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Education

ACCESSIBLE SCIENCE LABORATORY: A CHALLENGE FOR THE STUDENTS WITH DISABILITY AT HIGHER SECONDARY STAGE

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KEYWORDS

Introduction

Learning of Science requires some skills like problem solving ability, labelling and drawing diagrams, analysis, synthesis, keen observation etc. The concept of science can be a bit abstract to understand, that's why experiments are performed to make it clear through manipulation of equipments, specimens and observation of details. Experiments performed in the laboratory is said to increase critical thinking and problem solving ability among the students.

For the visually impaired students, learning science at higher secondary stage helps them to develop understanding of the concept as well as social interaction with the sighted students (Wild and Koehler, 2012). Sarva Shiksha Abhiyaan and Rashtriye Madhyamik Shiksha Abhiyaan have developed certain guidelines which promote barrier free school environment and access to all the teaching learning material even for the special students. But the question which arises here are: Are the school catering to the needs of disabled students in the laboratory? Are the laboratories well equipped with materials required for specific disabilities? These questions are also the main focus of Accessible India Campaign launched by the government of India under Ministry of social justice and Empowerment 2016 to achieve universal accessibility.

After a year of study in preparing the study materials and resources for the blind students, **Chevins and Nacer (2007)** had shown that the outcome was as good as expected from the sighted students. The students with disability face a lot of problems like lack of resources, unavailability of mentor, a knowledge gap between sighted students and visually impaired students **(Mahadeo, et al, 2014). Burgstahler (2016)** students having disabilities face a lot of challenges in demonstrating, participating and gaining knowledge from the laboratory activities.

This case study focuses on the challenges faced by the visually impaired students in performing science experiments in the laboratory and this also focuses on all the innovative strategies taken up by the teachers to help the special students develop conceptual knowledge of science through experiments.

Objectives of the Study

The study was conducted with the objectives to study the accessible infrastructural facilities available in the science laboratory for the students with visual disability and to study the problems faced by the students with visual disability in performing science laboratory experiments.

Research Questions

The study will attempt to answer the following research questions:

- To what extend science laboratories in the higher secondary schools are accessible for the students with visual disability disabilities?
- To what extent they get assistance from the teachers and peer group to perform the science laboratory experiments successfully?
- What are the major problems faced by the students with visual disability and locomotor disabilities in performing the science laboratory experiments?

Methodology:

The investigators used survey study method for the collection of data.

Tools Used for the Study

The following tools were used for the study

- A checklist to study the accessible infrastructural facilities available in the science laboratories for the students with visual disability and locomotor disabilities.
- An observation schedule to observe science laboratory tasks performed by the students with visual disability and locomotor disabilities.
- A questionnaire to study the major problems faced by the students with visual disability and locomotor disabilities in performing the science laboratory experiments

Sample

This study was conducted in four schools of Delhi and Haryana viz., Tagore International School, Vasant Vihar, Salwan Public School, Rajendra Nagar, Delhi Public School, Gurgaon, Jamia Milia Senior Secondary School, New Delhi. Out of six CWSN students in the schools, four students were visually impaired and two students were locomotive disabled. One locomotive disabled student was suffered by Polio and other is affected by radial ray deformity.

Analysis and Interpretation of Data

Accessible Infrastructural Facilities Available in the Chemistry Laboratory

Availability of Basic Apparatus and Chemicals

Basic apparatus and chemicals like beaker, pipette, titration flask, reagents, salts, ionic salt, water-bath, Heating facilities like LPG gas, spirit lamp etc. for chemistry practicals, 3-D models of human anatomy, heart and digestive system, etc. for Biology practicals, pendulum, tuning fork, Venire Calliper, screw gauge, meter-bridge, Ohms law setup, Ammeter, Voltmeter, half deflection setup, tuning fork experiments, lens experiments setup and for Physics practical were available in the laboratories of the schools.

As per our observation, the electrical points were available in adequate numbers in the schools and the electronic instruments were charge regularly. Some of the schools even had apparatus labelled in Brallie (like beakers, test tubes etc.) for the visually impaired students.

Biology laboratory of Salwan Public School had sufficient apparatus like microscope, water bath and test tubes. They also had digital thermometer which shows temperature in degree celcius and a talking watch for the laboratory related work. Apart from it, in almost all the schools 3-D model of various organs like brain, heart, digestive system, human skeleton, etc. were available for teaching the students.

Other Facilities and Laboratory Environment

There were special educators in all the schools we visited. They were there to teach the visually impaired and locomotive disabled students. Smart boards, e-resources, audio-video teaching learning materials and other ICT related resources were available in the school and were frequently used by the teachers and the students in the learning process. The visual and locomotive disability students used to get constant support from their peers, teachers and laboratory staff, to keep them motivated to learn and understand the concept.

Difficulties faced by visually Impaired and Locomotor Disabled Students during Laboratory Work

Problems faced by Visually Impaired students

The major problem faced by visually impaired students was the Braille books for subjects of XI science were not available. The students usually face the problem with the pace of the teacher, they think that

they cannot match with the pace of the teacher and are lagged behind. More adaptations would be required for them during the laboratory work so that they can work with the peer group without feeling isolated. Visually impaired students were able to perform the physics practical well and identify the equipments. The problem was faced with chemistry practical as the visually impaired students were not able to handle chemicals.

Problems Faced by Locomotive Disabled Student

The following problem were faced by the locomotive disabled students while doing practical -Difficulty faced while writing in the class due to improper development of fingers and bones. Difficulty in performing experiments as they have weak grip and cannot hold apparatus and equipments properly. Difficulty in folding hands which leads to slow writing skill. Difficulty faced while moving in the laboratory. Also, continuous standing in the laboratory was one of the difficulties faced by such students.

Case study of the of the difficulties Faced by Master Mohammad Adil, Jamia Milia Senior Secondary School, New Delhi in performing Titration experiment in Chemistry laboratory

Adil(student) had to face a lot of difficulties due to insufficient resources as well as awareness. First of all it was a huge problem for him to commute up and down as there were no lifts. Secondly, it was problematic for him to move in the laboratory to collect all the equipments and bringing to workstation. Above all he wasn't treated as he should have been. There were no considerations towards him and they were failing to cater to his needs.

Case 11 Case of Master Shivam

Shivam (student) faces problem in finding the right scriber to write for him in the examinations. Most of the scribers are from non-science background and it is really a task to make them understand the questions and the diagrams. It wastes a lot of his time. Shivam wants some advance technology which can help him record his voice for answers in exams.

Problem Faced by Teachers

The teachers also find it difficult to cater to the needs of children with special needs. They are struggling in providing a good learning environment to the special students. The teacher of Tagore international school said that there is a scarcity of resources as well as knowledge when it comes to dealing with children with special needs. They are not updated with the latest technologies in this field. Also, they feel there is a lack of teachers training programme to deal with special students. Some teachers from different schools feel that some practical demand tactile kits for a better understanding, which is not available in most of the schools. They cannot let the visually impaired students perform chemistry experiments without a kit because the experiments consist of harmful chemicals and flammable liquids.

Major Findings and Conclusions

It was evident from the research that very less number of students opted for science at higher secondary stage due to lack of resources and poor infrastructural facilities in schools.

On the other hand, the special students studying in private international schools were given all the facilities and resources they would require to perform the experiment. They were being treated as any other children in those schools and were not finding any difficulty in performing the practical on their own. This scenario couldn't be achieved in a government school due to the lack of facility and poor infrastructural facilities they were provided.

The study reveals that most of the visually impaired students couldn't perform practical on regular basis. They were allowed only limited practical which were fit for them. On the other hand, locomotive students were able to perform better and they were the parts of group also during practical. They face less difficulty in performing practical. However some visually impaired students were more interested in listening to online audio video lessons rather than using tactile books or Braille laboratory manual.

It was found that schools had not done any specific modifications to accommodate visually impaired students. Most of them preferred to study on laptop rather than Braille books. Also, the number of locomotive impaired students who opted for science in Government aided schools was less as there were no specific facilities for them like, ramp, wheel chair, Lower slab height etc.

In government schools there were no CWSN students found having a poor socio- economic background. This reflects the poor awareness of schemes and implementation, lack of motivation etc. on the other hand CWSN students studying in private schools got all sorts of opportunities like participating in science exhibitions, getting to attend science conferences.

Lack of resources, poor motivation by parents, lack of awareness, scarcity of expert teachers and poor infrastructural facilities are some of the reasons narrowed by the students which resulted in students refraining from opting science in higher secondary classes anymore.

The study reveals that the more visually impaired students were opting science as compared to the children suffering from locomotor disability, cerebral palsy, autism, etc. The teachers and students opined that it is due to physical problems in doing laboratories works like standing for a long time, poor accessibility, gripping of laboratories equipments, hence they like to opt arts and commerce. Also the teachers were not trained enough to deal with special children and cater to their needs.

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