Quality Enabling Conditions and Teaching-learning Process in Chemistry at Senior Secondary Level

Teachers' Perspective

R K Sharma* and R B Pareek**

Abstract

There are several factors which influence the regularity and performance of learners in the school and the learning environment of schools is one of them. Learning environment refers to the diverse physical locations, contexts, and cultures in which students learn. It gives the experience of pleasure or pain, success or failure, active involvement or passive listening, to the students. Proper learning of students depends on quality enabling conditions and teaching-learning process. Teachers play an important role in creating a learning environment, especially in the teaching-learning process. NCF 2005 (NCERT, 2005) recommends experiential learning in science and quality enabling conditions are required for it. In the present study, efforts have been made to study the quality enabling conditions and teaching-learning process of chemistry from the perspective of teachers in 20 senior secondary schools of Ajmer district of Rajasthan using mixed method (qualitative and quantitative) of research. It has been observed that schools under study lacks in desired quality enabling conditions and teaching-learning process and thus, interventions are needed to improve the quality.

Introduction

Quality of education has always been the concern of everyone and a large number of studies has been conducted on various aspects of improvement of quality education (Ameh and Dantani, 2012; Bedriye and Gulcin, 2020). Based on research outputs and

* *Assistant Professor*, Department of Education in Science and Mathematics, Regional Institute of Education, NCERT, Ajmer-305004, Rajasthan, India.

** *Professor*, Department of Education in Science and Mathematics, Regional Institute of Education, NCERT, Ajmer-305004, Rajasthan, India.

practices, educational policymakers have been able to plan and execute various flagship programmes for it (Bowen and Bodner, 1991, and Bodner, 2003). In the recent past, India has also initiated a large number of programmes for quality improvement of education in the country. Recently launched National Education Policy 2020 says that a good education institution is one in which every student feels welcomed and cared for, where a safe and stimulating learning environment exists, where a wide range of learning experiences are offered, and where good physical infrastructure and appropriate resources conducive to learning are available to all students (MHRD, 2020). All these aspects are important in view of quality enabling conditions and teaching-learning process. NCF 2005 NCERT 2005 recommends experiential learning in the teaching-learning process, for which quality enabling conditions are necessary.

In view of the above, a study was undertaken to see the quality enabling conditions and teaching-learning process of chemistry in selected schools of Ajmer district. The present study is mainly based on the perspective of teachers with respect to quality enabling conditions and teaching-learning process and the findings of the study are being presented in this paper.

Rationale of the Study

Chemistry is one of the important science subjects taught at senior secondary level in school education programmes/courses to prepare the students for developing knowledge and research aptitude, and attitude in the area of chemical sciences. Therefore, at school level, understanding of the subject must be emphasised considering the importance of experiential learning. Quality enabling conditions and teaching-learning process in the school aimed at experiential learning requires availability of learning resources like laboratories, models, improvised teaching-learning aids and e-resources, etc., in certain areas of chemistry like reaction mechanism and stereochemistry (Brand,1987). In view of the above, it was planned to study the availability, condition and use of learning resources with respect to quality enabling conditions and teaching-learning process in selected schools of Ajmer.

Objectives

The main objective of the study was to explore the quality enabling conditions and quality teaching-learning process in chemistry at senior secondary level especially in the form of availability, condition and use of learning resources.

Method

A mix method (qualitative and quantitative) of research was used in the present study. A questionnaire

was developed to know the quality enabling conditions and quality teaching-learning process through 20 chemistry teachers (one PGT from each school) of the twenty schools selected for the study. Researchers personally visited the sample schools to get information through questionnaire and also interacted with the teachers of sample schools located in different blocks of Ajmer district to find out more aspects of these parameters in depth. The interaction with the teachers was done in the form of unstructured interview.

Sample

The present study was conducted in the selected schools of Ajmer district. To conduct the study, State authorities were requested to facilitate the study and accordingly, a list of 20 schools having science stream was provided by considering the parameters of study for screening of schools like rural and urban schools, representation of blocks, availability of PGT and performance of the schools in State board examinations, etc.

Tools

In the present study, tools were developed and validated by the experts. These tools were in the form of questionnaires to obtain information about quality enabling conditions and quality teaching-learning process in organic chemistry in selected senior secondary schools of Ajmer district in Rajasthan. The close-and open -ended questions were included in the questionnaire as per the requirement of the study. Qualitative interviews of teachers were also conducted by considering the open-ended questions other than the questions included in the questionnaire.

Following questionnaires were used in the present study:

Questionnaire for the Principals

This questionnaire was developed to get general information about the school, and enrolment and attendance of the students at the time of visit of researchers.

Questionnaire for Teachers

This questionnaire was intended to seek information pertaining to school and teachers regarding quality enabling conditions and quality teaching-learning process. The information related to quality enabling conditions was taken in the form of availability of resources, time to complete the content matter and in-service training of the teachers, etc. To seek the information related to quality teaching-learning process, questions about content analysis, participation of students in teaching-learning process, teaching methods, teaching aids, assessments, source of information other than textbooks and remedial teaching, etc. were asked.

Procedure of Data Collection

In relation to collection of data regarding the learning environment of chemistry, investigators personally

visited the sample schools. The information about school, quality enabling conditions and quality teaching-learning process was obtained through questionnaires developed for principals and chemistry teachers of the sample schools. After collecting information in the form of questionnaire, each chemistry teacher was interviewed separately by the investigator to know more about their experiences related to quality enabling conditions and quality teaching-learning process in the schools.

Analysis of the Data

In the current study, quality of chemistry learning was observed considering the parameters of quality enabling conditions and quality teaching-learning process. Various aspects of quality were included in the above parameters and their detailed analysis is being presented here.

In general, the quality of education can be assessed through quality enabling conditions and quality teaching-learning process. These aspects frame a conducive learning environment in the school (Bedriye and Gulcin, 2020). Enabling conditions are characteristic of the school that facilitate effective teaching and learning and include the availability of adequate resources, accessibility of resources, effective management and organisation, including time spent for teaching, organisation of instruction, professional development of teachers for achieving desired learning outcomes and values by the students. A set of validated questionnaire was administered to seek the information pertaining to the quality enabling conditions and quality teaching-learning process in organic chemistry at senior secondary level and the data obtained were analysed. Analysis of the data is discussed below under the headings —(i) Quality: Enabling Conditions, and (ii) Quality: Teaching-Learning Process.

1. Quality: Enabling Conditions

Quality enabling conditions were observed by administering questionnaire to be filled by the PGTs of schools under study. The information pertaining to qualification of teachers was taken in the first part of the questionnaire and information related to quality enabling conditions—availability of resources, time duration and professional development—was taken in its second part. An analysis of the data is given below.

Availability of Resources

Teachers were asked about the availability of adequate resources in the school to transact the content matter of chemistry with special reference to stereochemistry and reaction mechanism. An analysis of the responses obtained indicates that 15.38 per cent teachers have adequate resources available in the school for chemistry teaching. During personal interaction with the teachers, it was found that e-resources are also

frequently used but the authenticity of e-resources is not checked.

Time Duration

When simply asked were whether they have sufficient time to complete the topics of stereochemistry and reaction mechanism, 84.61 per cent teachers said YES, but when they were asked about the required time duration for these topics, answers were different seven by teachers given in Table 1.

Table 1
Time Duration Required for the Topics

S.No.	Periods/Weeks Needed	Percentage of teachers
1.	1 week	7.69%
2.	2 weeks	30.76%
3.	3 weeks	23.07%
4.	More than 3 weeks	38.46%

Rajasthan Board of Secondary Education has prescribed the time duration of each topic, but different responses of teachers indicate that they are more concerned about the completion of syllabus instead of focusing on effective learning of students. It is also supported by the views of teachers on the same issue that the revealed while having personal interaction with them.

Professional Development

The professional development programmes are systemic efforts aimed at bringing about changes in the classroom practices of teachers, their attitudes and beliefs, and in the learning outcomes of the students (Guskey, 2002). In the present study, information was collected pertaining to the in-service training programmes on content enrichment and pedagogical processes attended by the teachers to improve their teaching skills in terms of content as well as pedagogy. The data indicates that only 30.76 per cent teachers got an opportunity to attend the in-service training programmes organised either by central government institutes like Regional Institute of Education, NCERT or Institute of Advanced Studies (a unit of teachers' training under state government). According to the teachers who attended the in-service training, they gained new insights into students' difficulties, increased their knowledge and understanding about the pedagogy, content knowledge and philosophy of chemistry.

2. Quality: Teaching-learning Process

Educational quality of students can be improved through adopting various innovative teaching-learning processes by the well-educated and trained teachers. Quality does not only mean to impart a quantum of knowledge to students but also the effectiveness with which they apply that knowledge in meeting the challenges of tomorrow. During the course of present study, information related to quality teaching-learning process was collected by administering the questionnaire consisting of

questions on content analysis, participation of students in teaching-learning process, teaching methods, teaching aids, assessments, source of information other than textbooks, remedial teaching and innovation to improve the quality of teaching, etc.

Content Analysis

The content of chemistry should be delivered in a simplified form so that students can easily understand it. It is possible by having the required academic competence of the teachers in content as well as pedagogy. It also includes content analysis for organising and planning the effective transaction of the topic. When teachers were asked whether they do content analysis or not, 92.30 per cent said that content analysis is done before transacting the lessons of stereochemistry and reaction mechanism. It shows the concern of teachers regarding content analysis for effective classroom planning.

Students' Participation

In the classroom, it is expected that students are engaged actively by playing the role of information seekers. It makes the process more supportive, cooperative, and student-centred (Fassinger, 1995). Asking questions during the process is an important way of participation by students. It has been reported that students are more likely to ask questions if they receive higher levels of support (Karabenick and Sharma, 1994) and lower levels of threat from their teachers (Peters, 1978).

In the present study, it has been reported by the teachers that 76.92 per cent of the students effectively participate in the learning process. Teachers were unaware about the. The reason for poor or no participation of 23.08 per cent students. When they were asked about the mode of participation of the students they revealed that it the participation's limited to asking question only. Teachers also argued that 92.30 per cent of the students ask the questions during the classroom transaction but most of the questions are of general nature and most of the times they are related to the blackboard work and dialogue during the process. Participation of students by asking questions in this way is not a reflection of effective participation of students in the conceptual understanding.

Teaching Method and Use of Teaching Aids

Methodology or the strategies used by the teacher during delivery of the topic is an important factor in making the class active for learning. In any teaching-learning situation the methodology used is vital and the method adopted by the teacher may promote or hinder learning amongst students (Ameh and Dantani, 2012). The studies focused on teaching organic chemistry at the introductory level have made it obvious to the teachers that understanding stereochemistry can be difficult

for students. Stereochemistry is frequently a source of confusion when students are first exposed to it, and unfortunately, this feeling may linger even after repeated exposure to the subject (Bowen and Bodner, 1991; Bodner, 2003). Visualising the three-dimensional aspects of molecules and their relationship with other molecules is difficult (Brand, 1987). Various studies have indicated that stereochemistry requires the use of Visio-spatial strategies because scientific problems often require explicit consideration of spatial relationships (Gilbert, 2005). The chemistry teachers should design students-centred and active learning approaches to integrate the concept is a three dimensional way for better learning of visual activities, wherever necessary, for the teaching of topics like stereochemistry and reaction mechanism at senior secondary level.

In view of the above, it is necessary to adopt suitable methodology and use proper learning aids during teaching-learning process of organic chemistry, especially stereochemistry and reaction mechanism. In the present study, it has been found that 90 per cent teachers use conventional lecture method in teaching of the entire organic chemistry. During interaction with the teachers, it was also revealed that no learning resources/teaching aids are used in the teaching-learning process of the concepts of stereochemistry and reaction mechanism due to unavailability of resources. These data indicate that most of the teachers follow conventional teaching methods mainly the chalk-and-talk method, which is not sufficient as per the needs of an active classroom.

Use of Source of Information Other Than Textbooks

Large number of sources of information on content of chemistry are available in the form of reference books, handbooks, journals and online resources, etc. These sources of information should be frequently used for content enrichment and making the classroom process effective. In the present study, it has been found that 61.53 per cent teachers use other resource material also along with textbooks, but it was confined to YouTube videos, and model papers. In this era of education, a large number of online resources are available in the form of softwares, programmes and apps, etc., and, therefore, they should be utilised in the teaching-learning process.

Assessment of Students during Classroom Process

Assessment is an important component of teaching-learning process, by which the effectiveness of the process can be observed. In the present study, teachers were asked about the methods of assessment by giving some common modes of assessment like asking verbal questions, conducting an activity, exercise or by giving some

assignment. The data obtained with respect to the methods of assessment used by teachers are given in Table 2.

Table 2
Assessment of Students during Classroom Process

S.No.	Method of Assessment	Percentage of teachers used
1.	By asking verbal questions	65
2.	By an activity	10
3.	By giving exercise during class	55
4.	By giving assignment	20

An analysis of the data indicates that asking verbal questions is most widely (65%) used method of assessment. Assessment through activities is considered an important way of assessment but in the present study, it is carried out only by 10 per cent teachers. Giving exercises is also a popular method indicating inclination towards the conventional method of assessment. Assessment through giving assignments is also not much popular amongst the teachers. All the teachers said that they assess their students by adopting various methods as mentioned, but asking questions during discussion is the most common method. When teachers were asked about their satisfaction with the assessment method used, 53.84 per cent teachers said that they are satisfied, but they need further orientation on using the new methods of assessment.

Remedial Teaching/Corrective Measures

Remedial teaching is given to the students who have not been able to achieve the expected learning outcomes. As per the present study, 69.23 per cent teachers conducted remedial classes to improve performance of the students.

Teachers' Satisfaction

Teachers feel highly satisfied if they have been able to transact the concept in the class to the level of understanding of students. When the teacher were asked whether they are satisfied with their teaching, especially in with respect to reaction mechanism and stereochemistry, 30.76 per cent teachers told that they are satisfied. However, this satisfaction was mainly based on the result of the students in the examination, not on their own satisfaction level of teaching. Teachers who felt unsatisfied responded that it is due to the lack of adequate learning resources that they are not able to transact the concept in an effective manner.

Improvement in Teaching-learning Process

In the present case, teachers had an opinion that they can improve the teaching-learning process in a

better way, if learning resources are made available to them. It was also emphasised that their duties other than teaching should be minimised so that they can focus more on learning activities.

Major Findings, Conclusion and Recommendations

During the course of the present investigation, various meaningful aspects related to quality enabling conditions and quality teaching-learning process of chemistry in the selected schools were observed and findings of the study are given below:

- During visit of the schools and interaction with PGTs with respect to quality enabling conditions and quality teaching-learning process of chemistry in the schools, most of the teachers highlighted that they do not have appropriate resource material to teach the concepts of stereochemistry and reaction mechanism. However, it has been observed that urban schools have relatively more resource materials than rural schools.
- It was also observed that teachers have not undergone any professional development programme. Same thing was also mentioned by the teachers through the questionnaire related to quality teaching-learning process.
- As far as quality teaching-learning process is concerned, it has been observed that teachers are using conventional teaching methods without any innovative ideas; it needs immediate attention of the authorities.
- There is a lack of learning resources in these schools and even minimum required resources are not available.
- Even after sincere efforts, students' participation in the teaching-learning process is poor and needs improvement.
- It was mentioned that topics like stereochemistry and reaction mechanism are least interesting for students and, therefore, most of the time, these topics are ignored.
- It was also pointed by the teachers that they are not much comfortable in teaching these topics as they do not have much clarity about the content because these two topics deal with 3-D structures of the compounds.

In view of the above, it is recommended that:

- Resource material must be made available to the PGTs of schools. At least ball and stick models may be given to each PGT to use these models in the teaching-learning process. Models developed by the NCERT are economical and effective, so these models can be procured for the same purpose.
- Capacity building programmes for content enrichment and pedagogical skills should be frequently organised for the teachers to make them confident and help them to make the

teaching-learning process effective.

- Professional development programme should be an integral part of the service of teachers. It can be linked with promotion for effective participation of teachers in these programmes.
- More attention is needed to be paid in rural schools in comparison to the urban schools, as these schools are highly lagging behind in the availability of learning resources.

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