



## A Case Study of Use of Micro-Scale Chemistry Kit in Heeralal Public School, Delhi

### KEYWORDS

Micro-Scale Chemistry Kit, Teacher friendly and laboratory skills

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### ABSTRACT

National Council of Educational Research and Training (NCERT) developed Micro-scale Chemistry Laboratory Kit at higher secondary level to enable the students to carry out chemistry experiments in an environmentally safe, pollution free atmosphere using small quantities of chemicals without compromising the quality and standard of experiments. A case study was conducted with the objectives to study the use of the Microscale Chemistry Kit in Heeralal Public School, Delhi, to study the efficacy of the Micro scale Chemistry Kit on achievement in chemistry among the higher secondary school students, and to study the perception of the higher secondary school teachers and students on the use of the Microscale Chemistry Kit. The study shows that the teachers can demonstrate all kinds of chemistry experiments at higher secondary level with the use of the kit. Teachers and students agree that the kit is teachers', students, Environment and administrator friendly. The scores of higher secondary school students in the achievement test in chemistry also prove that the students taught using Micro-scale Chemistry Laboratory Kit scored significantly higher marks than the students taught without Micro-scale Chemistry Laboratory Kit.

### Introduction

Science laboratories play pivotal role in developing various skills, concepts, cognitive abilities, understanding the nature of science and inculcating scientific attitudes among students. Learning of chemistry at all levels of school education depends on laboratory experiments that help students for the better understanding of the concepts and principles explained by the teachers in the classroom. On the other hand, the students get ample opportunities to apply the theoretical knowledge in the laboratory. It promotes collaborative relationship with classmates and improves problem- solving skills among students (Thakur, 2014). Omiko (2015) also reveals that the performing experiments in laboratory develops scientific attitude, scientific skills and problem- solving ability among students.

Science experiment kits help students to learn facts and concepts in science and also develop scientific curiosity and observation skills among students. Jones et al (2012) concludes that the science kits provide learning materials and inquiry lessons in a ready-to-teach format for teachers to use in teaching learning process. They also concluded that the students get opportunity to design and implement laboratory investigations by using the kits. Houston et al (2008) established that using science kits create more positive learning environment and ensure higher student satisfaction in classrooms. Moreover, Dickerson et al (2006) added that the use of science kits in constructing content understandings reveals that science kits enhance students' content understandings.

The Micro-scale chemistry laboratory kit developed by NCERT replaces traditional chemistry laboratory (NCERT, 2014) and enables the students to perform experiments in a safe atmosphere by using small quantities of chemicals without compromising the quality of experiments. All the experiments in chemistry at higher secondary level like inorganic chemistry practical, physical chemistry practical and organic chemistry practical can be performed using this kit.

NCF-2005 emphasises the importance of a science laboratory in the schools in developing scientific temperament among the students. Keeping in view the kit was developed by the Council to enable students to perform all chemistry experiments in school laboratories by reducing cost, wastage and minimize health hazards.

NCERT produces and supplies science kits on mass scale through empanelment of manufacturers/suppliers to various demanding States/UTs/Schools. Hence, it felt that it is necessary to conduct a study on the use of the kits in schools to analyse whether the schools are using the kits to develop various scientific skills among students or not.

### Objectives of the Study

A case study was conducted with the objectives: to study the use of Microscale Chemistry Kit developed by NCERT in Heeralal Public School, Delhi; to study the efficacy of the Micro scale Chemistry Kit on achievement in chemistry among the higher secondary school students; and to study the perception of the higher secondary school teachers as well as students on the use of the Microscale Chemistry Kit.

The research questions set for the study were: to what extent the Micro scale Chemistry Kit developed by NCERT is used by the teachers of Heeralal Public School, Delhi in the teaching learning process? How far the Micro scale Chemistry Kit is effective in improving the content knowledge in chemistry among the higher secondary school students? What is the perception of the higher secondary school teachers and students on the uses of the Micro scale Chemistry Kit?

### Tools

**The following tools were used for the study.**

- A questionnaire to study the use of Microscale Chemistry Kit developed by NCERT in Heeralal Public School, Delhi..
- An achievement test in chemistry to study the efficacy of the Micro scale Chemistry Kit on achievement in chemistry among the higher secondary school students
- A perception scale for teachers to collect their perception regarding the use of Microscale chemistry kit

### Uses of the Microscale Chemistry Kit

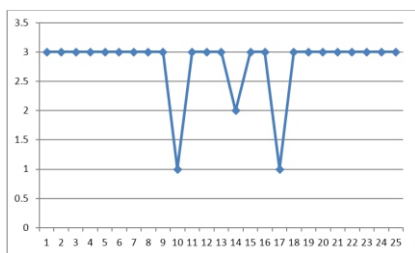
The Council developed the kit to develop better understanding of scientific concepts and principles among the higher secondary school students, developing skills and competencies like procedural and manipulative skills, observational skills, drawing skills, reporting, and interpretation skills among students and also ensure their curiosity in learning chemistry. In addition, the use of the kit reduces the facilities needed for chemistry experiments, ensures optimisation of use of resources, adaptation of cost-effective, safe and efficient techniques in the higher secondary schools.

There are 240 students studying chemistry in class XI and XII in the school. The school has a spacious laboratory with sufficient tables for conducting science experiments. One laboratory assistant is appointed to look after the laboratory activities. Funds for the maintenance of the laboratory and purchase of chemicals are arranged by the school from students' fee and also from the funds provided by the School Trust.

The teacher teaching chemistry at higher secondary classes in the school opined that they use the kit for demonstration of activities in the classroom, do experiments in laboratory and also designing new experiments. Most of the time they conduct chemistry experiments in groups. The kit items like w tubes, microfunnel, capillary tube, stirrer, micro test tubes, micro beaker, micro conical flask, chemical viols, droppers and micro spatula are frequently use by teachers. She also mentioned that almost all kit items are useful and adequate for conducting chemistry experiments in the classroom.

She says that "According to me the kit is perfect and ready to use anywhere whether there is a facility of supporting lab or not". Regarding the advantages of the kit she says "The kit limits storage space, easily transportable as all chemicals and apparatus can be carrying easily. In short Microscale Kit is a lab in itself". **The teacher also** opined that the students can do experiments by using small quantities of chemicals without compromising the quality and standard of experiments using the kit. The teacher added that the kit is environment friendly because it reduces use of chemicals, offers safety in the laboratory and reduces exposure to toxic chemicals and accidents.

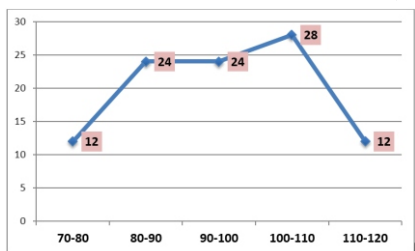
**Perception of the Teachers on Use of Microscale Chemistry Kit**



**Figure 1. Teacher's Perception-Statement-wise analysis**

The perception of the teacher is shown in the figure above. It shows that in most of the cases teacher strongly agrees to the advantages of the kit.

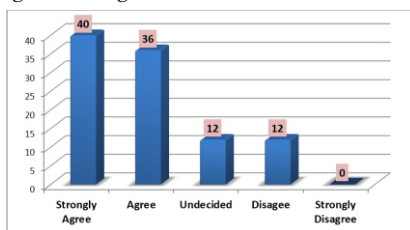
**Perceptions of Students on Use Microscale Chemistry Kit**



**Figure 2. Overall Perception of Students**

The figure given above shows that 28% of the total students scored between 100 and 110, 24% of students each came in the slabs 80-90 and 90-100. Hence, it is concluded that they have positive perception on the use of Microscale Chemistry Kit developed by NCERT.

**Minimising the Wastage of Chemicals**



**Figure 3. Perception regarding the Statement: 'Use of the kit minimizes the wastage of chemicals'**

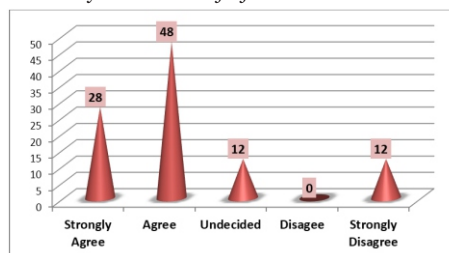
It is clear from the figure that the use of kit is very helpful to students

in minimizing the wastage of chemicals (76% of the students opined so). Only 12% students reported undecided to this statement while another 12% of them disagree to the same.

**Students and Teacher Friendly**

Solid chemicals in few milligrams quantities and liquid reagents in few drops are used in performing the experiments. The chemicals used are in very small quantity so that it reduces fumes and the risks of accidents, acid burns, etc. The students can perform the experiments quickly. So it enable them to save time and perform more experiments in a particular period. It helps teachers to maintain discipline in the class since students need not wander in the Laboratory in search of reagents

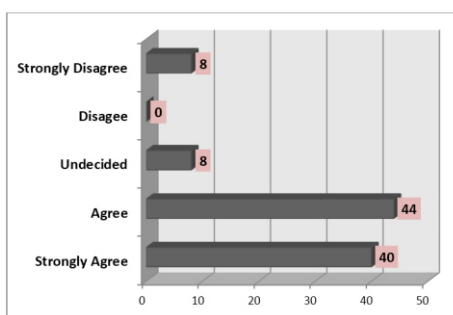
Regarding the friendly nature of the kit the chemistry teacher says "It is very easy to demonstrate experiments with the help of the micro apparatus". She says "The kit is useful for both teachers and students"



**Figure 4. Perception regarding the Statement: 'The kit is handy and portable'**

Most of the students are happy and comfortable with the size and portability of the kit and they report that it is handy and user friendly (76% of total students report so). At the same time, 12% of them disagree to the statement.

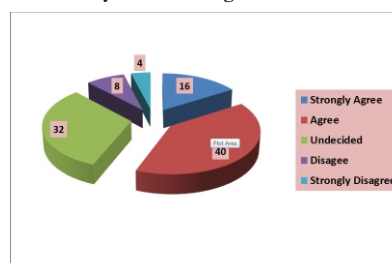
**Useful to Cover All the Experiments in the Syllabus**



**Figure 5. Perception regarding the statement: 'All the experiments prescribed in the syllabus can be done with the Kit'**

A good majority (84%) perceive that the kit is very useful to cover all the experiments prescribed in the syllabus while 8% of them opined that it is not sufficient to all the given experiments.

**Enhances Laboratory Skills among Students**



**Figure 6. Perception regarding the statement: 'I get ample opportunity to enhance my Laboratory Skills using the Kit'**

To the statement, use of kit provides ample opportunity to practice and enhance laboratory skills, 16% of them strongly agree and 40% of them agree. 32% of the total students marked undecided to this statement.

#### Administrator Friendly

The kit is administrator friendly because it reduces laboratory cost, lowers glass breakage cost and also saves storage space. The teacher opined that the kit is administrator friendly because it reduces expenditure on spacious laboratory with lots of apparatus. Higher secondary school teacher added that it is a lab in itself and easy to maintain it.

#### Efficacy of the Microscale Chemistry Kit on Achievement in Chemistry

Comparison of the Achievement test scores of Experimental and Control groups

Groups	No	Mean	Standard Deviation	t-value	P >
Experimental group	33	14.09	6.009	3.34	0.01
Control group	34	10.52	4.21		

The Mean and Standard deviation of the Achievement test scores of students in Experimental group are 14.09 & 6.009 and that of students in Control group are 10.52 & 4.21. The table value for significance (df 35) at 0.01 and 0.05 level are 2.72 and 2.03 respectively. The obtained t value, 3.34 is higher than the table value for significance at 0.01 level. From the above table it is clear that the difference is significant at 0.01 level. So it can be interpreted that the mean score of students in the Experimental group taught using Micro-scale Chemistry Laboratory Kit is significantly higher than the mean score of students in the Control group taught without Micro-scale Chemistry Laboratory Kit.

#### Conclusions

It is evident from the study that the school effectively utilises the Microscale Chemistry Kit for teaching chemistry at higher secondary level. The teachers and students agree to the fact that the kit helps in enhancing scientific concepts and principles among the higher secondary school students and also develops skills and competencies like procedural and manipulative skills among the students.

The teachers and students opined that the kit is a solution for the drawbacks of the traditional chemistry laboratory. It can be concluded that the kit is teachers students, administrator friendly, environmentally safe, hazardous free, handy, portable and low cost. Regarding the perception of teachers and students on the use of the kit, the study concludes that both of them have better understanding on the use of the kit. Most of the students opined that the use of the kit is very helpful to students in minimizing the wastage of chemicals and also provides ample opportunity to enhance their laboratory skills. A good majority of the students agree that all the experiments prescribed in the syllabus can be done with the Kit. Achievement result also proves that there is significant difference in the mean scores of higher secondary school students taught with and without Micro-scale Chemistry Laboratory Kit. The scores of students in the Experimental group taught using Micro-scale Chemistry Laboratory Kit is significantly higher than the mean score of students in the Control group.

#### References

1. Omiko, Akan (2015). Laboratory teaching: Implication on students' achievement in chemistry in secondary schools in Ebonyi State of Nigeria. (ERIC Reproduction Service, EJ1081346).