

TO STUDY THE EFFECT OF 'LIVE' MIRACULOUS DEMONSTRATIONS ON INCREASING INTEREST IN CHEMICAL SCIENCES

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Chemistry educators are familiar with traditional demonstrations, with which concepts in chemistry are made simpler. By doing 'live' miraculous demonstrations, concepts like exothermic reactions generally leading to combustion and the principle underlying of titrations involving colour change are made easy and understandable. The 'live' miraculous demonstrations are used to develop interest in students' about chemical sciences, explanation of so called miracle and to develop scientific temper. The 'live' miraculous demonstrations can be done safely with prior training and knowledge. Many students do not favour chemistry because of lack of interest in the subject. So there is a need to develop interest in it. A large number of people believed in various types of so called miracles because of lack of scientific knowledge, attitude and scientific temper. Many godmen, quacks and conmen with similar motive of exploiting and harming mentally, physically and financially the superstitious people in society perform so called miracles. Therefore, there is a need of explaining the scientific knowledge of so called miracles, through students. In the present study 'live' demonstrations of so called miracles and booklet prepared about it, is used at undergraduate level as an educational tool. The sample of the study was students studying in SYBSc class in the University of Pune jurisdiction area. The feedback of students through pre- and post-questionnaires was analysed and showed that (i) miraculous demonstrations are favoured by students as an attempt to increase interest in chemistry, (ii) students have an urge to know the chemical science behind the so called miracle, (iii) miraculous demonstrations are exciting and surprising, and (iv) miraculous demonstrations should be incorporated in chemistry curriculum.

Key words: *Demonstrations, miraculous, chemistry, education*

Introduction

Laboratory experiments are used in teaching and learning of science since many centuries. From 1980, the constructivist approach is used in teaching and learning. The role of hands-on experiments in learning science have been realised by many teachers, including those of chemistry. The demonstrations are preferred to laboratory experiments in teaching and learning of science, because they are performed in the safest way. The lecture demonstrations introduce fun; students like them because they are attention seeking, and they provide breaks from lectures too. The students of chemistry do report that demonstrations

helped them to understand the theories behind the chemistry. At the school level, laboratory demonstrations in the teaching of chemistry can provide colourful, surprising and dramatic effects, such as, placing a small tablet of sodium metal piece in a transparent container containing two to three drops of phenolphthalein in water, to motivate students. For demonstrations to be effective, the role of the demonstrator is as a mediator of student learning and an interpreter of the content of science. The demonstrations are made more student-centred by demonstrator using Predict-Observe-Explain (POE) activities. In this activity, students are given a chance to predict what would happen next in a demonstration.

Methods and Procedure

The miraculous demonstrations which are performed using chemicals and chemical or physical properties of commonly used materials are only studied in the present study. A sample of 174 students of S.Y. B.Sc. class from various colleges affiliated to Pune University from Nashik, Ahmednagar and Pune districts was selected for the present study. A booklet of 10 miraculous demonstrations was prepared according to guidelines of self instructional material. The way of writing it and the prototype of it were like: Title of miraculous demonstration, Concepts of chemistry associated, Material, Procedure, Observation/Effect, Theoretical principle, Reaction, Safety precaution, and References. The pre- and post-questionnaire was tested for reliability and validity. The pre-test was conducted and then actual miraculous demonstrations were performed in front of students. The feedback was taken and then booklet of miraculous demonstrations was distributed to them and explained in required depth. Then post-test was conducted.

Result and Discussion

The feedback of students through pre- and post-test questionnaire is analysed mainly for four points. The results (Box 1) for the point that 'Miraculous demonstrations increase interest in chemistry' show (Table 1) 54.02 per cent students are of the same opinion. The increase of 5.11 per cent in 'total agree' responses (Table 2) from 86.77 per cent (pre-test) to 91.94 per cent (post-test) directly

indicates that miraculous demonstrations increase interest in chemistry. When asked directly that whether by using miraculous demonstrations student's interest in chemistry is increased, 94.82 per cent students replied 'yes' (Table 3) indicating that miraculous demonstrations increase interest in chemistry. When further asked (Table 4) why interest will be increased by using miraculous demonstrations, then 20.6 per cent replied 'Understand the concept behind it', 24.84 per cent replied 'Curiosity is satisfied', 21.21 per cent replied 'seen knowledge last forever', 12.72 per cent replied 'It involves chemical science', 13.93 per cent replied 'Make to think' and 5.45 per cent replied 'Live and entertaining'. When asked about the use of the booklet of miraculous demonstrations to increase interest in chemistry, 97.12 per cent replied (Table 5) it is useful and when further asked (Table 6) 'How is it useful?' then 27.21 per cent replied 'Understanding the concept', 21.3 per cent replied 'Contain miraculous demonstrations and chemistry behind it', 40.82 per cent replied 'Gives clear-cut idea and knowledge about chemistry of compounds and commonly used materials' and 10.65 per cent replied 'Try to do more reactions'.

Box 1: The replies for the point that miraculous demonstrations are favoured by students as an attempt to increase interest in chemistry' in different ways.

Abbreviations: SA- Strongly agree, A- Agree, NI- No idea, DA- Disagree, SDA- Strongly disagree, NR- No reply, MD- Miraculous demonstrations.

Table 1

Item	Reply	%
In my opinion interest in chemistry can be increased by using	Computers	22.98
	Demonstrations	54.02
	Home assignments	12.64
	Any other way	9.77
	No reply	0.57

Table 2

Item		SA%	A%	NI%	DA%	SDA%	NR%
MD increases interest of students in chemistry	Pre	45.4	41.37	8.62	1.72	1.72	1.14
	Post	47.12	44.82	5.17	2.29	0	0.57

Table 3

Item	Yes %	No %	NR %
Can using MD increase student's interest in chemistry?	94.82	5.17	0

Table 4

Item	Reply	%
Can using MD increase students' interest in chemistry? If Yes, Why?	Understand the concept behind it	20.6
	Curiosity is satisfied	24.84
	Seen knowledge last forever	21.21
	It involves chemical science	12.72
	Make to think	13.93
	Live and entertaining	5.45

Table 5

Item	Yes %	No %	NR %
Can using booklet of MD increase student's interest in chemistry?	97.12	2.87	0

Table 6

Item	Reply	%
Can using MD increase student's interest in chemistry? If Yes, how the booklet will help to increase interest in chemistry?	Understanding the concept	27.21
	Contain miraculous demonstrations and chemistry behind it	21.3
	Gives clear-cut idea and knowledge about compounds	40.82
	Try to do more reactions	10.65

The results (Box 2) for the point 'the students have an eagerness to know chemical science behind miraculous demonstration' show that (Table 7) 78.73 per cent of them do not know the reason behind the most liked miraculous demonstration, and only 21.26 per cent replied that they know the reason. But when asked to mention the reason (Table 8) 78.37 per cent answered incorrectly, and only 21.62 per cent could give correct answer. When further

asked (Table 9) whether they wish to know the reason behind the miraculous demonstration 82.18 per cent of them replied 'yes', clearly indicates the eagerness of students to know the science behind the miraculous demonstration.

Box 2: The replies for the point that 'The students have an eagerness to know chemical science behind miraculous demonstration' (Abbreviation: NR- No reply)

Table 7

Item	Yes %	No %	NR %
Do you know the reason or science behind above mentioned miracle?	21.26	78.73	0

Table 8

Item	Reply	%
Do you know the science behind the above mentioned miracle? If Yes, give details of it	Correct	21.62
	Incorrect	78.37

Table 9

Item	Yes %
If No, would you like to know the reason behind it?	82.18

The results (Box 3) for the point that 'miraculous demonstrations are exciting and surprising' show increase (Table 10) of 6.90 per cent in 'total agree' responses from 86.19 per cent (pre test) to 93.09 per cent (post-test) directly indicates that miraculous demonstrations are exciting and

surprising. When asked (Table 11), why they like miraculous demonstration, 65.51 per cent replied that it is exciting and surprising.

Box 3: The replies for the point that 'Miraculous demonstrations are exciting and surprising.'

Table 10

Item		SA %	A %	NI %	DA %	SDA %	NR %
MD are exciting and surprising	Pre	40.22	45.97	8.04	4.02	1.72	0
	Post	47.12	45.97	1.14	4.59	1.14	0

Abbreviations: SA- Strongly agree, A- Agree, NI- No idea, DA- Disagree, SDA- Strongly disagree, NR- No reply, MD- Miraculous demonstrations

Table 11

Item	Reply	%
Why do you like the most liked miraculous demonstration?	Interesting	22.41
	Surprising	65.51

The results (Box 4) for various items (Table 12) to support the point that 'miraculous demonstrations should be incorporated in chemistry curriculum' show increase of 7.21 per cent in 'total agree' responses from 89.64 per cent (pre test) to 96.85 per cent (post-test) for the item 'Miraculous demonstrations motivate to learn chemistry' directly supports that miraculous demonstrations should be incorporated in chemistry curriculum. The increase of 4.41 per cent in 'total agree' responses from 89.70 per cent (pre test) to 94.11 per cent (post-test) for the item 'Miraculous demonstrations keep my interest during lecture/session' directly supports that miraculous demonstrations should be incorporated in chemistry curriculum. The increase of 2.83 per cent in 'total agree'

responses from 88.49 per cent (pre test) to 91.32 per cent (post-test) for the item 'Miraculous demonstrations are effective in initiating scientific enquiry' directly supports that miraculous demonstrations should be incorporated in chemistry curriculum. The increase of 4.59 per cent in 'total agree' responses from 75.28 per cent (pre test) to 79.87 per cent (post-test) for the item 'Miraculous demonstrations should be incorporated in chemistry curriculum' directly indicates that miraculous demonstrations should be incorporated in chemistry curriculum.

Box 4: The responses in pre and post-test for various items to favour the miraculous demonstrations should be incorporated in chemistry curriculum.

Table 12

Item	SA %		A %		NI %		DA %		SDA %		NR %	
	PR	PO	PR	PO	PR	PO	PR	PO	PR	PO	PR	PO

MDs motivate to learn chemistry	40.22	53.75	49.42	43.1	6.89	0.57	2.29	2.29	1.14	0.57	0	0
MDs keep my interest during lecture/ session	52.87	52.02	37.93	42.19	4.02	1.72	3.44	3.44	1.72	0	0	1.14
MDs are effective in initiating scientific enquiry	43.67	50.28	44.82	41.04	7.47	3.44	2.29	3.44	1.14	1.14	0.57	1.14
MDs should be incorporated in chemistry curriculum	32.18	37.35	43.1	42.52	16.66	9.77	4.02	6.32	1.72	3.44	2.29	0.57

Abbreviations: SA- Strongly Agree, SDA- Strongly disagree, NI- No Idea, DA- Disagree, SDA- Strongly disagree, NR- No reply, PR- Pre test, PO- Post-test and MD- Miraculous demonstrations

Conclusion

From the above results and discussion it is concluded that (i) miraculous demonstrations are favoured by students as an attempt to increase interest in chemistry, (ii) students

have an eagerness to know the chemical science behind the so called miracle, (iii) miraculous demonstrations are exciting and surprising, and (iv) miraculous demonstrations should be incorporated in the chemistry curriculum.

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