

TEACHING SCIENCE IN SELECTED SECONDARY SCHOOLS OF RAJASTHAN – A CASE STUDY

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The present study is based on the observation of 38 Science classes of IX and X of 14 Government schools of Churu and Jalore districts of Rajasthan. Data was collected by observing the teachers teaching Science, interviewing the Science teachers and by holding Focus Group Discussions with a representative group of students in each school. The present paper is based on the data collected for a study on 'Classroom Processes of RMSA' of NCERT. The study revealed that in most of the classes the lesson was introduced by stating the topic. Presentation of new concepts was done in most of the classes mainly by teacher talk. Activity was used for presentation of the new concept in only one class of a school located in Educationally Backward Block (EBB). Learner participation in asking questions was never found in about 34% of the classes where as in about 10% of the classes it happened often. Role play was organized for the learners only in two classes of SC/ST area. Blackboard was often used in most of the classes, but it was never used in five classes, which come under SC/ST area, disturbed area and EBB. The textbook was used to explain the content in 50% of the classes and for giving assignments in more than 20% of the classes. It was also observed that evaluation was done by asking oral questions in about 71% of the classes and no evaluation was done in 5% of the classes. The class was concluded abruptly in 25% of the classes without summarising the main points or creating opportunities to go beyond the textbook. The findings recommend for an intensive study of teaching Science and immediate actions for improving the teaching-learning process in schools.

KEYWORDS: Science Teaching, Classroom Process, Secondary level.

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INTRODUCTION

School Education is one of the important stages of education in the life of an individual. It comprises of pre-school, elementary, secondary and senior secondary levels. Of these, Kothari Education Commission has remarked that secondary education is a loose link between elementary and senior secondary stages of school education. The commission has also discussed various reasons for the said status of secondary education in its report (Kothari, 1966). The syllabus at secondary level has to ensure that most of the topics included are actively linked to experiments or activities that can be performed by children and teachers in the process of learning (Yashpal, 1993). Classroom process is considered as valuable and important aspect of any teaching learning process. The transaction that takes place with regard to content, the interaction between the teacher and the taught as well as among the learners and a classroom environment, play important roles in enhancing the performance of the learner.

At the secondary level, learners study both scholastic and co-scholastic subjects as compulsory. Under the banner of scholastic, they study science as one of the subjects and in the eyes of the public it is a subject of intellectuals with wide scope. It is a subject of learning by doing. Learners have to participate actively in the process of learning, develop information processing skills, apply to day-to-day life outside the school and strengthen their learning. All this doesn't happen on its own and requires a conducive environment in schools, which is created by an amalgamation of several resources. Are these resources really available? If available, are they utilized appropriately? What is the status of teaching of science in our classrooms? Does it enable to achieve the objectives of teaching science at secondary level? A review of studies can throw light on the status of classroom transactions.

REVIEW OF LITERATURE

Many studies have been conducted in the field of teaching and learning. A few studies have been reviewed to understand the status of classroom processes. A study (Bhat, 2000) was carried out at elementary level for the state of Kerala and its findings indicate a descriptive picture of classroom processes and interactions in diverse school/community contexts in the form of comparative case studies. To know about effects of class size on classroom interactions and pupil behaviour a study was carried out (Blatchford, Bassett & Brown, 2011) which showed that at primary and secondary levels, smaller classes led to pupils receiving more individual attention from teachers, and having more active interactions with them.

Classroom engagement decreased in larger classes, but, contrary to expectation, this was particularly marked for lower attaining pupils at secondary level. Low attaining pupils can therefore benefit from smaller classes at secondary level in terms of more individual attention and facilitating engagement in learning. Another study was conducted to examine the relationship between effective classroom management and students' academic achievement in Physics. The study revealed that effective classroom management skills or techniques have strong and positive influence on student achievement in Physics (Adeyemo, 2012). A study was also carried out to find the students' perception towards classroom proceedings and the strategies of classroom transaction at secondary level of science in the light of National Curriculum Framework (NCF-2005). The study showed an impact of NCF-2005 on classroom transaction of Science at secondary stage (Parashar & Singh, 2012). To find the effect of Smart Classroom Learning Environment on academic achievement of rural high achievers and low achievers in Science, a study was conducted. The result of the study revealed that smart class learning environment is better to teach both low achievers and high achievers than traditional class (Jena, 2013). These studies indicate some of the features of classroom processes that have influence on performance of learners.

SCHOOL EDUCATION IN RAJASTHAN

In India, Rajasthan is the largest state in terms of its geographical area, but in terms of literacy rate it stands 33rd in the country with its literacy rate of 66.11% as against the literacy rate of India, i.e. 74.04% (Census Report, 2011). Several factors influence the literacy rate and school education plays an important role. Though there are several components, the number of schools and teachers are essential components of school education. Table 1 gives the details of the number of schools, students and teachers in Rajasthan. As per Table 1, there are a total of 27,294 schools with 38,09,829 students enrolled and 1,31,782 teachers. Though the pass percentage of the students in class X board examination during the year 2014 was 66.46 and in 2015 were 78.10, there is a need to strengthen secondary education in Rajasthan. The State government has taken several initiatives in this regard. Besides the opening of new schools to ensure access to secondary education by all children, there are many more interventions being implemented by the Rajasthan Council of Secondary Education (RCSE), some of these are:

- Teachers training – this includes training of in-service teachers, head teachers and induction training of new teachers. Training of selected

head teacher on school leadership by NUEPA

- Preparing state resource group and master resource groups
- Assessment of learning level of children studying in class 9th
- Strengthening of guidance and counselling cell
- Strengthening ICT in schools
- Support and expansion of girls hostel scheme
- Introduction of vocational education at secondary level
- Self defence training for girls
- For SC/ST dominant districts, providing sports equipment to selected schools
- Remedial teaching for minority girls
- Training of SDMCs and expansion of coverage and improving the school infrastructure

Table 1

Number of Schools, Students and Teachers in Rajasthan.

Key Data	PS with UPS & Sec. & Hr. Sec.	UPS with Sec. & Hr. Sec.	PS with UPS & Sec.	UPS with Sec.	Sec. only	Sec. with Hr. Sec.	Hr. Sec. only	Other Categories	Total
Total Schools	5756	4147	8934	7156	25	1273	3	--	27294
School: Rural	3199	3351	6113	6724	12	838	1	--	20238
School: Urban	2557	796	2821	432	13	435	2	--	7056
Total Enrolment	1397836	950131	467286	509788	1805	482502	150	331	3809829
In Rural Areas	705364	676758	321328	475792	625	257276	23	331	2437497
In Urban areas	692472	273373	145958	33996	1180	225226	127	0	1372332
Total teachers	32969	29240	24437	29850	155	14950	23	168	131782
Teachers: Rural	16801	21707	15406	27793	55	7974	5	90	89831
Teachers: Urban	16158	7533	9031	2057	100	6976	18	78	41951

(Source: Rajasthan State Secondary Education Report Card, 2013-14)

PS: Primary School UPS: Upper Primary School Sec.: Secondary Hr. Sec.: Higher Secondary

ACTIVITIES OF RMSA PROJECT CELL OF NCERT

Other than the state government, attempts are also made at the national level to improve the status of secondary education. Rashtriya Madhyamik Shiksha Abhiyan (RMSA) project cell of NCERT has taken several initiatives in this direction like capacity building of teacher educators, curriculum studies and development of learning indicators etc. A recent attempt of RMSA Group of NCERT was to study the classroom processes of secondary schools in different contexts in selected states of the country. The study provided a descriptive picture of classrooms, teaching learning processes in different school subjects,

learner participation, and instructional resources and so on. The data for the present study is based on the report of this major study of NCERT, New Delhi, on classroom processes for the state of Rajasthan.

OBJECTIVES OF THE STUDY

1. To find the ways of introducing the lesson and presenting the new concepts.
2. To explore the extent of learner participation in the teaching learning process.
3. To study the mode of activities performed in the classroom.
4. To examine the adequacy, accessibility and use of resources.
5. To know the procedure followed for evaluation and conclusion of the lesson.

RESEARCH METHODOLOGY

SAMPLE

Two districts namely Churu (High Performing District) and Jalore (Low performing District) were selected for the study based on the performance of the districts in class X Board Examination for the last three years. From each district seven schools were selected representing the diverse context of Indian society such as SC/ST dominated area, minority, high gender gap, urban slum, rural, disturbed area and educationally backward blocks. The number of Science classes observed was 17 from Churu and 21 from Jalore. On the whole a total of 38 classes were observed.

TOOLS USED

Though NCERT had developed tools, which were exhaustive in nature, in the present study the data was limited to selected areas only.

The first tool used was a Classroom Observation Schedule, which had items on teacher, learner and classroom process with 15 items in both open ended and closed ended category.

The second tool was the Teacher Interview Schedule to collect the details regarding teaching learning of Science in the school.

The third tool used was the Students Focus Group Discussion which attempted at exploring more from the students about Learning Science in school.

DATA COLLECTION

The investigators observed 38 Science classes of class IX and X using Classroom Observation Schedule. After the class, the teacher was interviewed by the investigators and asked about teaching learning resources including the use of community resources. Further, a Focus Group Discussion was held in each school and the group consisted of students of class IX and X which represented SC, ST, minority, OBC, girls and CWSN depending on the availability of students in the specified classes. The highlights of the process of data collection were video graphed for authentication, with prior permission from the concerned authorities.

RESULTS OF THE STUDY

The collected data was analysed and discussed based on the objectives of the study.

Introducing the Lesson and Presenting the New Concepts

A teacher can introduce lessons in different ways. According to Passi (1976), a lesson can be introduced in several ways. Some of the ways quoted by him are by using examples, questioning, narrating, storytelling, role-playing, using audio visual aids and experimentation etc. In the present study possible options given were, stating the topic, reviewing the previous lesson, posing a problem, asking a question and writing on the black board, which are normally practised by the teachers. Table 2 gives the details.

Table 2

Ways of Introduction of the Lesson.

Introduction of the Lesson by the Teacher	Total classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Stating the Topic	31	9	3	6	6	1	1	5
Reviewing the previous lesson. (If it is in continuation)	10	1	0	2	4	1	0	2
Posing a Problem/ Asking a Question	3	0	0	0	0	2	0	1
Writing on Blackboard	1	0	0	0	0	1	0	0
Any other	0	0	0	0	0	0	0	0

Out of 38 classes observed, in 31 (81.57%) classes, the lesson was introduced by stating the topic, in 10 (26.31%) classes it was done by reviewing the previous lesson and by asking questions, as those classes were in continuation of the lesson covered in the previous classes. In one (2.63%) class, the lesson was introduced by writing on the blackboard. Though there are several ways of

introducing the lesson to the students to motivate them towards the topic, the above table shows that in more than 80% of the classes, it was done only by stating the topic, which may not be of much interest to the students. While analysing in terms of context, it is surprising to note that for introducing the lesson, out of 38 classes observed, only two (5.26%) classes in rural and one (2.63%) class in EBB have posed problems or asked questions. In rest of the contexts, the teachers have either stated the topic, reviewed the previous topic or wrote on the black board, which are routine ways of introducing the lesson. After introducing the lesson, teacher usually presents the new concepts to the class. Though we say that the classes are learner centred, table 3 gives a picture of how the new concepts were presented by the teacher in the class.

Table 3
Presentation of New Concepts.

Presentation of New Ideas	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Teacher Talk	29	9	2	4	6	2	1	5
Discussion with Explanation	10	1	1	2	2	1	0	3
Activity	01	0	0	0	0	0	0	1

With regard to presentation of new concepts, out of the 38 classes observed, in 29 (76.31%) classes, the concepts have been presented by teacher talk, in 10 (26.31%) classes it was through discussion with explanation and in only one (2.63%) class it was through activity. Even in terms of context, the table shows that the activity is used only in one class in a school located in EBB.

Mode of Explanation of the Concepts

There are several ways of explaining the concepts to the learners. Some of the ways followed by the teachers are given in table 4.

Table 4
Mode of Explanation of the Concepts.

Explanation of the Concepts	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
With Example	29	10	1	4	5	3	0	6
Without Example	10	0	2	2	3	0	2	1
With Demonstration	4	4	0	0	0	0	0	0
With Activity	3	0	0	1	1	0	0	1
Using Learner Experience	1	0	0	0	1	0	0	0

With regard to mode of explanation of concepts, it was done through examples in 29 (76.31%) classes and without examples in ten (26.31%) classes. Of course, demonstration was used in only four (10.52%) classes and they were in schools located in SC/ST dominated areas. This shows the facilities being used by the teachers, whereas in none of the other schools demonstration was used. While activity was used for explaining the concepts in three (7.89%) classes, one each of them is located in Gender gap school, Urban and EBB school. It is heartening to note that learner experience was used in only one (2.63%) class and that is in one School of Urban slum. Though, NCF 2005 often emphasises on using learner experiences in the class by the teacher and taking the learners beyond the textbook, this is hardly noticed in the classes observed.

Learner Participation in the Teaching Learning Process

Learner is a very important component in the teaching learning process. Active learning enhances learning as well as retention. Some of the ways in which the learners participated in the teaching-learning process are given in Table 5.

Table 5

Extent of Learner Participation in the Teaching Learning Process.

Students' Participation	Rating*	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Asking questions to seek clarification	1	13	3	2	2	2	1	1	2
	2	11	2	0	2	2	2	0	3
	3	4	1	0	0	0	2	0	1
Seeking more information on the topic under discussion	1	15	4	2	0	4	1	1	3
	2	7	2	0	2	1	1	0	1
	3	1	0	0	0	0	1	0	0
Making comments on the basis of their own experience	1	15	5	2	1	3	1	1	2
	2	4	0	0	1	0	0	0	3
	3	1	0	0	0	0	1	0	0
Raising issues relating to the topic under discussion	1	17	5	2	2	3	1	1	3
	2	3	0	0	0	0	2	0	1
	3	1	0	0	0	1	0	0	0

*1: Never

2: Sometimes

3: Often

Table 5 indicates that the learners in the classes have asked questions. But it was often asked in four (10.52%) classes only and they were located in SC/ST area, rural and EBB. It is sad to note that questions were never raised in 13 (34.21%) classes. However, with regard to seeking more information and making comments based on their experience, it was observed often in only one (2.63%) class each and it was in a rural school. With regard to raising issues, in

about 45% of the class, it was never raised. Science is considered to be a subject of enquiry but it is rarely observed in the classes. But when teachers were interviewed and asked whether learners ask questions in the class all the 15 teachers interviewed said that they do ask. However, actual class observation by the investigators doesn't support the response of the teachers in this regard.

Mode of Activities Organised During the Lesson

Activities help learners to learn by doing. It also gives them opportunities to explore which is a basic feature of learning Science. Table 6 provides information on activities used by the teachers to teach Science.

Table 6
Activities Organised During the Lesson.

Activities Organized During the Lesson	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Role Play	2	2	0	0	0	0	0	0
Game	0	0	0	0	0	0	0	0
Group work	0	0	0	0	0	0	0	0
Learning by doing	0	0	0	0	0	0	0	0
Field Study Observation	0	0	0	0	0	0	0	1
Any other	9	2	0	3	3	0	0	1

Table 6 shows that of all the activities mentioned, only role play was used by the teachers in two (5.26%) classes and it was noticed in SC/ST schools. Other activities like singing, acting were also organised but it was limited only to 23.68% of the classes observed. The rest of the classes do not seem to be performing any learner centred activities. As per NCF (2005), while teaching Science at secondary level, students should be engaged in learning Science as a composite discipline, in working with hands and tools to design more advanced technological modules. They should also be engaged in activities and analysis on issues related to environment and health. NCF further states that, systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving Science and technology, are to be important parts of the curriculum at secondary level.

Use of Resource Materials in Classroom Teaching

In any class teachers normally use a variety of resources to help learners to understand the concepts easily. Table 7 shows some of the resources used by the teachers while teaching Science in the class.

Table 7**Frequency of Use of Resource Materials for Teaching.**

Use of Resource Material	Rating	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Blackboard	1	5	1	0	0	0	0	1	3
	2	2	0	0	0	0	0	0	2
	3	29	8	3	6	8	3	0	1
OHP (Overhead Projector)	1	31	9	3	6	8	3	1	1
	2	1	0	0	0	0	0	0	1
	3	3	0	0	0	0	0	0	3
Films/ Videos	1	28	9	3	6	6	3	0	1
	2	1	0	0	0	0	0	0	1
	3	2	0	0	0	0	0	1	1
Computers	1	29	9	3	6	6	3	1	1
	2	3	0	0	0	0	0	0	3
	3	1	0	0	0	0	0	0	1
Other Learning Aid(s)	1	19	6	2	4	5	2	0	0
	2	2	1	0	1	0	0	0	0
	3	8	1	0	0	0	0	1	6

*1: Never 2: Sometimes 3: Often

Data in Table 7 shows that black board is highly used in almost all the classes and it is never used in five (13.15%) classes located in SC/ST area, Disturbed area and EBB. OHP's, Films and Computers are never or sometimes used in very few of the classes, where as, other materials such as charts and pictures are used in few classes (21.05%). This shows that there is a need to increase the use of teaching learning materials in the classroom teaching.

Availability, Adequacy and Accessibility of Resources

Though 38 classes were observed, 15 teachers teaching Science were available for interviewing. When they were asked about adequacy and accessibility of resources for teaching Science, 11 teachers said that it is adequate and 14 teachers said that it is accessible too. However, only eight teachers said that they make use of community resources for teaching Science. Regarding sources of information other than the textbook, six teachers said that they use reference books and notes. With regard to how learning can be improved, teachers had variety of responses. While four teachers said that CCE should be stopped, other four teachers asked for better lab facilities and three teachers for ICT facilities.

Use of Textbook by the Teacher

Textbook is one of the important sources of learning. Table 8 has listed varieties of ways by which a teacher can use textbooks. Table 8 indicates that the

textbook is mainly used for explaining the content of the lesson and giving home assignments. It is never used in any of the classes for consolidating learning but it was used in one class each from Rural and Disturbed area, for reading and learning through activities given in the textbook.

Table 8

Purpose for Which Textbooks were Used by the Teacher.

Use of Text Book	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Explain content of lesson	19	3	1	5	3	3	1	3
Asking students to read individually/in groups to increase understandings	1	0	0	0	0	0	1	0
Reading at the end to consolidate learning	0	0	0	0	0	0	0	0
Giving home assignment to consolidate learning	8	2	0	2	2	2	0	0
Develop the concept with help of activities given in the text	1	0	0	0	0	1	0	0

Mode of Evaluation of Students

Evaluation has to be continuous as well as comprehensive. A teacher may use different techniques for evaluating learning of the learners, which indirectly speaks about teaching by the teacher. Commonly used modes of evaluation are given in Table 9.

Table 9

Mode of Evaluation of Students.

Evaluation of the Student by Teacher	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Done through oral questioning	27	7	1	3	7	3	1	5
Done by given assignments	9	3	1	2	1	2	0	0
Done through written test	0	0	0	0	0	0	0	0
Not done at all	2	0	0	0	0	0	1	1

As per Table 9, in 27 classes, evaluation is done through oral questioning during the process of teaching and learning. Surprisingly in two (5.26%) classes, one in Disturbed area and one in EBB, evaluation is not at all done and in none of the 38 classes observed, written test is given. This calls for

improvement in the evaluation procedure at the end of every class.

Concluding the Lesson

Conclusion is an important stage of classroom transaction. It helps learners to consolidate and recapitulate their learning. Table 10 gives the details of the procedures followed by the teachers in concluding the lesson.

Table 10

Procedure Followed for Concluding the Lesson.

Procedure	Total Classes 38	SC/ST	Minority	Gender Gap	Urban Slum	Rural	Disturbed Area	EBB
Abruptly	13	3	1	1	3	1	1	3
Recapitulating the main points	9	2	0	2	2	1	0	2
Giving assignments	10	4	1	0	2	2	0	1
Highlighting some points for reflection	1	0	1	0	0	0	0	0

As per Table 10, in 13 classes (34.21%), teaching ended abruptly mainly in SC/ST schools, Urban slums and EBB. Giving assignments was followed in 10 (26.31%) classes and four (10.52%) of them were in SC/ST schools. Only in one (2.63%) class lesson was concluded by highlighting some points for reflection.

FINDINGS OF THE STUDY

The study has revealed that in most of the classes lesson was introduced by stating the topic. Presentation of new concepts was done in most of the classes mainly by teacher talk. Activity was used for presentation of the new concept in only one class i.e. EBB school. Learner participation in asking questions was not found in 34% of the classes but it was found often in about 10% of the classes. Role-play was organized for the learners in two classes of SC/ ST area. Blackboard was often used in most of the classes but it was never used in five (13.51%) classes, which come under SC/ST area, Disturbed area and EBB. Textbook was used to explain content in 50% of the classes and for giving assignments in more than 20% of the classes. Evaluation was done by asking oral questions in about 71% of the classes and no evaluation was done in 5% of the classes. Lesson was concluded by recapitulating in 25% of the classes but abruptly in 33% of the classes.

CONCLUSIONS

The study though on a small sample, throws light on teaching learning of

Science at secondary level. The situation is not as emphasised by NCF 2005. The findings show that there is an urgent need to improve the teaching learning situation in schools, especially related to classroom processes. Therefore, there is a need for RMSA to take a lead in planning interventions with regard to teaching learning process, in-service training of teachers and other factors which influence learner performance. Though there is much talk about use of ICT in schools, it doesn't seem to be reflected in any of the schools especially their integration in teaching the subjects. Hence, an action plan may be worked out by the authorities to improve all the aspects of teaching learning situation in schools with regard to teaching Science at secondary level.

REFERENCES

- Kothari, D.S. (1966). *Report of Secondary Education Commission*. New Delhi: Govt. of India.
- NCF (2005). *National Curriculum Framework*. New Delhi: NCERT.
- Passi, B.K. (1976). *Becoming better teacher: Microteaching approach*. Ahmedabad: Sahitya Mudranalaya.
- Blatchford, P.B., & Penelope, B.E. (2011). The effect of class size on classroom engagement and teacher-pupil interaction: Differences in relation to pupil prior attainment and primary vs. secondary schools. *Learning and Instruction*, 21, 715-730.
- Jena, P.C. (2013). Effect of smart classroom learning environment on academic achievement of rural high achievers and low achievers in science. *International Letters of Social and Humanistic Sciences*, 3, 1-9.
- Parashar, R.K., & Singh, V. (2012). Transactional strategies of secondary school science: In purview of national curriculum framework (India)-2005. *International Journal of Educational Planning and Administration*, 2(2), 55-63.
- Sunday, A.A.(2012).The relationship between effective classroom management and students' academic achievement. *European Journal of Educational Studies*, 4(3), 361-381.