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Examining the Challenges of Course Content Coverage in due Time Allocation and Teaching Practices as Perceived by Students in the Subject of Chemistry

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Abstract

The study was conducted to examine the challenges of content coverage of chemistry textbooks in due time allocation in the National Curriculum and the students' perception of the teaching practices of teachers at secondary schools. Two research questions were constructed; to what extent, the curriculum of Chemistry in terms of 'content coverage has been implemented in public schools with special attention to theoretical and practical aspects of contents distributed term wise? How teachers teach chemistry content both theoretically and practically in classrooms? To find out the answer to these questions, the survey method was applied. One questionnaire was prepared for teachers while students were interviewed to understand their perception about teaching practices. Quantitative data was collected in the first phase while students were interviewed in the second phase. The sample comprised of 97 teachers (56 male and 41 female teachers) teaching Chemistry to secondary level students and 27 students (15 boys and 12 girls). Percentage and mean score were calculated against the responses of teachers taken through the Likert scale. Open-ended responses from students were presented in paragraph form after generating themes for descriptions. Major results included; one teaching period was insufficient for content coverage of 9th and 10th classes to cover theoretical and practical aspects of the course of chemistry. Apart from teaching periods, extra periods for practical work should be allocated in time table to complete the theoretical and practical work at the secondary level. It was suggested that all teachers who teach chemistry must be familiarized with the use of supporting materials like audio-visual aids for practical work to enhance the learning of students

Keywords: Chemistry, Public Schools, Teachers, Course Coverage, Theoretical and Practical

Introduction

Curriculum reforms for secondary schools in science were started in 1967. The Curricula of Physics, Chemistry, and Mathematics were revised and introduced in two phases in classes IX and X in 1968 and 1969 respectively. In 1967, the secondary science curricula were revised for the second time and Biology was introduced as a compulsory subject for the science group. Later on in 1986, 1994-95, and in 2002 the science curricula were further revised (Rehman, 2004). The curriculum document is considered to be the road map for the attainment of the national goals. For this purpose, the textbooks are developed in such a way that the contents presented in the books are aligned with the curriculum document. If there is no alignment in the textbooks and curriculum document, it is tough to achieved national goals to the desired extent which badly affects the whole system of education (Saeed & Rashid, 2014).

Chemistry deals with the composition, structures, and properties of matter, the interactions between different types of matter, and the relationship between matter and energy. Through the learning of chemistry, it is possible to acquire relevant conceptual and procedural knowledge. A study of chemistry also helps to develop an understanding and appreciation of developments in engineering, medicine, and other related scientific and technological fields. Furthermore, learning about the contributions, issues, and problems related to innovations in chemistry will help students develop an understanding of the relationship between science, technology, society, and the environment. The curriculum attempts to make the study of chemistry exciting and relevant. It is suggested that the

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learning of chemistry be situated in real-life contexts (curriculum development council, 2014). The curriculum is the total of all learning experiences and the intended learning outcomes that are offered to the learners in the auspices of a school. The curriculum is also the vehicle through which educational goals/objectives/aims are being achieved. A countries hopes and aspirations are expected to be attained through the use of the school curriculum while also modifying and educating their youths. Given the above explanations, the school curriculum must be creatively and painstakingly incorporated or integrated (Ugwu, 2003).

Content Coverage

The content of Chemistry is of utmost importance for the teachers as well as the students. The science instruction is one range that has underground huge change trying to make science more applicable for all students (Beasley & Butter, 2002; De Vos, Bulte & Pilot, 2002; Gutwill-Wise. 2001). When all is said in done, the studies uncover that science has been instructed throughout the most recent 40 years in the conventional, instructional path bringing about high substance heaps of secluded truths withdrew from their experimental birthplace (Tobin & McRobbie, 1995).

All the more particularly, the transmission technique has been the transcendent method of instructing in science where instructors endeavor to ignore their insight to students through an address style drew nearer where the substance is transmitted (Bennett, 2003). The center in the classroom has been on the priority of the educational programs" which regularly includes very much organized, issues mechanical and algorithmic research facility work and the repetition learning of a recommended assortment of information. Students, in any case, were frequently not able to see the importance of the substance of the educational programs to their lives when exhibited along these lines (De Vos & Reiding, 1999).

The fundamental audits by Hofstein and Lunetta (1982) uncovered that research facility exercises were frequently not fulfilling the wanted results, for example, advancing scholarly advancement, request, and critical thinking aptitudes. Strikingly, the examination demonstrated that secondary school science students experienced lab work in a few distinct structures; the most continuous experience was the cookbook style lab movement where they took after routine guidelines with negligible scholarly engagement (Garnett, 1987).

Tobin (1990) arranged a subsequent amalgamation of exploration on the viability of educating and learning in the science research facility. He recommended that important learning was conceivable in the research facility if the students were offered chances to control hardware and materials in a domain reasonable for them to build their insight into wonders and related experimental ideas. Appropriate laboratory activities can be effective in helping students construct knowledge, develop logical and inquiry type skills as well as problem-solving abilities (Gunstone, 1991). Research on request based exercises in science gives an establishment of seeing new activities in science instruction. Request based examination is characterized as exercises in which students step up with regards to discovering answers to certifiable issues (Hackling & Fairbrother, 1996; Jones, Simon, Fairbrother, Watson, & Black, 1992).

Settlage (2003) recommended that the request starts with an inquiry taking into account perception, which eventually prompts a conclusion taking into account proof. A few creators have contends that exploratory critical thinking abilities can be created through request situated style research center work that gives students chances to rehearse the aptitudes of issue investigation, arranging tests, gathering, sorting out, and deciphering results (Roth & Roychoudhry, 1993; Tamir, 1989; Woonough,1991).

Garnett, Garnett, and Hackling (1995) portray a request based science examination as a logical issue that requires the student to arrange a strategy, do the movement and gather the fundamental information, sort out and decipher the information, and achieve a conclusion that is imparted in some structure. The evaluation undertaking in the connection based syllabus, for example, EEI explain fully then abbreviate and the ERT give chances to the teacher to plan valid request based exercises. This errand fuse the components talked about over that constitute a request based on true logical issues, for example, arranging the segment, information gathering through research facility exercises, translation of result, and correspondence.

Many previous researchers researched different aspects of chemistry but none of them researched identifying the challenges of content coverage of chemistry at secondary schools in Pakistan. There is a misconception about the difficulty of chemistry as a subject also which may be

the one reason for the low performance of students in the subject of chemistry. This study was conducted to find out what major challenges teachers faced during the teaching of chemistry to class IX and X in Pakistan? To what extent teaching of chemistry in one class duration of 45 minutes daily perceived by teachers for content coverage through three phases (Term means: teaching duration of almost 3 months followed by an internal examination in schools). Understanding of students studying chemistry was also thought of as appropriate to learn about the teaching practices of teachers in public schools. It was hoped that this research may bring into light the critical aspects needed to address while setting up national standards at the central level, provincial level and this study may also help authorities of centralized examination (boards of intermediate and secondary education) to rethink about content for examination keeping in mind the ground realities. It was also an intention that the result of this particular study may become a source of lessening the anxiety, academic pressure, and examination phobia on part of students in Pakistan.

Research Methodology

The study was conducted in two phases; the 1st phase was quantitative while the second phase of the study was qualitative. The study also followed the mixed method of inquiry. Quantitative data were collected from teachers who were teaching chemistry while students were interviewed to validate the data. According to Best and khan (1992), the survey is a more effective way of researching a large population. It consumes lesser time as compared to other forms of researches. As well, it is less costly. The population of the study was comprised of teachers teaching chemistry to secondary classes (class IX and X) and all the students (i.e. 4039) of class IX and X from 156 schools (EMIS, 2014-2015). A random sampling technique was used to select 97 teachers (56 male and 41 female) teachers teaching Chemistry to secondary level students. Similarly, 27 students both male and female from nine schools were selected through a convenient sampling technique for an interview. For the collection of data, two research instruments (i.e. questionnaire and interview) were developed and administered. The details of these tools are given below.

The questionnaire was developed to collect data from secondary school teachers. It consisted of the items related to the 'content coverage' of the chemistry curriculum at the secondary level. The interview consisted of the items related to the content coverage of the chemistry curriculum at the secondary level. The researcher distributed the questionnaire and interviewed the students. The teachers of Chemistry in the sampled schools were mostly met in person by the researcher. On the other hand, nine schools were visited to interview the students of Chemistry. The students of high, middle, and low achievement were included in the interview for the authenticity of data.

The data received from respondents were analyzed through the statistical tools of percentage and mean score. Each statement had four responses (i) Agreed (ii) Strongly agreed (iii) Disagreed and (IV) Strongly Disagreed. The Statistical Package for Social Sciences (SPSS) was applied to generate results in tabulated forms. The qualitative data were analyzed through thematic analysis.

Results and Discussion

Table 1: ***One period daily for content coverage of 1st Term***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	5	6	35	10	2.89
	%	8.9%	10.7%	62.5%	17.9%	(0.81)
Female	N	6	7	22	6	2.86
	%	14.6%	17.1%	53.7%	14.6%	(0.91)
Total	N	11	13	57	16	2.80
	%	11.3%	13.4%	58.8%	16.5%	(0.85)

Table 1 shows that male (80.4%, M=2.89, and SD=0.81), female (68.3% M=2.86 and SD=0.91), and both (75.3%, M=2.80, and SD=0.85) teacher are agreed with the statement for one period daily is used for content coverage of 1st Term.

Table 2: ***Allocation of separate periods for practical work***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	9	3	25	19	2.96
	%	16.1%	5.4%	44.6%	33.9%	(1.02)
Female	N	1	0	25	15	3.31
	%	2.4%	.0%	61.0%	36.6%	(0..60)
Total	N	10	3	50	34	3.31

%	10.3%	3.1%	51.5%	35.1%	(0.88)

Table 2 shows that male (78.5%, M=2.96, and SD=1.02), female (97.6%, M=3.31, and SD=0.60), and both (86.6%, M=3.31, and SD=0.88), teacher are agreed with the statement for allocation of separate periods for practical work.

Table 3: ***Six periods weekly for content coverage of 2nd Term***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	16	5	23	12	2.55
	%	28.6%	8.9%	41.1%	21.4%	(1.12)
Female	N	12	1	19	9	2.60
	%	29.3%	2.4%	46.3%	22.0%	(1.13)
Total	N	28	6	42	21	2.57
	%	28.9%	6.2%	43.3%	21.6%	(1.12)

Table 3 shows that male (62.5% M=2.55, and SD=1.12), female (68.3%, M=2.60, and SD=1.13) and both, (64.9%, M=2.57, and SD=1.12) teacher are agreed with the statement for six periods weekly for content coverage of 2nd term.

Table 4: ***Teacher performs regularly 5-6 experiments for secondary class***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	4	2	32	18	3.14
	%	7.1%	3.6%	57.1%	32.1%	(0.79)
Female	N	2	0	21	18	3.34
	%	4.9%	.0%	51.2%	43.9%	(0.72)
Total	N	6	2	53	36	3.22
	%	6.2%	2.1%	54.6%	37.1%	(0.77)

Table 4 shows that male (89.2%, M=3.14 and SD=0.79) female (95.1%, M=3.34, and SD=0.72), and both (91.7%, M=3.22 and SD=0.77) teacher are agreed with the statement for teacher perform regularly 5-6 experiments for secondary class.

Table 5: ***Teacher includes 9th -10th practical's work at the end of 3rd term***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	8	1	25	22	3.08
	%	14.3%	1.8%	44.6%	39.3%	(0.99)
Female	N	2	0	24	15	3.26
	%	4.9%	.0%	58.5%	36.6%	(0.70)
Total	N	10	1	49	37	3.16
	%	10.3%	1.0%	50.5%	38.1%	(0.88)

Table 5 shows that male (83.9%, M=3.08, and SD=0.99) female (95.1%, M=3.26, and SD=0.70) and both (88.6%, M=3.16, and SD=0.88) teacher are agreed with the statement for the teachers includes 9th-10th practical work at the end of 3rd term.

Table 6: ***All 9th -10th practical are related to given units work at the end of 3rd term***

Respondent	f	SDA	DA	A	SA	MEAN
Male	N	5.4%	1.8%	46.4%	46.4%	3.33
	%	0	0	28	13	(0.79)
Female	N	.0%	.0%	68.3%	31.7%	3.31
	%	3	1	54	39	(0.47)
Total	N	3.1%	1.0%	55.7%	40.2%	3.32
	%	10.3%	1.0%	50.5%	38.1%	(0.65)

Table 6 shows that male (99.7%, M=3.33, and SD=0.79) female (95.9% M=3.31and SD=0.47) and both (88.6%, M=3.32, and SD=0.65) teacher are agreed with the statement for all 9th - 10th practical are related to given units work at the end of 3rd term.

Table 7: ***All practical can be performed in school laboratories***

Respondent	f	SDA	DA	A	SA	MEAN
Male	N	6	2	17	31	3.30
	%	10.7%	3.6%	30.4%	55.4%	(0.97)
Female	N	2	0	26	13	3.21

	%	4.9%	.0%	63.4%	31.7%	(0.68)
Total	N	8	2	43	44	3.26
	%	8.2%	2.1%	44.3%	45.4%	(0.86)

Table 4.7 shows that male (85.8%, M=3.30and SD=0.97) female (95.1%, M=3.21, and SD=0.68), and both (87.7%, M=3.26, and SD=0.86) teacher are agreed with the statement for all practices can be performed in school laboratories.

Table 8: ***Teacher shares content knowledge with help of examples***

Respondent	f	SDA	DA	A	SA	MEAN
Male	N	13	9	18	16	2.66
	%	23.2%	16.1%	32.1%	28.6%	(1.13)
Female	N	3	1	26	11	3.09
	%	7.3%	2.4%	63.4%	26.8%	(0.76)
Total	N	16	10	44	27	2.84
	%	16.5%	10.3%	45.4%	27.8%	(1.01)

Table 4.8 shows that male (60.7%, M=2.66, and SD=1.13) female (90.2%, M=3.09, and SD=0.76), and both (73.2%, M=2.84, and SD=1.01) teacher are agreed with the statement for teacher shares content knowledge with the help of examples.

Table 9: ***Teacher encourages the student for their involvement***

Respondent	f	SDA	DA	A	SA	MEAN
Male	N	8	2	22	24	2.79
	%	14.3%	3.6%	39.3%	42.9%	(1.22)
Female	N	2	2	20	17	2.65
	%	4.9%	4.9%	48.8%	41.5%	(0.96)
Total	N	10	4	42	41	2.71
	%	10.3%	4.1%	43.3%	42.3%	(1.11)

Table 9 shows that male (82.2%, M=2.79, and SD=1.22) female (90.3%, M=2.65, and SD=0.96) both are (85.6%, M=2.71 and SD=1.11 teacher are agreed with the statement for teacher encourages the student for their involvement.

Table 10: ***Teacher motivates the student to implements their acquired knowledge of content***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	14	8	12	22	2.76
	%	25.0%	14.3%	21.4%	39.3%	(1.22)
Female	N	8	4	23	6	2.73
	%	19.5%	9.8%	56.1%	14.6%	(0.97)
Total	N	22	12	35	28	2.75
	%	22.7%	12.4%	36.1%	28.9%	(1.11)

Table 10 shows that male, (60.7%, M=2.76, and SD=1.22) female (70.7%, M=2.73, and SD=0.97), and both (65%, M=2.75, and SD=1.11) teacher are agreed with the statement for teacher motivates the students to implements their acquired knowledge of content.

Table 11: ***Teacher allows the students to criticize the content of chemistry***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	14	7	13	22	3.00
	%	25.0%	12.5%	23.2%	39.3%	(1.15)
Female	N	8	2	24	7	3.31
	%	19.5%	4.9%	58.5%	17.1%	(0.77)
Total	N	22	9	37	29	3.13
	%	22.7%	9.3%	38.1%	29.9%	(1.00)

Table 11 shows that male (62.5%, M=3.00, and SD=1.15) female (75.6%, M=3.31, and SD=0.77), and both (68%, M=3.13, and SD=1.00) teacher are agreed with the statement for teacher allows the students to criticize the content of chemistry.

Table 12: ***Teacher asks students to express what aspect of the lesson went well***

Respondent	F	SDA	DA	A	SA	MEAN
Male	N	12	1	18	25	2.64
	%	21.4%	1.8%	32.1%	44.6%	(0.99)

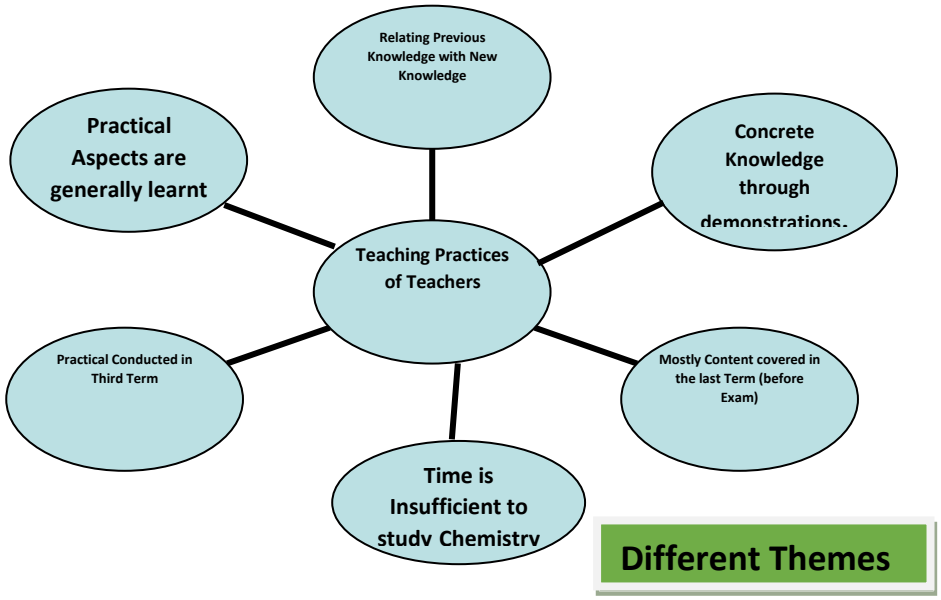
Female	N	2	0	22	17	2.63
	%	4.9%	.0%	53.7%	41.5%	(1.06)
Total	N	14	1	40	42	2.63
	%	14.4%	1.0%	41.2%	43.3%	(1.02)

Table 12 shows that male (76.7%, M=2.64, and SD=0.99) female (95.2%, M=2.63, and SD=1.06), and both (84.5%, M=2.63, and SD=1.02) teacher are agreed with the statement for teacher asks students to express what aspect of the lesson went well.

This study brought into light the results which were similar to those of Utsa, Ceng, Kasti, and Ayas (2009) supported the idea to increase the length of time for course coverage in the subject of Chemistry. Similarly, Knight and Wood (2005) arrived at similar results as of this study, the performance of the students can be assessed from their activities like group discussion and group work of students. Hart (2000) also stressed that the students have to acquire relevant content knowledge before the start of the activity and in this study, it was found that teachers tried to relate previous knowledge with new knowledge. This study found that students were encouraged to participate in the learning process but a study conducted by Sutamn and Bruce (1992) opposed the idea, according to them teachers did not encourage the students for their involvement and participation during the class teaching. Hackling and Fairbrother (1996), Jones, Simon, Fairbrother, Watson, and Black (1992) expressed similar views that students should be motivated for better learning in the form of an inquiry-based method. Settlage (2003) also supported the inquiry-based method by observation for the conclusion based on scientific evidence. Research at secondary school, students showed that activity-based learning enables the students for scientific skills to provide scientific problems (Gibson & Chase, 2002; Hodson, 1990; Hofstein, Shore & Kipnis, 2004; Rigano& Ritchie, 1994; Skinner, 1994; Watts, 1991).

Students' Interview Data

The following themes were extracted from the responses of students about the teaching practices of teachers in classrooms. The students were asked to freely share their perceptions about different aspects of the teaching-learning process for the subject of chemistry.



Most students responded that teachers used their knowledge to develop the connection between previous and new information. Students' observations were also asked and their previous knowledge/experiences were considered valuable.

Students also responded that they got the basic knowledge regarding the laboratory work through the description given in the practical notebooks, detailed experimental procedures, and through teachers' demonstration of practical work.

Students claimed that they were taught in a hurry especially in the third term which started after December just two months earlier to the final examination. They were burdened in the last term due to which they felt chemistry was a very difficult subject to study. Students told that their teachers did not have a pre-plan strategy to teach the content of the chemistry equally during three terms.

Students also reported that the teacher covers up the whole given chemistry course including theoretical and practical content by dividing it into three terms. They also concluded that the specific time for the teaching of chemistry was not sufficient during the whole session to understand the content fully and easily

Students responded that the teachers usually performed practically in a small group at the end of the 3rd term course due to the shortage of time and resources. They also reported that they were not allowed to do practical laboratory experiments most of the time and they were bound to learn the practical work by heart only. Practical work initiated in the final term did not spare anybody to pay full attention because both theoretical and practical components of the chemistry were going side by side.

Recommendations

1. The analysis of the study showed that more time for completion of the course is needed. According to the national curriculum 2006, 197 periods have been allocated for teaching chemistry theory and practical's on the other hand in schools 213 working days were having one study period for chemistry to teach so, proper planning on part of teachers may be required to complete the course of chemistry and other subjects at the proper time.

2. The requirement of increase in study time by the students and teachers was due to their differences concerning their teaching strategies, professional skills, and mental capabilities. Teachers of public schools may need to be trained in making proper academic planning of complete annual session. The students utilized their knowledge to the practical situations in the chemistry laboratory under the supervision of a chemistry teacher but they could not utilize /apply their knowledge in any new practical situation by themselves.

3. Students were not able to demonstrate their understanding of science to identify the problems in their surroundings without conceptual clarity of the topics under study so, teachers of chemistry should be trained to connect textbook knowledge with the daily experiences of students.

4. Experts from the industry should be invited to give students practical usage of knowledge of chemistry in their daily life by explaining what's going on in our metabolism, how we digest what we eat, how energy is extracted from food etc.

5. A separate practical period is allocated for complete practical work coverage and students' understanding. Activity-based content may be introduced to promote scientific and creative skills among the students. Scientific vision is created among the students and the relationships between chemistry, the world, and real-life situations need to be strengthened.

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