

## Activity-based Learning and Development of High Mental Abilities an Intention of Intermediate Level Chemistry Syllabus

Swehra Moeed  
University of Peshawar, Pakistan  
aliyaali19@yahoo.com

### Abstract

Course content is a hub of educational activities. The method of teaching and assessment procedure more or less rely on the nature of syllabus. Being core of educational activities great importance is given to course content. This study was conducted to investigate the opinion of teachers concerning existing syllabus of intermediate level chemistry subject. The data was gathered through questionnaire based on 5 point Likert scale items. Sixty three teachers of chemistry subject were working at Government Degree Colleges (GDCs) and Government Higher Secondary Schools (GHSSs) of district Peshawar. Among sixty three fifty seven teachers were selected randomly as sample of study. The collected data prevail that the implemented syllabus is mostly based on theory, hence in such circumstance the national aim to produce skill generation as per demand of market seem impossible. The condition of practical work and hand on activities is dispiriting in government educational institutes. The psychological and social need of students has been ignored while designing the syllabus. The text book is a mean of imparting pre-set information, it seems failed to provide valuable engaging activities.

### Keywords

Creativity; Job Market; Activity; Intellectual Ability; Brain Storming



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### INTRODUCTION

Science and technology play significant role in the progress of a state. It has been suggested that every single person should keep himself aware of the scientific information and its utility in daily life. Due to the vast utility of scientific education in personal and social life of people, acquisition of scientific and technological

literacy is strongly recommended for all (Gregorio, 1997 & Holbrook, 1997).

Learning and better understanding of nature occur through observation and practical handling of things. Students usually learn by conducting practical activities, and by comparing investigated data to some perimeter. The practical work is a real mean of gaining scientific knowledge. It compels students

to design and perform experiment or an investigation to manipulate solution of the problem (Hofstein & Lunetta, 2003).

Hand on activities enhances motivation and stimulates interest of the learner by providing devices, gadgets and events. On the other hand the traditional class room compel learner to be a passive participant of the class. Science classrooms and laboratories are places where learner link personal experience with outer world. The students' get familiarities of scientific phenomena either through direct observations of an entity or by practical experience (Gungor *et al*, 2007; Prain & Tytler, 2007).

Learning by doing and practical work is an indispensable and essential feature of learning science. Science educators agree that in-depth and better understanding of science occur through practical activities. In order to produce well qualified and skilled generation, it is essential to arrange conducive environment to the learners to practically utilize scientific laws and theories. Moreover, science may raise spirit of learner toward development of problem solving abilities. It also motivates students towards exploration of new scientific phenomena (Ottander & Grelsson, 2006).

Learning by doing develop conducive environment that inspires and motivate students to improve critical thinking, problem solving ability and experimentally-based inquiry skills. Science rooms and laboratories are core of practical work that involves observation, analysis and experiments (Alsop & Watts 2003).

Modern educational programme discourage memorization and encourage development of high level cognitive domain through learning by doing. Benjamin, Bloom has classified cognitive domain into six levels that include knowing, Understanding, applying, analyzing, synthesizing, evaluating and creativity. Hence it is necessary to design curriculum that help in the development of creativity (Bloom, 1956). Children are curious by nature. It is necessary to design subject matter in such a way that facilitate the curiosity of children and enhance the IQ and skills of the learner. The subject matter that is activity based, laboratory centered or is based on inquiry technique is beneficial to students, as it develop logical thinking, curiosity and scientific attitude of the learner (Elser & Esler, 1988).

Hands on experience and practical work are an effective approach of learning. It engages learner in learning process and

provides inspiration toward scientific learning. It is suggested that science rooms and laboratories at secondary and higher secondary level may be supplemented with appropriate apparatus, material and facilities. Theory should be taught side by side with practical. Appropriate time should be allocated to practical work (Akbar, 2012).

In educational institutes of Pakistan the curriculum is conveyed in the form of syllabus, in which the concepts are bifurcated in a series of topics and sub-topics. Through textbooks objectives of the curriculum can be achieved. The concepts and examples given in the books are usually difficult. Scientific explanations are usually too complicated to understand. It is vital that new and unfamiliar ideas may be presented gradually in the course content and the new information should be skillfully linked with the previous one for better understanding of scientific phenomena. Government of Pakistan laid emphasis on provision of appropriate textbooks and reading materials to educational institutes. The National Textbook Conference held from 4-6 September 1994, recommended that multiple textbooks may be utilized instead of single (Moegiadi, 1997).

In Pakistan teaching learning process is mostly based on textbook, which is insufficient to elaborate and describe scientific concept comprehensively. As a result teacher encourages pupils to memorize textbook material rather than to develop rational and critical thinking. Teachers and students both prefer to find answer to 'What' instead of 'Why' and 'How' (Tajik *et al*, 2012).

Unfortunately textbooks failed to represent curriculum in a true sense. It does not inculcate objectives, language proficiency and prior knowledge of students. Logical sequences of the content are usually not maintained. Textbook does not focused on activities of high order skills and self-assessment questions (Unesco, 2016).

The current scenario of Pakistan prevails that students enrolled in science curriculum are beyond the level to meet the expected needs of next generation and to improve scientific literacy in the country. Science classrooms and laboratories are no more places of fun and motivation. The message given to young scientist is to aim for short term success rather than aspiring them for breadth and long term wisdom (Iqbal, 2011).

### **Objectives of the Study**

The following were the objectives of the study:

1. To explore the opinion of teachers regarding intermediate level chemistry curriculum with special reference to course content.
2. To compare gender wise opinion of teachers regarding intermediate level chemistry curriculum with special reference to course content.
3. To compare experience wise opinion of teachers regarding intermediate level chemistry curriculum with special reference to course content.

### **RESEARCH QUESTIONS**

1. What is the opinion of teachers regarding chemistry curriculum at intermediate level with special reference to course content?
2. What is the gender wise opinion of teachers regarding chemistry curriculum at intermediate level with special reference to course content?
3. What is the experience wise opinion of teachers regarding chemistry curriculum at intermediate level with special reference to course content?

### **Hypotheses of the Study**

Ho1: Mean scores of female teachers of GHSSs & GDCs and male teachers of GHSSs & GDCs do not significantly differ on construct Course Content.

Ho2: Mean scores of teachers of GHSSs & GDCs on the basis of 03 categories of experience (1-5, 6-10 & 11-22 years) do not significantly differ on construct Course Content.

### **Significance of the Study**

The course content is planned keeping in view the beneficiary of different topics, student interest and social need. The syllabus of subject is selected in the light of its utility for a nation and human well being. The content is commonly chosen as per intellectual and psychological needs of students. This study showed opinion of teachers concerning implemented syllabus of intermediate level chemistry subject. They pinpoint the strength and area of development of course content of chemistry syllabus. The teachers laid stress on course content that cater over all development of students. They suggest that syllabus should be made parallel to the national and international need. The course content should be designed in a manner that it enables students to earn livelihood without relying on external

source. It should contain valuable activities that enable students to explore their hidden abilities and creativity. It should be loaded with meaningful topics so as to quench thrust of students for latest knowledge.

### **Population**

There are 30 Government Higher Secondary Schools (19 for boys and 11 for girls) (EMIS, 2016) and 17 Government Degree Colleges (09 for boys and 08 for girls) (HED, 2015) in district Peshawar. The chemistry teachers of all GHSS and GDC of district Peshawar constitute the population

of this study. 63 teachers were working in GHSS & GDC of district Peshawar. Among which 16 (10 males and 06 females) teachers were working in Government Higher Secondary Schools, while 47 (32 males and 15 females) teachers were working in Government Degree Colleges of district Peshawar.

### **Sample**

The sample of the study was comprised of eight (04 Males & 04 Females) Government Higher Secondary Schools

**Table 1.** Distribution of the Responses of Teachers on Construct Course Content

No	Items	SA (f)	A (f)	UD (f)	D (f)	SD (f)
1.	The Chemistry curriculum is emphasizing on					
	i. Knowing	6 (10.7%)	47 (83.9%)	1 (1.8%)	2 (3.6%)	0 (0%)
	ii. Understanding	6 (10.7%)	37 (66.1%)	8 (14.3%)	4 (7.1%)	1 (1.8%)
	iii. Applying	1 (1.8%)	15 (26.8%)	14 (25%)	16 (28.6%)	10 (17.9%)
	iv. Analyzing	1 (1.8%)	23 (41.1%)	7 (12.5%)	17 (30.4%)	8 (14.3%)
	v. Evaluating	15 (26.8%)	15 (26.8%)	22 (39.3%)	3 (5.4%)	1 (1.8%)
	vi. Creativity	1 (1.8%)	10 (17.9%)	6 (10.7%)	30 (53.6%)	9 (16.1%)
2.	Chemistry syllabus is updated and compete universal standard	5 (8.9%)	12 (21.4%)	5 (8.9%)	24 (42.9%)	9 (16.1%)
3.	Chemistry syllabus is mostly based on theoretical work	11 (19.6%)	33 (58.9%)	2 (3.6%)	6 (10.7%)	3 (5.4%)
4.	Students prefer selective study, instead of studying whole syllabus	20 (35.7%)	26 (46.4%)	5 (8.9%)	3 (5.4%)	1 (1.8%)
5.	Chemistry syllabus is designed according to the					
	i. Intellectual ability of students	9 (16.1%)	18 (32.1%)	9 (16.1%)	18 (32.1%)	2 (3.6%)
	ii. Psychological needs of the students	3 (5.4%)	17 (30.4%)	8 (14.3%)	25 (44.6%)	3 (5.4%)
	iii. Social need	2 (3.6%)	17 (30.4%)	9 (16.1%)	26 (46.4%)	2 (3.6%)
6.	Present chemistry course content enhance critical and rational thinking of the students	4 (7.1%)	11 (19.6%)	18 (32.1%)	16 (28.6%)	7 (12.5%)
7.	Course content contain effective and engaging activities	1 (1.8%)	18 (32.1%)	7 (12.5%)	18 (32.1%)	12 (21.4%)
8.	Concepts are briefly explained in simple and precise manner in the text book	5 (8.9%)	25 (44.6%)	10 (17.9%)	14 (25%)	2 (3.6%)
9.	Exercise at the end of the text book leads to brain storming	5 (8.9%)	19 (33.9%)	6 (10.7%)	24 (42.9%)	2 (3.6%)
10.	Syllabus of practical work enhance knowledge and skills of learners	6 (10.7%)	18 (32.1%)	4 (7.1%)	19 (33.9%)	9 (16.1%)
11.	Practical copy is very helpful in boosting knowledge and information of students	7 (12.5%)	15 (26.8%)	2 (3.6%)	27 (48.2%)	5 (8.9%)
12.	Chemistry teacher effectively demonstrate practical work in	12 (21.4%)	23 (41.1%)	4 (7.1%)	13 (23.2%)	4 (7.1%)

(GHSS) and eight (04 Males & 04 Females) district Peshawar. 56 Chemistry teachers

Government Degree Colleges (GDC) of from GHSS and GDC of district Peshawar

was included as sample of the study through the table of Krejcie and Morgan (1970). Simple random sampling technique was used for the selection of institutes as well as teachers. 27 male and 29 female teachers were selected as sample of study.

### Data Collection Instrument

Questionnaire was prepared on the basis of objectives. The questionnaire was started with items containing biographic data of the individual. Part 1 was developed on five point Likert scale (Likert, 1932) while, Part 02 was linked to open ended questions (See table 1.

Table 1.1.i indicated that 94.6% respondents were of the opinion that the chemistry curriculum is emphasizing on knowing, while 3.6% disagree with statement. 1.8% respondents remained undecided about statement concerned.

Table 1.1.ii indicated that 76.8% respondents were of the opinion that the chemistry curriculum is emphasizing on understanding, while 8.9% disagree with statement. 14.3% respondents remained undecided about statement concerned.

Table 1.1.iii indicated that 28.6% respondents were of the opinion that the chemistry curriculum is emphasizing on applying, while 46.5% disagree with

statement. 25% respondents remained undecided about statement concerned.

Table 1.1.iv indicated that 42.9% respondents were of the opinion that the chemistry curriculum is emphasizing on analyzing, while 44.7% disagree with statement. 12.5% respondents remained undecided about statement concerned.

Table 1.1.v indicated that 53.6% respondents were of the opinion that the chemistry curriculum is emphasizing on evaluating, while 7.2% disagree with statement. 39.3% respondents remained undecided about statement concerned.

Table 1.1.vi indicated that 19.7% respondents were of the opinion that the chemistry curriculum is emphasizing on creativity, while 69.7% disagree with statement. 10.7% respondents remained undecided about statement concerned.

Table 1.2 indicated that 30.3% respondents were of the opinion that chemistry syllabus is updated and compete universal standard, while 59% disagree with statement. 8.9% respondents remained undecided about statement concerned.

Table 1.3 indicated that 78.5% respondents were of the opinion that chemistry syllabus is mostly based on theoretical work, while 16.1% disagree

with statement. 3.6% respondents remained undecided about statement concerned.

Table 1.4 indicated that 82.1% respondents were of the opinion that students prefer selective study, instead of studying whole syllabus, while 7.2% disagree with statement. 8.9% respondents remained undecided about statement concerned.

Table 1.5.i indicated that 48.2% respondents were of the opinion that Chemistry syllabus is designed according to the intellectual ability of students, while 35.7% disagree with statement. 16.1% respondents remained undecided about statement concerned.

Table 1.5.ii indicated that 35.8% respondents were of the opinion that Chemistry syllabus is designed according to the psychological needs of the students, while 50% disagree with statement. 14.3% respondents remained undecided about statement concerned.

Table 1.5.iii indicated that 34% respondents were of the opinion that Chemistry syllabus is designed according to the social need, while 50% disagree with statement. 16.1% respondents remained undecided about statement concerned.

Table 1.6 indicated that 26.7% respondents were of the opinion that present chemistry course content enhances critical and rational thinking of the students, while 41.1% disagree with statement. 32.1% respondents remained undecided about statement concerned.

Table 1.7 indicated that 33.9% respondents were of the opinion that course content contains effective and engaging activities, while 28.6% disagree with statement. 17.9% respondents remained undecided about statement concerned.

Table 1.8 indicated that 53.5% respondents were of the opinion that concepts are briefly explained in simple and precise manner in the text book, while 53.5% disagree with statement. 12.5% respondents remained undecided about statement concerned.

Table 1.9 indicated that 42.8% respondents were of the opinion that exercise at the end of the text book leads to brain storming, while 46.5% disagree with statement. 10.7% respondents remained undecided about statement concerned.

Table 1.10 indicated that 42.8% respondents were of the opinion that syllabus of practical work enhances



knowledge and skills of learners, while 50% disagree with statement. 7.1% respondents remained undecided about statement concerned.

Table 1.11 indicated that 39.3% respondents were of the opinion that practical copy is very helpful in boosting knowledge and information of students, while 57.1% disagree with statement. 3.6% respondents remained undecided about statement concerned.

Table 1.12 indicated that 62.5% respondents were of the opinion that Chemistry teacher effectively demonstrate practical work in laboratory, while 30.3% disagree with statement. 7.1% respondents remained undecided about statement concerned.

Table 1.13 indicated those 66% respondents were of the opinion that 50% of chemistry curriculum need to be based on practical work, while 26.8% disagree with statement. 04% respondents remained undecided about statement concerned.

**Ho1:** Mean scores of female teachers of GHSSs & GDCs and Male teachers of GHSSs & GDCs do not significantly differ on construct Course Content.

**Table 2.** Gender Wise Comparison of Opinion of Chemistry Teachers of GHSSs &

GDCs on Construct Course Content of Chemistry Curriculum

Construct	Gender	N	Mean	Std. Deviation	P-Value
Course Content	Male	27	8.1658	15.22942	.270
	Female	29	4.4893	8.84596	

<sup>1</sup>Note. Independent-Samples T Test; t = 1.114; df = 54

The table 2 indicated that the Independent-Samples T Test was used for calculation of significance difference at significance level of 0.05 between opinion of male and female chemistry subject teachers of government institutes. The  $P > 0.05$ , thus average score on construct Course Content for male teachers ( $M= 8.1658$ ,  $SD=15.22942$ ,  $N= 27$ ) is insignificantly different than female teachers ( $M= 4.4893$ ,  $SD=8.84596$ ,  $N= 29$ ) opinion scores. Hence the two groups on the basis of gender could be treated as equal on construct Course Content and null hypothesis ( $H_01$ ) is accepted. The result of test showed that both male and female teachers were on the same page in connection with course content of chemistry subject.

**Ho2:** Mean scores of teachers of GHSSs & GDCs on the basis of 03 categories of experience (1-5, 6-10 & 11-22 years) do not significantly differ on construct Course Content.

**Table 3.** ANOVA presenting Insignificance Difference between Mean scores of Teachers of GHSSs & GDCs of Different Experience on Construct Course Content

Variables	Sum of Squares	df	Mean Square	F	P
Between Groups	621.963	2	310.981	1.934	.156
CC Within Groups	7719.950	48	160.832		
Total	8341.913	50			

<sup>1</sup>Note. ANOVA

The table 3 statistical values ( $F= 1.934$ ,  $P>0.05$ ) presented insignificant difference between mean scores of teachers of GHSS & GDC of different experience on construct Course Content. Hence the three groups on the basis of experience could be treated as equal on construct Course Content and null hypothesis ( $H_0$ ) is accepted. The data revealed that teachers divided into three categories on the basis of experience express similar opinion regarding in-practice chemistry syllabus. All the three categories agreed that chemistry syllabus is emphasizing on knowledge and to some extent on evaluation while other cognitive domains are neglected. During designing syllabus psychological need of students and demand of society was ignored. Importance is given to theory limited opportunity for practical work is available which need improvement.

## FINDINGS

- 1) The course work is too lengthy, while limited time has been allocated for the completion of the same. There is little consistency between syllabus and practical work.
- 2) There is shortage of scientific equipment and chemicals at Government institutes.
- 3) Most of the teachers stated that chemistry curriculum emphasized on knowledge and understanding, however it ignores higher level of cognitive domain like applying, analyzing and creativity except evaluating.
- 4) Syllabus is not up-to-date and cannot compete universal standard. It is mostly based on theory. Further they stated that students do selective study. Teachers were also of the opinion that chemistry syllabus is designed according to the intellectual abilities of students, however psychological and social needs are ignored.
- 5) Present chemistry curriculum failed to enhance critical thinking of students, because it does not contain effective and engaging activities. Chemical

concepts are briefly explained in simple and precise manner in the textbook and exercise given at the end of textbook leads to brain storming.

- 6) Practical copy and syllabus of practical work do not provide productive information and skill. Further teachers stated that they effectively demonstrate practical work in the laboratory and suggested that 50% curriculum should be based on practical activities.
- 7) No significant difference was found between female teachers of GHSSs & GDCs and male teachers of GHSSs & GDCs on construct Course Content (Table 2)
- 8) No significant difference was found among 03 categories of teachers on the basis of experience (1-5, 6-10 & 11-22 years) on construct Objective (Table 3).

### **Recommendations**

- 1) Chemistry curriculum needs to be based on thought provoking activities. Implementation of activity based learning and practical work is desired. The course should be designed in a way that enhances analytical and critical thinking of students. Research projects and research based activities must be launched. The syllabus needs to be arranged in psychological order i.e. from simple to complex. It should be designed according to the need of society. Pattern of A-level Syllabus should be followed while designing the intermediate level syllabus. Syllabus needs to be designed according to the job market e.g industries.
- 2) Syllabus may be designed in such a manner, that it can be easily completed within time period allotted for the academic session. The curriculum at intermediate level need to be research based and it should mostly focus on the practical work. Practical activities need to be incorporated with each and every topic.
- 3) Curriculum should be designed according to the mental caliber and interest of students. Course outline of practical work should be updated. Introduction of new experiments is also desired at intermediate level.
- 4) In science subject, theory and practical go side by side, hence balance should be kept between both.
- 5) Number and size of chapters need to be reduced. Mistakes in text book

- should be rectified. Easy (English) language may be used, while writing a text book.
- 6) Books should be designed in such a manner that it expose creativity and enhance multiple skills of students. Repetition of topics should be avoided at intermediate level. Practical aspect of chemistry need to be strengthened. Applied chemistry should be integrated at Intermediate stage.
- 7) Careful and up-to-date curriculum is intensely needed, therefore well qualified persons with good interpersonal skills and critical thinking may be deputed to textbook board to critically analyze the in-practice curriculum and propose a suitable outcome based curriculum for educational institutes.
- 8) Exercise at the end should contain thought provoking questions. Concept based questions and activities should be included at the end of each topic.
- students toward self-directed learning. It cannot compete universal standard as syllabus of chemistry subject is based on memorization of certain information. Practical side is completely ignored. Limited opportunities for practical activities are available. Practical work is limited to verification of certain tests. Text books are considered as source of imparting wordy knowledge. The attribute of development of rational and critical thinking and struggle for exploration of new knowledge among student is completely neglected. The implemented syllabus does not endorse creativity and useful skill among the intermediate level chemistry students.

Teachers belonging to both gender and three categories of experience of intermediate level government institutes accepted that implemented syllabus is not in coherence with psychological and social need. Stress is laid on acquisition of information. Little attention has been paid to understanding, application and analysis of knowledge. Creativity is comparatively more ignored than evaluation. Students are practiced of studying specific chapter and topics. They avoid thorough study of textbook. Chemical concepts are explained briefly in simple and understandable way in the textbook. The syllabus is in need of

## CONCLUSION

Now a day's the course content that arouse curiosity among students and motivate students towards in depth study is preferred. The study revealed that implemented curriculum failed to motivate

effective and interesting activities. Syllabus of practical work does not fulfill criteria of creative work as it has been delimited to testing of little information. According to teachers they properly demonstrate the practical at start of practical class. They also emphasized on increasing percentage of practical work as students cannot get mastery over subject by relying only on theoretical portion.

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