

RESEARCH ARTICLE

TEACHING LEARNING PROCESS OF SCIENCE CLASSROOM AT SECONDARY LEVEL SCHOOLS: AN EXPLORATORY STUDY

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Abstract

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Key words:-

Constructivist Teaching, Profile of Teacher, Readiness for Learning, Learners Engagement, Teaching-Learning Process

The objective of this paper is to find out the profile of teachers teaching science at secondary level and to study the classroom transaction process of science at secondary level with reference to constructivist approach of teaching. The study was conducted through qualitative method. For this study researcher selected 20 secondary schools from Vaishali district of Bihar, India. The investigator used information blank for teachers for developing their profile and observation schedule for examining teaching learning process. The investigator used frequency, percentage and qualitative descriptions and accordingly interpretations are made. The study found that i) Teachers teaching science are well qualified as 60.86% have B.Sc., B.Ed. and 39.13% have M.Sc., B.Ed. qualification, ii) 30.43% of science teachers have attended in-service programmes like science pedagogy, ICT in teaching etc. organised in last three years, iii) 78.26% of teachers never test the previous knowledge before teaching and 73.91% of teachers never engage students to create interest to topics, iv) 82.60% of teachers never encourage learners for asking questions in class and 86.95% of teachers distributes questions throughout class, v) 78.26% of science teachers never use locally available things as teaching learning materials and illustrates concepts with variety of examples from the local context, 82.60% of teachers never change method as per the mood of learners, vi) 52.17% of teachers never allow students to interact with each other in class, 78.26% of teachers never encourage group work and 91.30% of students never activates learners during teaching in class, vii) no teachers teaches how to learn a topic, suggests other learning materials for references and uses ICT in classroom. 60.86% of teachers never encourage self-reflection, 91.30% of teachers never encourage divergent thinking among learners and 73.91% of teachers never focus on process of learning in class, viii) 86.95% of teachers never asks questions as per the objectives of the lesson, ask question beyond textbook and provides home assignment that requires enquiry. The study has suggested implications for teachers, teacher educators and government to improve quality of science education at secondary level.

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Introduction:-

Conceptualisation of the Problem

Science is the most important subject in the school curriculum because it plays a vital role in all spheres of activities in the 21st century. Kothari Commission (1964-66) strongly emphasized on making science an important element in school curriculum. Science and mathematics should be taught on compulsory basis to all pupils as a part of general education during first ten years of schooling. International Education Commission (1972) recommended that, "science & technology must become essential components in any educational enterprise; they must be incorporated into all educational activity intended for children, young people & adults." In order to improve the quality of science education, the National Policy of Education (1986) has suggested several measures such asactivity-based learning, increase in laboratory work, integration of modern communication technologies, field trips and projects for developing favourable attitude and interest in science. Programme of Action (1992) recommended for strengthening science education so as to develop in the child well defineded abilities and values such as spirit of inquiry, creativity, problem solving approach, objectivity, the courage to question, and an apathetic sensibility interest in science. National Curriculum Framework (NCF) 2005recommended for observation, field trip, project method, dramatisation, exhibition, quiz, extempore and children science congress method in formal science education. Knowledge Commission (2007) suggested a National Science and Social Science Foundation (NSSF) to look at all knowledge as one seamless entity & also ensure that science and technology are maximum used for betterment of the lives of our people. Even though a lot of efforts are being made at different levels in our country to impart quality science education, experts are reported that teaching of science at school level has remained an area which needs to be improved and strengthened considering modern day educational requirements. The teaching of science is felt important because the science helps an individual to be a self-seeker (Heuristic) of knowledge and develop curiosity by the demonstration, trial and error method etc.

The National Curriculum Framework (NCF) 2005 brought a paradigm shift in the teaching-learning process, by placing an emphasis on constructivist approach, which gives lots of autonomy to the learners in deciding their own learning process. Constructivism is a theory of how the learner constructs knowledge from experience, which is unique to each individual. Constructivism according to Piaget (1971) is a system of explanations of how learners as individuals adapt and refine knowledge. Constructivism is relatively a new paradigm which is based on the assumption that knowledge is subjective, contextual and inherently partial. The Constructivist epistemology assumes that learners construct their own knowledge on the basis of interaction with their environment. Learning in constructivism framework contributes to intellectual, social and psychological development of learners to transmit it in different context. A constructivist classroom provides opportunities to observe, work, explore, interact, raise question enquiry and share their expectation to all. The classroom transaction in science must follow constructivist approach of teaching as it develops critical concept about the subject as well as process of learning.

Rationale of the Study

Science is part and parcel of our life. Several measures have been taken to strengthen science teaching, especially at the crucial stage of secondary education. Science has been introduced as a part of the curriculum so that every secondary school pupil is able to gain a basic understanding of the fundamental principles of scientific phenomena. Realising the importance of science education, many researchers has conducted study on different aspects of science education in school level. Some of the relevant research studies are discussed in following paragraphs.

Chan et al. (2020) viewed that teachers aimed for the development of understanding among the students through planning learning activities that elicit active engagement. Questioninghas been used to initiate and induce engagement among learners. Assessment procedures planned and implemented by the teachers embodied constructivist approach in terms of assessing students' understanding of concepts, creation of new knowledge, and integration of ideas to other disciplines. This was clearly shown in the use of various formative and authentic assessment tasks during classroom instruction which allowed students to exhibit knowledge formation and creation. Chandi (2020) reveals that the constructivist approach also positively effective in teaching-learning situations in the various field of education. Students are intrinsically motivated and doing much better performance through the teaching of the constructivist approaches other than any approach. Students are also gain in problem-solving, flexibility in thinking, reflective thinking, reasoning skill, learn to make connections and associations by relating the subject matter to their own life experiences, clearly articulate their ideas, communicate their ideas & findings with others.Hidayati (2020) stated that constructivism-based learning science has a significant impact on the character mastery of early children. The average score of mastery of students' character values is higher after being given science learning with a constructivist approach. Tuerah (2019) stated that through the implementation of

constructivism approaches in the science subject, it can improve learning outcomes. The constructivism learning approach had a positive influence on science learning. Adak (2017) found that the students exposed to the constructivist 7E-model significantly achieved better than traditional method. The constructivist approach strategy is capable of improving student's mastery of content at the higher order levels of cognition. Students exposed to the 7E-model performed significantly higher than those exposed to the traditional teaching method in respect of their gained scores at every intelligence levels. Kola (2017) viewed that constructivist teachers should give serious attention to the prior knowledge of the students. This will determine the mode of teacher instruction. The teacher content knowledge and pedagogical knowledge are central to excellent teaching. The physics teacher should promote student interactions and respect student ideas: being the kernel of the constructivist learning. Abulnour (2016) viewed that constructivist assessments allow students to develop higher-order thinking and become independent autonomous learners. Qarareh (2016) show that there is statistically significant difference at ($\alpha = 0.05$) for the effect of the constructivist Learning model on the achievement and scientific thinking in favor of experimental group, and there is no statistically significant difference at ($\alpha = 0.05$) for the constructivist Learning model on the achievement and scientific thinking attributed to gender. Muragaiah (2015) found that the science teacher possessing more qualification both in general and professional field are more effective in their level of teaching effectiveness, and experience of the science teacher proved to be significant variable in influencing their teaching effectiveness. Singh and Yaduvanshi (2015) pointed out that constructivism is helpful in learning of science in true sense i.e., not only as a body of knowledge but also as process for making sense of surroundings. Students are not just a passive gainer of knowledge but became active learner who themselves construct knowledge through experience, observation, documentation, analysis and reflection. George (2015) viewed that teaching science with multimedia materials would encourage students to develop deep reflective scientific thinking. Achievement of knowledge and skills in science with multimedia teaching would help to develop interest in students to learn science. Rai, et al. (2014) stated that the mixed way of teaching and learning which involves teaching using technology computer based and without using technology is mostly used by various teachers for teaching and learning process in higher education. Learning also is found effective by using mixed teaching method. Nair (2014) reported that the metacognitive skills, achievement in science and scientific creativity of primary school students taught using constructivist approach-based instruction will be significantly higher than those who were taught through the present method of teaching. Raj (2013) found that the achievement level of the students learning general science through electronic classroom technique is significantly higher for all students irrespective of their age, gender and grade. The effectiveness of electronic classroom technique was perceived to be (highly) effective by both the teachers and the students who were involved in the study. Ranganath (2012) stated that the graduate science teachers are with average creativity & post - graduate science teachers with low creativity, and the rural & urban, male & female prospective science teachers are with average creativity with no significant differences between them. There is no significant difference in scientific attitude and attitude towards science of rural & urban, male & female prospective science teachers. Kaur (2012) reported that most of the science teachers have exhibited above average level of role commitment & attitude towards teaching, female science teachers are more committed than the male teachers, and private science teachers are more committed than the government science teachers. Ifeakor(2006) and Ossai(2004) observed that despite the availability and recommendation of innovative teaching methods, science teachers still exhibit absolute dependence on the expository methods in which they simply deliver pre-planned instruction to learners with or without the use of learning materials.

On the analysis of the above research studies, it is found that most of the study is conducted on teacher qualification both in general and professional fields, use of constructivism in learning of science, use of multimedia materials for scientific thinking etc. No study reported that focuses on teaching learning process of science with reference to the constructivist perspectives. In this context, the researchers have raised following research questions for investigation.

- 1. Whether teachers teaching science have relevant qualification and experiences?
- 2. Whether teachers are following constructivist approach in the classroom transaction process of science?

Statement of the Problem

The current situation of science teaching and learning is a concern to all including government and the society at large. Research indicates that many students found science to be difficult, boring and not interesting to them. Large class sizes, insufficient curriculum resources and teaching learning material, poor teaching skills and assessment methods are the factors that limit the quality of science teaching and learning in secondary school. To solve these learning problems, one needs to develop a realistic picture of what is currently happening in the teaching and

learning of science in schools. Hence the researcher conducted a study "Teaching Learning Process of ScienceClassroom at Secondary Level Schools: An Exploratory Study".

Objectives:-

- 1. To find out the profile of teachers teaching science at secondary level.
- 2. To study the classroom transaction process of science at secondary level with reference to constructivist approach of teaching.

Methodology:-

The study was conducted through qualitativemethod to ascertain the teaching learning process of science classroom. The population of the study was all secondary schools of Vaishali district of Bihar, India. For this study researcher selected 20 secondary schools from Vaishali district of Bihar. All the science teachers from these schools were involved as sample. The schoolswere selected randomly and all the science teachers of every selected schoolswere selected purposively. The investigator used Self-developed information blank for science teachers for developing their profile and using self-developed classroom observation schedule consisting of 52 items for examining teaching learning process of science classroom. Self-developed information blank consists 15 items such as Name of Teacher, School address, Date of Joining in School, Age of teachers, Gender of teachers, Educational qualification of teachers, Experience of teachers, In-service programme attended, Science programme conducted, Participated as Resource Person, Excursion tour, Award Received Member of Professional Body, Contribution for teaching science, etc. The science teacher information blank consists of both open ended and close ended items, self-developed classroom observation schedule is divided into different aspects / criteria i.e., introduction, Presentation, Assessment/ Evaluation and Teacher Personality. The introduction aspect has 6 items which is focused on the introductory part of the classroom. The presentation part has 32 items that focused on the presenting the lessons, questions and reinforcement, use of teaching learning materials, and the classroom management. The assessment part has 6 items that focused on assessment process of the classroom. The last aspect teacher personality has 8 items that explore the teacher personality. The classroom observation schedule is three-point scales such as Never, Sometimes, and always. The validity of tools was ensured by taking experts comment during the development phase. The collected data are analysed as per as the objectives of the study. The investigator used frequency, percentage and qualitative descriptions and accordingly interpretations are made.

Analysis and Interpretation

The first objective of the study was to find out the profile of the teachers teaching science. For this the investigator collected data from teachers by using information blank, which are presented in following tables.

Sex		Age		Qualification		Experience	•
Male	Female	<45 Yrs	>45 Yrs	B.Sc., B.Ed.	M.Sc., B.Ed.	<10 Yrs	>10 Yrs
12 (52.17)	11	20	3	14	9	18	5
	(47.82)	(86.95)	(13.04)	(60.86)	(39.13)	(78.26)	(21.73)

Table 1:- Profile of Teacher Teaching Science.

The table-1 indicates that 52.17% of science teachers are male and 47.82% of teachers are female. Majority (86.95%) of teachers teaching science are under 45 years of age and 78.26% of teachers have less than 10 years of teaching experience. It also reveals that teachers teaching science are well qualified as 60.86% have B.Sc., B.Ed. and 39.13% have M.Sc., B.Ed. qualification.

Professional Development Activities	Yes	No
Attended in-service training	7 (30.43)	16 (69.56)
Organised in service science programme	6 (26.08)	17 (73.91)
Participated as resource person in training	3 (13.04)	20 (86.95)
programme		
Undertaken science excursion/tours	7 (30.43)	
Attended state/national level conference/	1 (4.34)	22 (95.65)
workshop in science		

Table 2:- Participation in Professional Development Activities.

The table-2 indicates that 30.43% of science teachers have attended in-service programmes like science pedagogy, ICT in teaching etc. organised by RMSA in last three years.26.08% of science teachers have conducted science programme/s in school like Science Quiz, Bal Vigayan Congress, Sustainable Management of Natural Resources, Science Essay Competition, etc.Only 13.04% of science teachers have participated as resource person in science programmeorganised at cluster, block and district level. Further, 30.43% of science teachers have gone excursion tour with school children to Vaishali and Patna to see VaishaliGarh, CharmukhiMahadev, Shanti Stup, Goal Ghar, Sanjay Gandhi Zoological Park, Museum, etc.

Classroom Transaction

The nature of classroom transaction process of science teachers is presented in this section with reference to certain teaching behaviour. The teaching behaviours are rated in three-point scales such as never, sometimes and always. All the ratings are presented in terms of frequency and percentage. The classroom transaction process is categorised in six aspects i.e., learner engagement in introductory part, presenting the lesson and questioning-answering session, use of teaching learning materials and classroom management, reflective practices, assessment and the personality of the teachers. Each aspect is presenting in the tabular form with explanation.

Sl.	Items	Never	Sometimes (N	Always
No		(N & %)	& %)	(N & %)
1	Gets the class settled prior to teaching	8 (34.78)	11 (47.82)	4 (17.39)
2	Creates readiness among learners	11 (47.82)	7 (30.43)	5 (21.73)
3	Tests previous knowledge before teaching	18 (78.26)	3(13.04)	2 (8.69)
4	Engages students to create interest towards the topic	17 (73.91)	4 (17.39)	2 (8.69)
5	Uses appropriate strategy for introducing the topic	4 (17.39)	11 (47.82)	8 (34.78)
6	States the topic before teaching	2 (8.69)	1 (4.34)	20(86.9)

Table 3:- Classroom Transaction Relating to Engaging the Learner in Introductory Part.

The table-3 indicates that only 17.39% of teachers are settled the classroom prior to teaching whereas 47.82% of teachers sometimes settled the class prior to teaching and 34.78% of teachers never do it. Further, 47.82% of teachers never create readiness among learners before teaching and 21.73% of teachers always create readiness among learners. The table also indicates that 78.26% of teachers never test the previous knowledge before teaching. Only 8.69% of the teachersalways engage their student to create interest in the topics whereas 73.91% of teachers never engage the students to create interest to topics. The same table also highlighted that only 34.78% of teachers always states the topic and rest are not. 86.95% of teachers always states the topic before start the teaching.

Table 4:- Classroom Transaction Relating to Presenting the Lesson and Questioning & Reinforcement.

Sl.	Items	Never	Sometimes	Always
No.		(N and %)	(N and %)	(N and %)
1	Teaches basing on what students already know	5 (21.73)	8 (34.78)	10 (43.47)
2	Presents information in a clear and organized	8 (34.78)	3 (13.04)	12 (52.17)
	manner			
3	Explains the concepts with familiar language	2 (8.69)	5 (21.73)	16 (69.56)
4	Uses language of the students in teaching	2 (8.69)	4 (17.39)	17 (73.91)
5	Explains in audible voice	1 (4.34)	2 (8.69)	20 (86.95)
6	Prompts learners for enquiry	5 (21.73)	17 (73.91)	00
7	Interacts with students in class	3 (13.04)	8 (34.78)	12 (52.17)
8	Asks questions with precision and clarity	2 (8.69)	8 (3.78)	13 (56.52)
9	Encourages learner for asking questions	19 (82.60)	1 (4.34)	3 (13.04)
10	Distributes questions throughout whole class	3 (13.04)	20 (86.95)	00
11	Allows reasonable time for answering	2 (8.69)	13 (56.52)	8 (34.78)
12	Gives appropriate reinforcement	4 (17.39)	15 (65.21)	4 (17.39)

It is found from the table-4 that 43.47% of teachers always teach basing on what students already know whereas 34.78% and 21.73% of teachers are sometimes or never teaching based on the students' previous knowledge respectively. More than half of the teachers present information in a clear and organized manner while almost half of the teachers (47.82%) are not presenting the content or information in organize manner. The table also reveals that

73.91% of teachers always use language of the students in teaching, 69.56% of teachers always explains the concepts with familiar language and 86.95% of teachers always present lesson in an audible voice in class. Table-4 also indicate that no teacher is always prompts the learners for enquiry and asking question while 73.91% of teachers sometimes prompts learners for enquiry, almost half of the teachers (52.17%) always interact with students in class whereas almost same number of teachers sometimes or never interact with student in classroom. 56.52% of teachers always allow reasonable time to students for answering the questions. The table also indicates that 82.60% of teachers never encourage learners for asking questions in class, 86.95% of teachers distributes questions throughout class and 65.21% of teachers sometimes give appropriate reinforcement to students.

SI.	Items	Never	Sometimes	Always
No		(N and %)	(N and %)	(N and %)
1	Writes in legible handwriting on blackboard	1 (4.34)	14 (60.86)	8 (34.78)
2	Uses different activities (listening/reading/doing) in	2 (8.69)	12 (52.17)	9 (39.13)
	class			
3	Uses appropriate teaching learning method	1 (4.34)	18 (78.26)	4 (17.39)
4	Uses locally available things as teaching learning	18 (78.26)	4 (17.39)	1 (4.34)
	material			
5	Illustrates concepts with variety of examples from	18 (78.26)	2 (8.69)	3 (13.04)
	the local context			
6	Changes method/ strategy as per the moods of the	19 (82.60)	4 (17.39)	00
	learners			
7	Uses primary source/material for teaching	3 (13.04)	15 (65.21)	5 (21.73)
8	Uses ICT in classroom	23 (100)	00	00
9	Suggests other learning materials for references	23 (100)	00	00
10	Maintains order in the class with the consultation of	18 (78.26)	5 (21.73)	00
	the groups			
11	Offer personal support to learner at the time of	18 (78.26)	3 (13.04)	2 (8.69)
	difficulty during class activity			
12	Allows learners to interact with each other	12 (52.17)	9 (39.13)	2 (8.69)
13	Encourage pair work/ group work and ensures peer	18 (78.26)	5 (21.73)	00
	learning			

Table 5:- Classroom Transaction Relating to Use of Teaching Learning Materials and Classroom Management.

The table no.5 indicates that only 34.78% of teachers always writes in legible handwriting on the blackboard remain 60.86% and 4.34% of the teachers sometimes and never writes in legible handwriting on the blackboard. 39.13% of teachers always uses different activities (listening/reading/doing) in classroom during the science teaching learning process while 52.17% of the teachers sometimes uses different actives (listening/reading/doing) in classroom. Only 17.39% of the teachers always use appropriate teaching learning method remain are either sometimes (78.26%) or never (4.34%) uses appropriate teaching learning method. The table also states that 78.26% of science teachers never use locally available things as teaching learning materials and illustrates concepts with variety of examples from the local context whereas only 4.34% of the teachers always uses locally available things as a teaching learning method as per the mood of the learners whereas only 17.39% of teachers sometimes change their teaching method as per the mood of learners. Only 21.73% of teachers always use primary sources for teaching. None of the teachers are using ICT. It is alsorevealed from the table-5 that 78.26% of teachers never consult students for maintain discipline and offers personal support to learners at the time of difficulty in class activity. Further, the table also indicates that 52.17% of teachers never allow students to interact with each other in class, 78.26% of teachers never encourage group work.

Table 6:-	Classroom	Transaction	Relating to	Reflections
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SI.	Items	Never	Sometimes	Always
No		(N and %)	(N and %)	(N and %)
1	Possess mastery over content knowledge	3 (13.04)	15 (65.21)	5 (21.73)
2	Teaches how to learn a topic	23 (100)	00	00
3	Activates learners during the class	21 (91.30)	00	2 (8.69)
4	Encourage learners for self-reflection	14 (60.86)	8 (34.78)	1 (4.34)

5	Encourages divergent thinking among learners	21 (91.30)	2 (8.69)	1 (4.34)
6	Focuses on the process of learning in the class	17 (73.91)	4 (17.39)	2 (8.69)
7	Summarizes at the end of the class	1 (4.34)	14 (60.86)	8 (34.78)

The table-6 points out that only 21.73% of the teachers have mastery over content knowledge remain 65.21% of teachers have sometimes mastery over content and sometimes not mastery over content and 13.04% of the teachers have never mastery over content. None of the teachersteaches how to learn a topic. It is also found from the table that only 8.69% of the teachers activates their learner during the class remain 91.30% of the teachers never activates their learner during the class.60.86% of teachers never encourage the learners for self-reflection, only 4.34% of teachers are always encourage the learners for self-reflection over the content. Over ninety percent (91.30%) of teachers never encourage their learners for divergent thinking and 73.91% of teachers never focus on process of learning in class. Only 34.78% of the teachers always summarizes the class at the end whereas more than sixty percent of the teachers (60.86) sometimes summarizes the class at the end and 4.34% of the teachers never summarizes the class at the end.

Table 7:- Classro	om Transact	ion Relating	to Assessing	Learning.
				4.3.

SI.	Items	Never	Sometimes	Always
No		(N and %)	(N and %)	(N and %)
1	Assess learners understanding throughout the class	2 (8.69)	19 (82.60)	2 (8.69)
2	Asks questions as per objectives of lesson	20 (86.95)	1 (4.34)	2 (8.69)
3	Ask questions beyond the text	20 (86.95)	3 (13.04)	00
4	Gives importance on learners work in assessment	21 (91.30)	2 (8.69)	1 (4.34)
5	Helps learner in self-assessment	21 (91.30)	1 (4.34)	1 (4.34)
6	Provides home assignments that requires enquiry	20 (86.95)	2 (8.69)	1 (4.34)

The table no. 7 reveals that less than ten percent of the teachers (8.69%) always assess the learners understanding throughout the class whereas more than eighty percent of the teachers (82.60%) sometimes assess learners understanding throughout the class. More than eighty percent of the teachers (86.95%) never asks questions to the learner as per the objectives of the lesson, only 8.69% of the teachers always ask the questions to the learners as per the objectives of the lesson. None of the teachers always ask the questions to the learners beyond textbook whereas 13.04% of the teachers sometimes ask the questions to the learners beyond textbook whereas 13.04% of the teachers (86.95%) never provides home assignment that requires enquiry. The table further indicates that 91.39% of teachers never give importance on learners work in assessment and help learners in self-assessment.

SI.	Items	Never	Sometimes	Always
No		(N and %)	(N and %)	(N and %)
1	Remains active throughout the class	3 (13.04)	6 (26.08)	14 (60.86)
2	Dresses himself/ herself properly	2 (8.69)	7(30.43)	16 (69.56)
3	Enjoys the classroom teaching	3 (13.04)	17 (73.91)	3 (13.04)
4	Remains empathetic to learners	2 (8.69)	19 (82.60)	2 (8.69)
5	Ensure democratic practice in the classroom	2 (8.69)	15 (65.21)	6 (26.08)
6	Seeks cooperation of the students	2 (8.69)	20 (86.95)	1 (4.34)
7	Ensures an inclusive classroom environment	3 (13.04)	13 (56.52)	7 (30.43)
8	Maintain flexibility in the movement	3 (13.04)	12 (52.17)	8 (34.78)

Table8:- Personality of Science Teacher.

It is found from the table no.8 that more than sixty percent of the teachers (60.86%) are always remain active throughout the class while 13.04% of the teachers never active during the class. 69.56% of the teachers always dresses himself/herself properly. Further, 13.04% of the teachers always enjoys the teaching whereas 73.91% of teachers sometimes enjoy the classrooms teaching. 65.21% of teachers sometimes ensure democratic practice in the classroom, 86.95% of teachers sometimes seek cooperation of the students. The table also indicates that 56.52% of teachers never maintain flexibility in the movement whereas 52.17% of teachers sometime maintain flexibility in the movement in classroom.

Major Findings

Profile Science Teachers:

- 52.17% of science teachers are male and 47.82% of teachers are female. Majority (86.95%) of teachers teaching science are under 45 years of age and 78.26% of teachers have less than 10 years of teaching experience. Teachers teaching science are well qualified as 60.86% have B.Sc., B.Ed. and 39.13% have M.Sc., B.Ed. qualification.
- 30.43% of science teachers have attended in-service programmes like science pedagogy, ICT in teaching etc. organised by RMSA in last three years. 26.08% of science teachers have conducted science programme/s in school like Science Quiz, Bal Vigayan Congress, Sustainable Management of Natural Resources, Science Essay Competition, etc. Only 13.04% of science teachers have participated as resource person in science programmeorganised at cluster, block and district level.

Nature of Classroom Transaction:

- 1. 47.82% of teachers never create readiness among learners before teaching, 78.26% of teachers never test the previous knowledge before teaching and 73.91% of teachers never engage students to create interest to topics.
- 2. 43.47% of teachers always teach basing on what students already know and 52.17% of teachers present information in a clear and organized manner. 73.91% of teachers always use language of the students in teaching, 69.56% of teachers always explains the concepts with familiar language and 86.95% of teachers always present lesson in an audible voice in class.
- 3. 52.17% of teachers always interact with students in class and 56.52% of teachers always allow reasonable time to students for answering the questions. 82.60% of teachers never encourage learners for asking questions in class and 86.95% of teachers distributes questions throughout class.
- 4. 78.26% of science teachers never use locally available things as teaching learning materials and illustrates concepts with variety of examples from the local context, 82.60% of teachers never change method as per the mood of learners.
- 5. 78.26% of teachers never consult students for maintaining discipline and offers personal support to learners at the time of difficulty in class activity. 52.17% of teachers never allow students to interact with each other in class, 78.26% of teachers never encourage group work and 91.30% of students never activates learners during teaching in class.
- 6. No teachers teach how to learn a topic, suggests other learning materials for references and uses ICT in classroom.60.86% of teachers never encourage self-reflection, 91.30% of teachers never encourage divergent thinking among learners and 73.91% of teachers never focus on process of learning in class.
- 7. 86.95% of teachers never asks questions as per the objectives of the lesson, ask question beyond textbook and provides home assignment that requires enquiry. 91.39% of teachers never give importance on learners work in assessment and help learners in self-assessment.
- 8. 60.86% of teachers always remain active throughout the class, 69.56% of teachers always dresses himself/herself properly. 56.52% of teachers sometimes ensure an inclusive classroom environment and 52.17% of teachers sometimes maintain flexibility in the moment in classroom.

Educational Implications

The present study has implications for Government, Educational administrators, HMs, teachers and teacher educators.

- 1. The study found that majority of science teachers have not attended in-service training programme in last three years. So, initiatives may be taken by the Government for organising in-service training programmes for science teachers to update content knowledges and pedagogical knowledge inscience. Efforts must be made to orient teachers in constructive pedagogy so that they can help learner in creating knowledge. It is appreciable that majority of teachers have B.Sc., B.Ed. qualification and few are having M.Sc., B.Ed. Hence teachers may be encouraged to pursue higher qualification through distance/online mode from MOOC providers.
- 2. Teachers are not creating readiness and testing previous knowledge of learners before starting to teach new lesson which is very important step in teaching science. Hence teachers must guide to engage learners at the beginning of the class. Mostly the new and young teachers' classes must be supervised by senior teachers or HM and provide on-site support so that classroom transaction in science can be improved. Teacher must encourage students to ask questions in the class as asking questions is very essential for learning science. Students must be allowed to interact and discuss about the lesson in the class. This will facilitate peer learning.
- 3. Teachers must utilise materials available in and around school and locality as teaching learning material in teaching science. Hence, they must be oriented in preparing and using low cost and no cost material in science.

One important aspect of constructivist pedagogy is learning how to learn and teaching process of learning. This study indicated that few teachers teaching science does it. Hence it suggested that teacher must teach how to learn a topic or lesson along with the content. This will create independence of learners.

- 4. Evaluation must be continuously held throughout teaching. Teacher must ask questions based on the objectives of the lesson and questions that demands enquiry for home assignments. For constructivist learning, teacher must relate classroom teaching with outside world and ask questions beyond textbook. This will develop divergent thinking, self-reflection and innovative ideas among learners.
- 5. Pre-service teacher education has great role in the quality improvement of teaching learning in science. All teacher education curriculum must include constructivist approach of teaching different subjects. Emphasis must be given during pedagogy classes and internship. Trainees must be given practical exposure in developing lesson plans in constructivist pedagogy and writing test items for assessing divergent and higher order thinking skills.

Conclusion:-

Science education is a powerful means of developing attitude of critical inquiry; respect for truth, simplicity, adaptability and systematic work, which are pre-requisite for maintaining the process of social change and national development. The NCF - 2005 has emphasised on constructivist approach, which makes both teacher and learner active in the learning process. In the light of the research findings, it is felt that the present piece of research may contribute to bring quality in science education. In-service programme should be organised for teachers to use constructivist approach in their teaching and assessment. Prospective teachers must be expose to the practical way of using constructivist approach of teaching in pre-service course.

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