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Availability and Implementation of Instructional Materials in Science Teaching: A Glimpse of Gorkha District

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Abstract

This paper focuses on the availability and implementation of instructional materials in science teaching with the main objectives to find the extent of laboratory and improvised materials used at the secondary level and to assess the practical activities completed by secondary science teachers prescribed in the science curriculum at the secondary level. This study is carried out based on the concept learning of Brunner, the cognition theory of Piaget and Skinner's operant conditioning learning theory. This study is based on the descriptive survey design to explore the knowledge of teachers and students. For the study, eight public secondary schools within the Gorkha Municipality of Gorkha district were selected purposively and then eight science teachers were selected purposively and forty students selecting five students from each secondary level were selected using a simple random sampling method. A checklist, questionnaire and class observation guidelines were prepared and used to generate data. Data obtained from different tools were analyzed first using simple statistical methods quantitatively, then information obtained from class observation, the interview was analyzed qualitatively making themes and then interpreted linking with prescribed theory. From the data, it was found that most of the schools haven't sufficient materials in their laboratory. Similarly, most of the science teachers have knowledge but they did not give priority to the improvised materials and did not follow the practical work prescribed in the science curriculum. Teachers can make materials; however, they were found depending upon the marketed science materials neglecting socio-culturally generated materials.

Keywords: Scientific method, practical science teaching, improvised materials, teaching science, inquiry-based teaching

Background of the Study

The curriculum of science teaching is one of the foundational elements of effective schooling and teaching from the basic level to the higher level. According to Sharma (2009), it is an interconnected series of concepts and conceptual schemes that have developed as a result of experiment and observation and are fruitful for further experimentation and observation of the study. The secondary science curriculum is also divided into many branches i. e. Physics, Chemistry, Zoology and Astronomy (MoE, 2063 BS). In the same way from each branch practical work is also separated. It is very important for science in the School curriculum which helps to develop intellectual value, practical value, cultural value, moral value, vocational value, aesthetic value, etc (Sharma, 2009).

Nepal National Education Planning Commission (NNEPC, 1954), All Round National Education Commission (ARNEC, 1961), National Education System Plan (NESP, 1971), Primary Report of Royal Higher Education Commission 1983 have given the importance to implement innovative instruction pedagogy in science teaching (Koirala, 2074 BS; Sharma, 2059 BS). Like that in the present context School Sector Development Plan (SSDP) 2016-23 has played a crucible role to change the science curriculum by focusing on ICT, local technologies and societal science i.e trying to provide the combined knowledge of Science Technology and Society (STS) in secondary level science teaching (MoE, 2016). For academic improvement, there should evolve new methods of teaching for every subject as it is found somehow mentioned in the National Education System Plan (Sharma, 2059 BS). In this context Reiss, Millar and Osborne (1999) said that the Nuffield foundation arouses the four questions for the enhancement of science education which are as follows:

What science education is needed by young people today? What might be the form and structure of a suitable model for a science curriculum for all young people? What problems and issues would be raised by the implementation of such a curriculum, and how might these be addressed? and what are the successes and failures of science education to date? (p. 68).

These questions also suggest the implementation of experimental and

investigative science teaching to obtain technological literacy.

For effective and inspiring science teaching, instructional materials are very important and play a crucial role for increase the science achievement of students. Instructional materials make the instruction concrete, behavioral and life long-lasting (Karla & Gupta, 2009). As saying Miller et al. (2018), it supports the student to engage scientific knowledge construction- to position them as doers of science, rather than the receiver of facts. Science is a daily useful and practical subject. Teaching sciences is directly related to the use of teaching materials for effective teaching, practical work as well as the use of instructional materials are essential. Written, audio, video, improvised materials make the science instruction effective (Sharma, 2009). Now a day, Information Communication and Technology (ICT) is mostly used to teach science at school. The present time is the age of use of ICT. It helps us in any situation to use innovative practical teaching (Shrestha, 2069 BS). There are so many conditions and events where science education cannot make effective from using other instructional materials (Koirala, 2019 b). In that condition the students may be confused to understand the lesson in that situation, if ICT is used by teachers, students also may be clear about the lesson and also it helps the teacher to maintain the time as well as help search for new knowledge and idea (Shrestha, 2069 BS). So ICT is an instructional material that is most important for the teaching-learning process in the present context (Koirala, 2019 b). Science is a practical subject. Practical work is very essential for teaching science, in this context ICT would play a crucial role to provide the new knowledge to the students in an innovative way (Ahmad, 2009), so that SSDP has provided the emphasis on the use of ICT in science teaching (MoE, 2016). ICT is seen as relevant to providing practical skills to the students in the present Pandemic situation.

Considering the value of practical work of science education, the National curriculum framework 2063 BS also gave the priority to practical work in secondary science, and a separate practical course is designed embedding within the theoretical time frame (CDC, 2063 BS). For practical work science laboratory with necessary materials should be required. According to Curriculum Development Centre [CDC] (2063 BS), 75% of the weight is separated for the theoretical part and 25% is for practical work (Koirala, 2019 a). Practical work is divided into different parts and tried to link the science more practical based rather than theoretical concept provided than before that time. However, it is even being unable to prepare life situated science curriculum based on day to events of students. It is also guided by Western

science knowledge so that would not be applicable in the multicultural context of Nepal (Koirala, 2021). Although it is considered a golden opportunity in the context of science teaching. The prescribed structure of the practical portion in the secondary level science curriculum is given below

Title	Marks
Sporting	5
Management of project work	6
Experiment/ materials construction and demonstration	6
Mini project work and demonstration	4
Viva Voce	4

Koirala, 2074 B S

In 1982, Science Education Development Project (SEDP) was implemented under Science Education Development Unit (SEDU) at 25 District of Nepal (Pandit, 2070 BS). The main objective of SEDU was to train the science teachers to use activity-based teaching methods. Many educational Reports have been given more emphasis on teaching materials and activities in teaching science at the school level, however, significant change cannot be found until now in science performance both at the school and university levels.

Policies taken by different commissions to make science practical based

Educational reports	Policy
NNEPC, 1954 B. S	Manage Science laboratory in every School
NESP, 1971-1975 B. S	Construction of education teaching materials at the local level
HLNEC, 1998 B. S	Activity Centered Instructions
NCF 2063 B. S	Technology-based Education

(Pandit, 2070 BS)

Instructional Materials for Effective Science Teaching

Almost all psychological and educationists emphasized the use of teaching materials saying that teaching materials in science make the teaching concrete, develop scientific attitudes, motivate the student, develop the problem-solving

capacity and creativity and critical thinking in students (Mohan, 2010; Shrestha, 2009). Many psychologists, pedagogists and educational reports have given importance to instructional materials in the teaching-learning method. Instructional materials are of four types, they are visual, audio, audio-video and printed materials (Ahmad, 2009; Sharma, 2009). Charts, flatten boards, real objects and overhead projector, etc. which are used to see are visual materials, materials giving sensing of hearing are audio materials, videos with sound are audio-video materials, and the written materials like textbooks, reference books, booklets and journal, etc. are printed materials (Davar, 2012; Karla & Gupta, 2009). Instructional materials can be made by using locally available low cost and no-cost materials, these materials are called improvised materials (Shrestha, 2009). For the use of effective teaching material, science teachers should have taken the professional development training as well as higher academic qualification (Koirala et al., 2020).

Some research is conducted to investigate the relationship between the achievement of Science students and the use of teaching materials. The achievement of girls in science is low because of teaching strategies taken by science teachers in the classroom (Koirala & Acharya, 2004). Moreover, science teacher doesn't use inclusive approaches and they don't use instructional materials which are causes having students' achievement different. Hence, instructional materials are very important for effective teaching. However instructional techniques are influenced by students' learning level, use of process skills, teacher's attitude, course load, rigid curriculum structure, learning environment, the economic condition of parents and schools, etc.

In our context, most science teachers do not use instructional material in science teaching. The lack of knowledge, required instructional materials and resources reduce the students to more passive participation in the learning process. Consequently, there is an erosion of enthusiasm in the teaching-learning processes by both teachers and students (Okobia, 2011). Instructional materials make excitement for the students to learn and the teacher to teach practically. So, the use of instructional materials helps to make the teaching-learning process active and effective. For effective teaching science, the concept provided to students should be related to daily life works and society. These instructional materials used in school should be prepared in the local setting as far as possible. These improvised materials can make teaching meaningful realistic and lifelong. According to Mbotto et al. (2011), the following technique should be adopted by physics teachers for effective

teaching.

Physics teachers should adopt the use of improvisation to complement the standard / manufactured materials in teaching physics. Students should be encouraged with the help of the teachers to assemble locally made materials, resources that should be used in the teaching of physics. The government should assist in the supply of those materials that could not be locally produced. A regular workshop should be organized for serving teachers to broaden their knowledge of improvisation. (p. 350).

This also shows that improvised materials are very important for teaching science which helps to link modern science knowledge with Ethno knowledge (Aikenhead, 2006). Science teaching requires so many instruments, chemicals and apparatus. The laboratory is must necessary for teaching science practically. Ahmad (2009) pointed out the importance of the use of concrete materials in a meaningful understanding of many abstract relationships in the following words: the use of visual materials plays an important role in mastering abstract or general concepts. They are helpful because we want an accurate image of the things used are easier to provide concrete knowledge to see the relationship. They, thus facilitate learning because we can attend to concrete things more readily than imaged things”.

Valuing the Instructional Materials in Science Teaching

Instructional materials are very essential for the teaching and learning process in school science. The laboratory is also must necessary for teaching science but it is wrong that science subjects can't teach effectively without expensive and imported materials. We can use the materials in a local setting which helps the learner to relate the knowledge with their daily experiences and these materials are economic (Ahmad, 2009) as well as based on sociocultural norms and values and students easily understand their use and would be attention towards the classroom teaching.

There is a popular Chinese Slogan If I hear, I forget, if I see I remember and if I do I know (Sharma, 2009). It also indicates that teaching materials are the most important factor in teaching science at the school level. But in practice, it is being a problem in Nepalese schools. Most of the schools in Nepal are still using traditional approaches like the lecture method, through drill, repetition, and memorization. It is heard that the main reason for the low achievement of students in science is due

to instruction without practical work and effective teaching materials. Mainly in the government school of Nepal, however, there is the main problem is not to done the science practical work by science teachers due to different problems; such as lack of proper science lab, lack of practical knowledge in science teachers, lack of essential materials for science practical, lack of interest in students for done practical work and lack of knowledge to link the modern science curriculum with the practice of sociocultural knowledge (Aikenhead, 2006). So the main objectives of this study are to find the extent of laboratory and improvised materials used at the secondary level and to assess the practical activities completed by secondary science teachers prescribed in the science curriculum at secondary school.

Theoretical Framing

There are so many theories that guide science teaching. Some guiding theories of science teaching based on the teaching materials are as follows

The main theory is Bruner's concept of learning theory. This is based on inductive learning theory, which focuses on practical activities for effective learning (Sood, 1989). According to this theory, in the inactive stage of learner instructional materials are important (Bruner, 1960). According to Bruner learning is an active process in which learners construct new ideas or concepts based on their current/past knowledge/ experience (Karla & Gupta, 2012). As far as instruction is concerned, the instructor should try and encourage students to discover principles by themselves. The principles of Bruner's which indicates the importance of instructional materials in the teaching-learning process are as follows

- a) Instruction must be concerned with experiences and contexts that make the students willing and able to learn.
- b) Instruction must be structured so that it can be easily grasped by the student.
- c) Instruction should be designed to minimize the gaps.

According to the cognitive theory of Piaget, four types of cognition structure are needed for learning. They are schema, assimilation, accommodation, and equilibrium (Koirala, 2074 BS; Sharm, 2009; Sood, 1989). To strengthen these four aspects instructional materials, play an important role. So, this study will be based on Piaget's learning theory. He mentioned that "intellectual development is first based on activity and then later on conceptualization, each development begins

with concrete experiences and only after its mastery its move to its mastery” (Sood, 1989, p. 137) indicates the value of practical work for effective learning for children. Meaningful and practical aspects refer to visualization and intuition; the instructional materials touch the feelings of the learner.

According to Piaget, a child passes through four distinct stages of mental growth which he calls ‘sensory-motor stage’, ‘pre-operational stage’, ‘concrete operational stage’ and ‘formal operational stage’ (Sharma, 2009; Sood, 1989). The transition from one stage to the next can be hastened by enriched experiences and appropriate teaching materials. Piaget expresses this thesis in his book ‘The growth of logical thinking from childhood to adolescence’ (Sharma, 1992). The use of instructional materials helps the learner to make a concrete schema and it helps to assimilate and accommodate towards the new schema (Koirala, 2074 BS; Sood, 1989).

Methods

The design of the study was descriptive which is mainly based on qualitative inquiry. A qualitative inquiry is a research technique in which data are gathered by asking questions of a group of individuals (Yin, 2016). Inquiry studies are conducted to collect detailed descriptions of existing phenomena with the intent of employing data to justify current conditions and practices (Sood, 1989). So, an inquiry is a kind of research in which information is collected from an individual through the questionnaire, interview and observation (Yin, 2016). In this study, the inquiry-based investigation was carried out to find out the condition of availability and implementation of instructional materials in the sample school in the Gorkha district. The life experiences of science teachers and students regarding the improvisation of materials and laboratory materials were studied by using qualitative inquiry.

The population of the study was the school teachers and students of the secondary level of the Gorkha District. There were more than 110 community schools in Gorkha District in which classes nine and ten are conducted. So that all community secondary schools in the Gorkha district, their respective teachers and students were taken as the population of this study. The sample of this study was the purposively selected (Creswell, 2007; 2013) from eight schools, their respective secondary science teachers, and randomly selected five students from every eight schools. First of all, a list of eight secondary schools was selected purposively (Creswell, 2007; 2013) from the community school list of the Gorkha municipality.

Five students studying in class ten from each school were also selected by a simple random sample method (Best & Khan, 2003). Similarly, the respective science teacher from each school was taken as a sample.

Observation checklist of laboratory instruments, structural questionnaire, open-ended interview guideline was used as tools for data collection (Yin, 2016). The researchers have also studied the syllabus, textbooks, teacher guides, curriculum of classes nine and ten as well as other sources based on which list of instructional materials can be made.

To collect the data second researcher visited each sample school twice. During the first visit class observation of class ten was done with the permission of the school head and class teachers. The observation checklist was filled by researchers by observing the storeroom and laboratory and by asking the questions to the science teacher as well as the administrator. Similarly, science teachers' classroom teaching was observed indirectly and his classroom teaching activities were noted in a diary. On the second visit to each school, a questionnaire for teachers and students was filled and again classroom teaching of class ten was observed. The questionnaire was filled out by students of class ten in their classroom and the questionnaire for the teachers and administrator was filled in the office room. Information and data by questionnaire and checklist were collected during the Tiffin time, mini Tiffin time, or before and after the class time. The classroom teaching was observed during regular class time.

The data obtained by the checklist, observation and questionnaire about the availability of improvised and other instructional materials were presented in the table and the available percentage was interpreted. Similarly, a list of basic instructional materials was also organized in the table and the available percentage was analyzed separately. The information obtained from the teachers, administrators and students and the information obtained from the class observation was arranged and then themes were made. The conclusion was drawn by linking the themes with different related theories.

Result and Discussion

This section deals with the result and discussion obtained from the collected data. The result and discussion deal with the analysis of the collected data is one of the major steps in descriptive statistical research, which draw a reliable conclusion.

The data provided some useful conclusions for researchers about teaching science in secondary schools. The analysis was carried out based on the following aspects.

Availability of the Instructional Materials

The instructional materials found in the schools are given below. The instructional materials were divided into ten different categories and presented in the table. The available instructional materials are presented and analyzed below:

S.N.	Name of materials	Available	Not available	Available %
1.	Instruments			
i.	Compound microscope	6	2	75
ii.	Beam / spring / pan balance, Meter scale	7	1	87.5
iii.	Stop watch	2	6	25
iv.	Hydrometer, Lactometer	4	4	50
v.	Barometer, Hygrometer	1	7	12.5
vi.	Thermometer	8	0	100
vii.	Ammeter, Voltmeter, Galvanometer	7	1	87.5
viii.	Rheostat, Resistor	2	6	25
ix.	Power supply, Cell, Battery	8	0	100
x.	Vernier calipers	1	7	12.5
2.	Apparatus			
i.	Test tubes, Delivery tubes, Corks, Gas jar	8	0	100
ii.	RB flask, Conical flask, Beaker, funnel	7	1	87.5
iii.	Burner, Wire gauge, Tripod stand	5	3	62.5
iv.	Prism, Glass slab, Mirror, Lens, the Filter paper	7	1	87.5
v.	Bar magnet, Compass	6	2	75
vi.	PH scale, PH paper	2	4	25
vii.	Dissection box	4	2	50
viii.	Vacuum tube, Optical bench	0	8	0
ix.	Fuse, Transformer	2	6	25

x.	Tuning fork	4	4	50
xi.	Ureka can	2	6	25
3.	Chemicals			
i.	Sulphuric acid / Hydrochloric acid	8	0	100
ii.	Nitric acid	6	2	75
iii.	Calcium hydroxide	5	3	62.5
iv.	Potassium hydroxide	3	5	37.5
v.	Calcium carbonate, Iodine	4	4	50
vi.	Formalin, Phenolphthalein, Methyl orange	5	3	62.5
vii.	Red cabbage juice	0	8	0
viii.	Sodium, Magnesium ribbon, Sulphur, Phosphorus	3	5	37.5
ix.	Glycerin, Ether, Alcohol	4	4	50
x.	Copper sulphate	5	3	62.5
xi.	Sodium thiosulphate, Potassium chlorate	2	6	25
4.	Charts			
i.	Modern Periodic Table	4	4	50
ii.	Mitosis and Meosis cell division	3	5	37.5
iii.	The life cycle of insects and plants	4	4	50
iv.	Monohybrid and Dihybrid cross	2	6	25
v.	Nervous / Skeleton / Digestive system	3	5	37.5
vi.	Respiratory/ Circulatory system	3	5	37.5
vii.	Receptive organs	4	4	50
viii.	Phases of moon / Solar and lunar eclipse	5	3	62.5
ix.	Solar system, Constellation	4	4	50

x.	Anatomy of roots, leaf, the stem of the plant	2	6	25
xi.	Eco system	5	3	62.5
xii.	Bio chemical cycles	2	6	25
5.	Slides			
i.	Anatomy of cell	5	3	62.5
ii.	Cell division	3	5	37.5
iii.	Anatomy of roots, leaf, the stem of plants	3	5	37.5
iv.	Sperm and Ovum	4	4	50
v.	Micro plants, Micro animals	7	1	75
6.	Specimens			
i.	Invertebrates	4	4	50
ii.	Vertebrates	5	3	62.5
iii.	Plants	4	4	50
iv.	Sea livings	2	6	25
7.	Models			
i.	Cell	0	8	0
ii.	DNA, RNA	2	6	25
iii.	Skeleton system	4	4	50
iv.	Atoms	4	4	50
v.	Solar system	0	8	0
vi.	Heart, Lungs	2	6	25
vii.	Simple machines	7	1	87.5
viii.	Generator, Dynamo	2	6	25
ix.	Electric bell	3	5	37.5
8.	Improvised materials			
i.	Models	7	1	87.5
ii.	Chemicals	2	6	25
iii.	Apparatus	6	2	75
iv.	Charts	7	1	87.5
9.	Herbarium collection	3	5	37.5
10.	Audio / Videos			
i.	Volcano, Flood, Earthquake, Landslide	1	7	12.5

ii.	Eclipse, Solar system	1	7	12.5
iii.	Phases of the moon, constellation	1	7	12.5
iv.	Working of machine	1	7	12.5
v.	The function of the system of the human body	1	7	12.5

Discussion About the Condition of Available Materials

The data obtained from the observation checklist is analyzed below:

Instruments

The instruments like Thermometer, Battery and Power supply were found in all the sample schools. Vernier callipers, Barometer and Hygrometers were presented only 25% of sample schools. The Compound Microscope was found in 75% of schools; and Ammeter, Voltmeter, Beam/ Spring/ Pan balance and meter scale were found in 87.5% of schools. The entire science teacher said that they know the idea to use available instruments.

Apparatus

Apparatus like Test tubes, Delivery tubes, Corks, Gas jar were presented in all the sample schools. Ureka can, Fuse, Transformer. PH scale and Litmus paper were presented only in 25% of schools. Tuning fork and Dissection boxes were presented in 50% of schools. RB flask, Prism, Mirror, Beaker, Funnel, Glass slab, Lens and Filter paper were presented in 87.5% of schools. But the Vacuum tube and Optical bench were not presented in any school. Burner, Wire gauge, and Tripod stand were presented in 62.5% of schools. All the science teachers from each sample school said that they have known the application of available materials.

Chemicals

The chemicals in basis acids like Sulphuric acid and Hydrochloric acids were available in all the sample schools but Nitric acid was found only in 75% of schools. Calcium hydroxide, Formalin, Phenolphthalein, Methyl orange, and Copper sulphate were found in 62.5% of schools. Calcium carbonate, Iodine, Glycerin, Ether, and alcohol were found in half of the sample schools. In the same way, Sodium thiosulphate and potassium chlorate were found in only 25% of schools and potassium hydroxide was available in only 37.5% of schools.

Charts

Charts of the modern periodic table, Life cycle of insects and plants, Receptive organs, Solar system and Constellation were found in half of the sample schools. Charts of Monohybrid and Dihybrid cross, Anatomy of roots, leaf, the stem of plants were available in 25% of schools. Similarly, charts of Mitosis and Meiosis cell division, Nervous/ skeleton/Digestive, Respiratory and Circulatory system were available in 37.5% of schools. In the same way chart of the ecosystem, phases of the moon, Solar and Lunar eclipse were found in 62.5% of schools.

Slides

Permanent slides of sperm and ovum were available in half of the sample schools. Slide of stages of cell division, the anatomy of roots, leaf, the stem of plants were found in 37.5% of schools. In the same way, slides of micro plants and animals were available in 75% of schools and 62.5% of schools have kept using the slide of the anatomy of a cell.

Specimens

The specimens of sea animals like octopus, amoeba, jellyfish, starfish were preserved only in 25% of schools. Specimens of vertebrate animals were preserved in 62.5% of schools and that of invertebrates and plants were in 50% of schools.

Models

Models of heart lungs and dynamo were found only in 25% of schools. Models of atoms of DNA/ RNA and the skeleton system of the human body were available in half percentage of the sample schools. Similarly, models of atoms of elements and electric bell were found in 37.5% of schools and models of the simple machine like lever, pulley, wedge, screw in 87.5% sample schools. But the model of solar system and cell were not found in any sample schools.

Improvised materials

More improvised materials were found in the form of models and charts. They were about 87.5% of schools. Most of the models were related to the simple machine and charts were related to biology, geology and astronomy. Improvised apparatus like a funnel, beaker, gas jar, test tubes and stands have consisted in 75% of schools. Concept maps related to the classification of plants and animals were

also found at school. Chemicals as improvised materials were found only in 25% of schools but 62.5% of teachers said that they have used chemicals and metals locally available.

Discussion About the Availability of Basic Materials

The availability of basic materials are presented and analyzed below

Table 2

Availability of Basic Materials

S. N.	Name of materials	Available	Not available	Available %
i.	Text book	8	0	100
ii.	Black / White board, duster, chalk/ marker	8	0	100
iii.	Curriculum	5	3	62.5
iv.	Teachers guide	3	5	37.5
v.	References books	2	6	25
vi.	Bulletin board	3	5	37.5

The statics in table 2 shows all the sampled schools are founded to have major instructional materials such as textbooks, marker or chalk, whiteboard or blackboard. In the same way, teacher guides and bulletin boards were available in only 37.5% of schools. Similarly, the curriculum was found in 62.5% of schools but reference books were available only in 25% of schools.

Use of the Instructional Materials

Out of all sample teachers from each sample school, only 87.5% of teachers opined that they have used instructional materials during teaching time. They argue that the students feel well in a study by using teaching materials. Students felt enjoyed and they did the cooperation with each other. Teaching becomes effective by using materials but 12.5% of teachers opined that the practical work and use of more instructional materials are not practicable and it takes a long time. 75% of teachers said that the students cooperate during the conduction of practical work and use materials but administrators have given low priority to their use.

In all eight sample schools, practical work was conducted during the period of regular class time. In four schools, the practical class was conducted weekly but

in the other four schools, it was conducted as necessary. Three schools have separate science laboratory rooms for practical work but the other five schools do not have a separate room to do practical. Audio-video material was used in only one school, however, there was also an electric problem for use them continuously. 65% of students said that their science teacher uses textbook as instructional materials in most of the teaching time but sometimes demonstrate charts and real objects. Most of the students said that they have felt enjoyed and easy to learn when they are studied by using instructional materials. About 70.44% of students said that practical work has not been conducted regularly. 22% were not satisfied with the teaching style of their science teachers.

Most of the science teachers said they have used different teaching methods as necessary. They said they use child-centered methods. From the information of teachers, common problems in practical work and use of materials can be listed as below: Lack of instructional materials, lack of proper time, lack of electricity, lack of separate science lab and furniture, lack of proper training and workshop, lack of encouragement to the teacher to do practical work by the administrator. We observed sixteen classes of eight selected school science teachers. All most classes that we observed were dominated by chalk and talk method and some were demonstration. Out of sixteen classes, two classes were related to astronomy and geology, six classes were related to chemistry and eight classes were related to biology. In one astronomy class, no materials were used and the method of teaching was completely lectured. In that class, students acted as active listeners and the teacher as a speaker like a storyteller. But at the end of that class homework was given to students to make a chart of the geological era and evolution of living beings which was not related to classroom teaching. The classroom teaching was not linked with students' daily life experiences and day to day cultural events.

In chemistry classes, the Demonstration method was used in one class and materials like lemon, salt, ash, and soap were brought by students and H₂SO₄, HCL, CaOH, litmus paper, and phenolphthalein were kept by the teacher from the laboratory room. Similarly, in another class, a chart of the periodic table was used but the lecture method dominated. At the end of that class, the science teacher provided homework on the blackboard for students to make the electronic configuration of Magnesium, Sulphur, Calcium and Copper.

In biology classes, real dicotyledonous and monocotyledonous plants were

used as instructional materials to differentiate between Dicot and Monocot leaves, roots and stems. Similarly, Dicot and Monocot seeds were also used. At that time students were divided into four groups and materials were provided to them to identify the differences and asked them to list them in their copies. Similarly, in another class, a diagram of the heart was demonstrated and explained the internal structure of the heart and asked for students to draw figures in their copy. In the same way, another class was observed in class nine about the lesson on the different phylum of invertebrate and slides were used as instructional materials.

In the teaching of biology classes, improvised materials were used like plants and seeds of dicotyledonous and monocotyledonous plants. Similarly, the co-operative learning method was used by dividing students into groups. Slides and microscope were used as laboratory apparatus. Co – operation between students and teachers was also seen as materials brought by students. Audio-video was not seen in any class. In more schools, basic materials were presented but in two schools there were no satisfactory materials. In four schools there was a separate room for practical work but not in the other four schools. Students were seen as happy, excited and curious while using the co-operative and demonstration method but seen as passive when using the lecture method. Students were seen as unsatisfied during the teaching of chemical reactions.

According to Brunner’s theory of concept learning, in the inactive stage of learner instructional materials are important and in the symbolic stage, instructional materials are not needed (Pandit, 2070 BS). In this study, 87.5% of respondents said that they like to use instructional materials during teaching. They said students feel better during use of materials. Similarly, students feel enjoy and they co-operate with each other. In the same way, teaching becomes effective by using such types of materials but 12.5% of respondents said the practical work and use of more instructional materials are required for effective teaching. As saying Piaget’s cognitive theory, in the sensory-motor stage, preoperational stage and concrete operational stage, materials are needed for learning science (Sharma, 1992). It is justified as saying 87.5% respondents of this study gave priority to the use of instructional materials.

Science learning is based on the active use of teaching materials as well as the use of ICT in the present COVOV-19 Pandemic context. So as saying Skinner’s operant conditioning learning theory, students’ active participation is needed for

effective learning. This theory may be the base of active involvement of students in science learning but classroom practice was not seen as prescribed by operant conditioning theory. Both teachers' and students' involvement could be developed for the preparation and use of local and improvised materials as well as the ICT-related material for effective science teaching.

Implementation of Practical Work Prescribed in the Science Curriculum

Curriculum refers to the lesson and academic content taught in school or a specific course or program. To teach the students only a textbook and the teacher's guide is not enough but also the curriculum is very important for teaching-learning purposes. But from the collected data it is seen that only 62.5% of sample schools have kept the science curriculum in the school. From the questionnaire and the interview, it is found that only a few schools have used the curriculum for their practical work. After asking science teachers of that sampled school that had not done practical work properly said that they have no idea how to use the practical instrument for the practical work as well as lack knowledge about the practical work. And also due to lack of the proper time they had not done the practical work properly and they said that there is no separate time given for the practical work in the curriculum. And also due to the earthquake in many sample schools the laboratory instructional materials had been damaged so, they could not maintain properly the practical work as prescribed in the curriculum. But as the form of improvised materials for the practical work many schools have used the local materials which helped somehow to fulfill the aims which are prescribed in the science curriculum.

Findings and Conclusions

Although science has been given an important place in the curriculum of all levels of school education, most of the students are weak in a science subjects. It is not known what factors impede students' progress in this subject. However, it is felt that most students dislike science subjects and are afraid of its learning. It indicates that the teaching-learning environment can't attract them to science and therefore their performance in this subject is being poor day by day. The collected data were analyzed by using the frequency counts of the availability and use of materials assigned to each set of materials. Similarly, a general description of the use and improvisation of the materials has been done. Based on the analysis of the collected data, the finding of this study was determined which are as follows:

About 85% of science teachers were trained, had Bachelor's degrees with experience. Despite their training and experiences, either they could not provide time for materials making or they didn't have the required materials. Though 62.5% of teachers used available materials, 37.5% of them didn't use it because they thought that the use of such materials did not play an effective role in the teaching and learning process. After all, it takes a long time and breaks the indiscipline among students. Even the sufficient instructional materials were not provided by the responsible institution like the central as well as local government. Therefore, such materials were not available in sufficient numbers in most of the schools. However, 47% of the sample schools science teachers made materials by themselves, 37.5% of teachers by using students, while more instruments and apparatus were brought from the market.

Other essential materials like textbooks, blackboards, marker/chalk, and duster were available in all schools but teacher guide books were not available in 62.5% of sample schools. The curriculum was not available in 37.5% of sample schools and reference books were not available in 75% of the sample schools. Due to a lack of generating interest in the science practical work in students, the practical work which is prescribed in the curriculum was not more effective in many sample schools. Due to the lack of good laboratory conditions in 62.5% of the sample schools, the practical work which is prescribed in the curriculum was not conducted more effectively.

The availability of instructional materials in schools is not a sufficient number. Institutions like the central and local governments didn't support sufficient materials. Most of the teachers can use the materials available in their school. Proper numbers of materials are not found in more schools and even available materials in the schools are not used properly by teachers at the time of teaching. Though only some materials are made by teachers themselves, most of the materials aren't made either because of lack of time or available local materials. That's why most of the materials are bought from the market. Daily life materials such as textbooks, board, marker/chalk, and duster are present in all schools but the curriculum, teacher guides, and reference books are not found in most of the schools. Due to various reasons like economic conditions, and geographical conditions, the physical condition of the room of many sample schools is not found satisfactory.

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