluate the National Curriculum of Chemistry for Higher Secondary level in Pakistan. This was a Descriptive and Evaluative study with a special focus on the achievement of objectives set at the National Level. The researcher prepared two questionnaires and served to the sample of curriculum experts and teachers of chemistry. The sample comprising of 50 experts and 400 teachers was selected from all the Provinces and the Districts through multistage random sampling techniques. The tool used was Chi-Square. Analysis of the data led to the findings of the study. The important findings reflected that Experts were satisfied with the alignment of the curriculum with the ideology of Pakistan. However, they were not satisfied with the attainability of objectives within the given timeframe and the process of curriculum development. The teachers expressed their satisfaction with the content but dissatisfaction with the students' evaluation process. On the basis of findings, recommendations were offered, which included the involvement of the teachers in the curriculum development process.*

Key Words: Curriculum, Evaluation, Chemistry.

Introduction

Education in general and science education, in particular, can rightly be called the foundation upon which the entire edifice of our future social, cultural and economic development is erected. Science is the combination of Cognitive activities, including psychological, emotional and Practical experiences. However, there may be certain issues that influence learners' perceptions and practices about science education in Pakistan, like the nature of the textbooks, overemphasizes factual information and lack of relevance with the social and personal lives of students, abstract concepts and intangible entities etc. Pakistan being an ideological state, cannot ignore the provision of educational facilities to its masses, and in the era of science and technology where the world is undergoing rapid changes in all of its spheres, the importance of education has increased manifold. Science Education has provided the springboard for all the progress of the world, and man has been able to conquer time and distance. Nations that have embarked upon technological and scientific development with long and short term planning in educational system and implementations have been able to attain the status of developed countries.

Pakistan, right from the day of its emergence, has realized the importance of education in general and science and scientific education in particular. Soon after independence, the All Pakistan Educational Conference was convened in 1947 at the behest of Quaid-e-Azam. Father of the nation provided basic guidelines for future educational development by stressing inter-alia that the system of education in Pakistan should suit the genius of the people, be consonant with our history, culture and instil a sense of honour, integrity, responsibility and selfless service to the nation. The importance of science and scientific education for Pakistan is quite evident from the message of the Quaid to the First Educational Conference.

"The future of our nation will and must greatly depend upon the types of education we give to our children and the way in which we bring them up as future citizens of Pakistan. Education does not

[*] Pakistani Islamic Private School, Al Ain, UAE. Email: bangashrashid@yahoo.com

mean the academic education. There is an immediate and urgent need of training our people in scientific and technical education in order to build up our future economic life. But do not forget that we have to compete in the world, which is moving very fast" (Iqbal, 1981).

The curriculum plays a vital role in the development of a nation and society. It is a path leading toward the success of nations. In the era of technological advancement, the challenges of modern technology can only be met by choosing the right path, i.e. the right curriculum of science subjects. Chemistry is the central science, and the concepts and ideas developed in it may be applied virtually to every other area of science, including biology, physics etc. affects our lives in many ways. Therefore, keeping in view the importance of chemistry, it was considered appropriate to carry out an evaluation of the chemistry curriculum for higher secondary level classes and make viable recommendations for its enrichment to overcome the deficiencies and align the curriculum with international standards.

Statement of the Problem

The problem of the study was to evaluate the National Curriculum (chemistry) approved by the Government of Pakistan, Ministry of Education, for Higher Secondary School Certificate. The study was designed to find out the opinions of the stakeholders of the curriculum, i.e. teachers, students and curriculum experts, for finalizing the recommendations to the concerned agencies and authorities.

Objective of the Study

Following were the objectives of the study: -

1. To carry out an evaluation of the existing curriculum through exploring the opinion of the experts and teachers regarding attainment of the objectives, appropriateness of the content, teaching methodologies and student evaluation system
2. To offer recommendations for improvement and enrichment of the existing curriculum.

Method and Procedure

The study was descriptive/evaluative in nature and was conducted as per the descriptive design of the research. The researcher initially undertook an extensive review of available related literature before collecting the data pertinent to the research project.

All curriculum experts working in the Ministry of Education Curriculum Wing, Curriculum Bureau in Provinces Curriculum Bureaus and Textbook Boards in the provinces and teachers teaching Chemistry at the higher secondary level both in public and private secondary schools / higher secondary schools and colleges in Pakistan constituted the population of this study. Stratified Random sampling procedures were adopted for the selection of the sample.

Sample of Experts

1. Curriculum experts from Ministry of Education Islamabad (16)
2. Curriculum experts from Curriculum Bureau (20)
3. Curriculum experts from Textbook Boards (14)
4. Total 50

Sample of Teachers

Cat	Islamabad	Punjab	NWFP	Sindh	Balochistan	Total
Male	12	104	28	35	21	200
Female	12	104	28	35	21	200
Total	24	208	56	70	42	400

Data Collection and Analysis

Instrument

For the collection of data, the questionnaires at a five-point rating scale were developed and administered. The questionnaire for experts included 64 items, out of which three items were to be responded by Yes or No and the rest of the items at five-point scale. The questionnaire for teachers had 45 items with two open-ended questions. The questionnaire was sent to respective respondents through post office mail and by hand to the respondents in Islamabad, Peshawar and Rawalpindi. The data collected was presented for analysis.

Tool

The data were collected through administering the questionnaires in person, where possible, and through the post where required. The data were analyzed using the Chi-square technique. The value of the chi-square of the statement was compared with the Table value of the chi Square at 0.05 levels. The statement was accepted in case of values of the chi-square is less than the table value and rejected in case of higher result values. Accordingly, the findings were formulated, and the recommendations were furnished. SSPSS software was used to ensure the accuracy of results.

Analysis of data is presented in the following tables: -

Section 1. Opinion of Experts

Table 1. The opinion of Experts Regarding Curriculum Development Process

Response		Mean	SD	χ^2
Yes	NO			
18 36%	32 64%	.36	.485	3.92

N =50 χ^2 *table = 3.841*

The above table indicates that the obtained Chi-square value is greater than the table value at 0.05 levels. It means that statistically, there is a significant difference in the opinion of the experts regarding their satisfaction with the curriculum development process in Pakistan. The experts are unequally distributed with regard to their satisfaction or dissatisfaction with the curriculum development process in Pakistan. The mean of the scores is 0.36, which is smaller than 0.50 falls in the rejection range. 64 percent of experts have not shown their satisfaction with the present curriculum development process in Pakistan. Therefore, the statement is rejected and concluded, as "The experts are not satisfied with the present curriculum development process in Pakistan".

Table 2. The opinion of Experts Regarding Selection Process of Course Content

	Response					Mean	SD	X^2
	SDA	DA	UD	A	SA			
Judgmental procedure	2 4%	3 6%	1 2%	8 16%	36 72%	4.46	1.073	87.40
Experimental procedure	15 30%	14 28%	8 16%	7 14%	6 12%	2.50	1.374	7.00
Analytical procedure	16 32%	14 28%	8 16%	6 12%	6 12%	2.44	1.373	8.80
Consensual procedure	14 28%	16 32%	9 18%	5 10%	6 12%	2.46	1.328	9.40

N =50 χ^2 *table = 9.48*

The above table indicates that the obtained Chi-square value in the case of statement that "The content of chemistry curriculum for SSC and HSSC in Pakistan have been selected by following the "Experimental procedure", "Analytical procedure", and "Consensual procedure" is smaller than the table value at 0.05 level. It means that statistically, there is no significant difference in the opinion of the experts regarding the statements. The means of the scores are smaller than 2.50; hence, not supported by the experts. More than 50 % of experts have rejected the statements. However, the statement that "The content of chemistry curriculum for SSC and HSSC in Pakistan has been selected by following the "Judgmental procedure" is supported by the experts as its chi-square value is greater than the table value at 0.05 level. In addition, the mean of the scores is also greater than 2.50. More than 80 % of experts have been found in favour of the statements. Hence, the statement is accepted. Therefore it is concluded that "The content of chemistry curriculum for SSC and HSSC in Pakistan has been selected by following the "Judgmental procedure and no Experimental, Analytical or Consensual procedure is adopted for selection of content for chemistry at this level".

Table 3. The opinion of Experts Regarding Curriculum Revision in Pakistan

Response					Mean	SD	χ^2
SDA	DA	UD	A	SA			
6 12%	7 14%	6 12%	19 38%	12 24%	3.48	1.328	12.60

N =50 χ^2 *table = 9.48*

The above table indicates that the obtained Chi-square value is greater than the table value at 0.05 level. It means that statistically, there is a significant difference in the opinion of the experts regarding Curriculum revision in Pakistan. The experts are unequally distributed with regard to the statement. The mean of the scores is also greater than 2.50. 62 per cent of experts have supported the statement. Therefore, statement is accepted and concluded as "Curriculum revision in Pakistan is carried out abruptly".

Table 4. The opinion of Experts Regarding Philosophical Foundation of Curriculum

	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Progressivism	15 30%	15 30%	8 16%	7 14%	5 10%	2.44	1.327	8.800
Essentialism	17 34%	12 24%	9 18%	6 12%	6 12%	2.44	1.387	8.6
Reconstructionism	14 26%	16 32%	9 12%	5 16%	6 14%	2.46	1.328	9.400
Idealism	14 28%	16 32%	8 12%	5 16%	7 12%	2.50	1.374	9.00
Realism	14 26%	16 32%	9 12%	5 18%	6 12%	2.46	1.328	9.400
No philosophy at all	3 6%	2 4%	0 0%	7 14%	38 76%	4.50	1.111	70.480

N =50 χ^2 *table = 9.48*

The above table reflects that the obtained Chi-square value of the statement that "In our curriculum of chemistry for SSC and HSSC we follow no philosophy at all" is greater than the table value at 0.05 level. It means that statistically, there is a significant difference in the opinion of the experts regarding following the philosophy for Curriculum development in Pakistan. The experts are unequally distributed with regard to the statement. The mean of the scores is greater than 2.50. 80 percent of experts have

been found agreed with the statement. Therefore, the statement is accepted and concluded as "In our curriculum of chemistry for SSC and HSSC, we follow no philosophy at all".

Section II. Teachers' opinion

Table 5. The opinion of teachers regarding the compatibility of aims and objectives of the curriculum with national ideology

Gender	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Male	26	20	38	47	69	3.65	1.25	10.93
Female	12	24	32	70	62			
Total	38	44	70	117	131			
%	9.5	11.0	17.5	29.3	32.8			

N =400 χ^2 table = 9.48

The above table indicates that the Chi-Square value of the data is greater than the table value at 0.05 level. It means that statistically, there is a significant difference in the opinion of the respondents. In addition, the mean of the scores is 3.65, which is acceptable, being greater than 2.50. More than 61% of the respondents have favoured the statement. Therefore, the above statement is accepted and concluded: " The aims and objectives of the curriculum are consonant with our national ideology ".

Table 6. The opinion of teachers regarding the role of chemistry in the following: -

a. To develop in students Imaginative and critical thinking
b. To enable students to recognize the role of chemistry in everyday life
c. To enable students to recognize the role of chemistry in industry

	Gender	Response					Mean	SD	χ^2
		SDA	DA	UD	A	SA			
Imaginative and critical thinking	Male	57	63	34	26	20	2.40	1.246	2.075
	Female	55	71	36	25	13			
	Total	112	134	70	51	33			
	%	28.0	33.5	17.5	12.8	8.3			
To recognize role of chemistry in everyday life	Male	56	65	32	32	15	2.38	1.246	6.121
	Female	66	53	45	22	14			
	Total	122	118	77	54	29			
	%	30.5	29.5	19.3	13.5	7.3			
To recognize role of chemistry in industry	Male	33	41	46	52	28	3.03	1.290	2.483
	Female	26	47	50	44	33			
	Total	59	88	96	96	61			
	%	14.8	22.0	24.0	24.0	15.3			

N =400 χ^2 table = 9.48

The above table indicates that the obtained Chi-square value in the case of statements that " The curriculum develops in students Imaginative and critical thinking, Enable them to recognize the role of chemistry in everyday life and Enable them to recognize the role of chemistry in the industry is smaller than the table value at 0.05 level. It means that there is no significant difference in the opinion of the respondents. The respondents are equally distributed with regard to the statements. The means of developing Imaginative and critical thinking and enable the students to recognize the role of chemistry in everyday life is smaller than 2.50; hence, More than 60 % of teachers have not supported the statements. However, the statement that "The curriculum enables the students to recognize the role of chemistry in the industry is has been supported by the respondents as the mean of the scores is greater than 2.50. Therefore it is concluded that "The curriculum does not develop in students the Imaginative

and critical thinking and does not enable them to recognize the role of chemistry in everyday life however it enables them to recognize the role of chemistry in the industry".

Table 7. The opinion of Teachers Regarding Fulfillment of Future Needs of Students

Gender	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Male	58	85	27	23	7	2.44	1.186	1.775
Female	59	82	34	21	4			
Total	117	167	61	44	11			
%	29.3	41.8	15.3	11.0	2.8			

N =400 χ^2 table = 9.48

The Chi-Square value of the data is smaller than the table value at 0.05 level. It means that there is no significant difference in the opinion of the respondents. The respondents are equally distributed with regard to the statement. The mean is smaller than 2.50, and more than 60% of teachers have been found against the statements. Therefore, the statement is rejected and concluded as "The curriculum is not sufficiently rich to make the future requirement of the students".

Table 8. The opinion of teachers regarding the vertical sequence of curriculum

Gender	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Male	23	20	39	49	69	3.69	1.256	11.295
Female	9	24	33	71	63			
Total	32	44	72	120	132			
%	8.0	11.0	18.0	30.0	33.0			

N=400 χ^2 table = 9.48

The Chi-Square value of the data is greater than the table value at 0.05 level. It means that there is a significant difference in the opinion of the respondents. The respondents are unequally distributed with regard to the statement. The mean is greater than 2.50, and more than 60% teachers have supported the statements. Therefore the statement is accepted and concluded as "There exists a gap in the vertical development (relationship among the components of the subject from lower level to higher level) of the chemistry curriculum".

Table 9. The opinion of Teachers Regarding Appropriateness of Ratio between Theory and Practical

Gender	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Male	59	87	26	22	6	2.44	1.186	1.451
Female	59	80	34	22	5			
Total	118	167	60	44	11			
%	29.5	41.8	15.0	11.0	2.8			

N =400 χ^2 table = 9.48

The Chi-Square value of the data is greater than the table value at 0.05 level. It means that there is no significant difference in the opinion of the respondents. The respondents are equally distributed with regard to the statement. The mean is smaller than 2.50, and more than 70% of teachers have not

supported the statement. Therefore the statement is not accepted and concluded as "The ratio between the theory and practical experiments is appropriate".

Table 10. The opinion of Teachers Regarding Enrichment of Content

	Gender	Response					Mean	SD	χ^2
		SDA	DA	UD	A	SA			
Explanation of various topics	Male	9	27	40	66	58	3.63	1.121	9.83
	Female	3	37	48	66	46			
	Total	12	64	88	132	104			
	%	3.0	16.0	22.0	33.0	26.0			
Examples in the chapters	Male	30	38	64	36	32	3.39	1.087	65.2
	Female	10	22	21	73	74			
	Total	40	60	85	109	106			
	%	10.0	15.0	21.3	27.3	26.5			
Questions given in the exercises	Male	30	39	62	37	32	3.70	1.074	62.8
	Female	10	21	22	73	74			
	Total	40	60	84	110	106			
	%	10.0	15.0	21.0	27.5	26.5			

N =400 χ2 table = 9.48

The above table indicates that the obtained Chi-square value in the cases of teachers' response with respect to the need for revision and enrichment of the contents is greater than the table value at 0.05 level. It means that statistically, there is a significant difference in the opinion of the respondents. The means of the are greater than 2.50, therefore falling in the accepted range. More than 57 % of respondents have been found in favour of the statements. Therefore the statements are accepted and concluded that "Explanation of various topics, Examples in the chapters and Questions given in the exercises the textbook needs to be revised/enriched ".

Table 11. The opinion of Teachers Regarding Availability of Library Equipments

Gender	Response					Mean	SD	χ^2
	SDA	DA	UD	A	SA			
Male	3	40	39	67	51	3.66	1.126	13.396
Female	9	20	53	57	61			
Total	12	60	92	124	112			
%	3.0	15.0	23.0	31.0	28.0			

N =400 χ^2 table = 9.48

The above table indicates that the obtained Chi-square value (13.396) is greater than the table value at 0.05 level. It means that statistically, there is a significant difference in the opinion of the respondents. The teachers are unequally distributed with regard to the statement. The means of the scores are falling in the accepted range being greater than 2.50. 59 % of respondents have supported the statement. Therefore, it is concluded that "Sufficient equipment are available in school for teaching chemistry ".

Findings and Discussion

In Pakistan, this important aspect is either totally ignored or has been given very little importance, whereas it is generally agreed that curriculum is the foundation stone that provides a solid base for the whole edifice of education of any nation. Pakistan being an ideological state, has a logical and rational ground for devising a progressive curriculum in accordance with the boundaries set in the constitution.

The researcher also found the fact that curriculum revision, changes in the textbooks & even changes in the content are being carried out without any research and justification. That is the reason that each

new government comes out with so-called innovative ideas for bringing changes in the curriculum. The researcher felt that efforts in that direction did not give any fruit. While interacting with the people of the Curriculum Bureau, the researcher came to know that at times most of the members of the panel of Review Committee are selected on the basis of their political affiliation rather than merit. Education in general and curriculum in particular in Pakistan are ignored to a very large extent..

It was astonishing for the researcher to find out that even the people associated with curriculum development were not satisfied with the processes of curriculum development in Pakistan. There is no evaluation and research culture in the curriculum wing. Teachers are not involved in devising and revising the curriculum.

Furthermore, since the literature on curriculum development emphasizes on affective and psychomotor domain to a very large extent, but the study revealed that the curriculum is sufficiently rich to cater for the cognitive domain of the students, and the affective and psychomotor domain is totally ignored. The literature on curriculum development emphasizes on affective and psychomotor domain to a very large extent. Being a progressive and developing country, Pakistani youths must be mature in attitude and competent in performing practical activities.

However, in spite of all these shortcomings, the curriculum and the content still provide & fulfil many basic requirements of a good curriculum. The curriculum of chemistry is sufficiently rich to develop many aspects of the scientific attitudes of the students. There is yet a lot of needs for catering to many other aspects like human development, curiosity, inquiry of the students to be developed. In Pakistan, we can draw our own objectives from the names of our country, i.e. Islamic Republic of Pakistan. It means the curriculum must take care of the Islamic aspect & values etc. It must inculcate the values of democracy in the students, and similarly, the curriculum must be able to make a student a good and patriotic Pakistani.

The content must be sufficiently rich to target all the three domains specified in the taxonomies of educational objectives. Examples are given from our own social and Islamic setup. Application to the scientific concepts is given for the understanding of the students. Practicals in the subjects of chemistry do not follow the theoretical teaching of the concept. The researcher felt that concepts must be explained and elaborated upon through the practical experiments in the laboratories. The qualification of the teaching staff is not up to the mark.

On the whole, the researcher is satisfied with his efforts to carry out an evaluation of the curriculum and recommends that a proper evaluation system be introduced in future as a regular feature.

Conclusions

The key conclusions based on the descriptive and statistical evidence indicated that the objectives set in the curriculum document are in line with the national ideology of the country. It revealed that the objectives set in the curriculum could not be achieved within the stipulated time. It was indicated that the experts were not satisfied with the curriculum development process in the country. The majority of the teachers were of the opinion that the curriculum in vogue was not capable of attaining most of the objectives set in the document. Contents have been selected by applying the criteria of significance only, and the rest of the aspects like utility, human development and interest have been ignored. Teachers use lecture methods for teaching the subject, and the rest of the teaching methods like participation, discussion, demonstration and individual experiment methods have been ignored. The teachers, as well as the students, were not satisfied with the present system of students' evaluation. Students were also having the same opinion as their teachers had. It was explored that ambitious objectives have been given in the curriculum. In addition, the laboratory facilities are not available in most of the institutions. The recommendations offered are; the opinion of teachers be sought and given due consideration while developing the curriculum. Developing the objectives for any standard must be based on research and must be realistic. The curriculum is enriched as suggested. Setting ambitious objectives without supporting contents and facilities is a mere wastage of time and resources. Like a utility, human development and interest have been ignored. Teachers use lecture methods for teaching the subject, and the rest of the teaching methods like participation, discussion, demonstration and individual experiment

methods have been ignored. The teachers, as well as the students, were not satisfied with the present system of students' evaluation. Students were also having the same opinion as their teachers had. It was explored that ambitious objectives have been given in the curriculum. In addition, the laboratory facilities are not available in most of the institutions. The recommendations offered are; the opinion of teachers be sought and given due consideration while developing the curriculum. Developing the objectives for any standard must be based on research and must be realistic. The curriculum is enriched as suggested. Setting ambitious objectives without supporting contents and facilities is a mere wastage of time and resources. Important findings and recommendations have been summarized below:-

1. The experts opined that they are: -
   a. Not satisfied with the present curriculum development process in Pakistan.
   b. Satisfied with the Judgmental procedure of content selection but not satisfied with the Analytical and Consensual procedure.
   c. Not satisfied with the following philosophical foundation in the curriculum development process.

2. The teachers opined that they are: -
   a. Not satisfied with the relationship of aims of the curriculum with national ideology.
   b. Not satisfied with the role of chemistry in daily life and industry
   c. Satisfied that there is a vertical sequence in the curriculum but did not agree that the present curriculum fulfills the future needs of the students.
   d. Not satisfied with the present content of the chemistry curriculum.
   e. Satisfied with the availability of equipment in schools.

Recommendations

1. The objectives are made simple, realistic, which should be attainable within a period of two years.
2. The curriculum is revised and enriched, making it consonant with the need of society.
3. Contents are revised, and aspects of interest, human development and utility be included in it.
4. The evaluation system is revised, and a continuous assessment system is devised to give due weightage to homework, assignments, class participation.
5. Teachers are given the training to use modern techniques of teachings.
6. Strong linkage between the school and industry needs to be bonded.

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