Article 3

Effective Transaction of Social and Moral Values among Students through Chemistry Curriculum at Higher Secondary Stage

Anjni Koul and Alka Mehrotra

Abstract

Education is the tool to inculcate social values among students. Ethical development provides skills required for living in harmony with oneself and with others. The moral values give direction, determination, contentment, peace and bring joy to life. So, it becomes necessary that these should be inculcated among children from the very beginning. These can be easily inculcated through teaching- learning process of school subjects. In this study, Researchers have tried to find out how far the chemistry curriculum at higher secondary stage may help in imparting values among students. It has been revealed that the present chemistry syllabus has good potential of inculcating the social and moral values among students. The students and teachers have quoted values that can be inculcated during teaching-learning process through various topics of chemistry at higher secondary stage.

Key Words: Chemistry Curriculum, Social Values, Moral Values, Higher Secondary Stage, Teaching-Learning Process

Introduction

"If we are to teach real peace in the world we shall have to begin with children".

---Mahatma Gandhi

Children begin to learn social and moral values from their families, peers, media, community, and various other sources of interaction. The researches reveal that children probably develop moral sense within the first two years of life (Kagan & Lamb, 1887). Therefore, children arrive at schools with their own values. But it has been observed that moral values are diminishing and intolerance is growing among children. The focus on spreading of education has not made much difference in this regard. Usually, our school systems focus on rote memorization and give very less space to students to learn in a collaborative, reflective manner, which can help students to acquire certain social skills. Limited opportunities are usually given to students to think independently or creatively. It has been found that when values are inculcated during the teaching-learning of subject, the students relate values with their daily life and transaction of the lesson becomes easier (Tan, et al., 2010). The studies have shown that value education programmes have significant effect on development of values among students (Thapliyal, et al., 2015). In classrooms, chemistry is usually taught within the cognitive level of students, whereas psychomotor learning is achieved while performing laboratory experiments, project works etc. However, affective domain learning is often considered the least when it comes to chemistry teaching.

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The National Council of Educational Research and Training (NCERT) is an apex body constituted by the Government of India for school education. It develops National Curriculum Framework to provide guidelines for development of curricular materials. The National Curriculum Framework-2005 (NCF-2005) emphasizes that value education must be a concern that penetrates the school life through curriculum, extra-curricular activities, classroom environment, school management, teacher-pupil relationship, teaching-learning processes, and entire range of school activities. Teachers should make deliberate attempt to infuse the related values appropriate with the textual material in classroom (NCERT, 2005). It emphasizes that education for peace as one of the national and global concerns. The Position Paper National Focus Group on Education for Peace (NCERT 2006a) highlights that education for peace nurtures ethical development; inculcates the values, attitudes and skills required for living in harmony with oneself and with others, including nature.

In school curriculum, chemistry is taught as one of the core essentials. Chemistry plays a vital role in daily life. There are many hidden values in chemistry curriculum which may help the present generation in protecting environment, leading a happy, disease free, healthy and peaceful life. These values can be passed on safely to the students during teaching-learning of chemistry. Since the existing curriculum of chemistry (NCERT, 2006b & 2007) is in use for more than a decade in the school system, a research study was taken up by the Department of Education in Science and Mathematics on the content being transacted during teaching-learning process with the following objectives:

- Content load
- Difficulty level
- Learning gaps
- Interdisciplinary connectivity
- Laboratory work
- Inclusion of values

In this research paper the focus is on inclusion of values only through chemistry curriculum and to know that how far these values are being transacted and inculcated among students of higher secondary stage.

The Researchers focused on the following research questions:

Research Questions

- Which topics of chemistry curriculum inculcate values among students?
- What strategies are being adopted by the teachers to inculcate values among students?

Research Design

Methodology

The Researchers tried to find out how pedagogy in textbooks has enabled students to relate values in life with the concepts of chemistry transacted at higher secondary stage. For this, tools were developed, validated, and modified. The modified tools were administered in 40 schools across the country comprising a sample of 46 teachers and 909 students. Out of 909 students, 265 students were of Class XI and 644 students were of Class XII. Purposive sampling technique was used in the selection of the sample.

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Analysis of Data

The responses of teachers and students collected from various schools were tabulated and analyzed. Summary of number of responses of Classes XI and XII students about Class XI syllabus have been shown in Tables-1a and 1b respectively.

The values quoted by students of Classes XI and XII about Class XI syllabus are given in Table- 1c. To maintain the originality of the study, the actual responses of the students have been given as such, without any modifications.

Table 1a Responses of Class XI Students about Class XI Syllabus

Summary of number of responses of class XI students about class XI syllabus	
Total number of students = 265	Number of students who did not mention about values 61 (34.66 %) out of 176 answers
Number of students who did not answer this question =89 (33.58 % out of 265)	Number. of students who mentioned about values 176-61=115 (65.34%) out of 176
Number of students who answered this question (265-89= 176)(66.41% out of 265)	Out of 115 students 77 students (66.96%) quoted the value

Table 1b Responses of Class XII Students about Class XI Syllabus

Summary of number of responses of class XII students about syllabus of class XI	
Total number of class XII students who answered for class XI syllabus = 584	Number of students who responded that values were not mentioned =45 (19.15%) out of 235 answers
Number of students who did not answer this question=349 (59.76%) out of 584students	Number of students who answered that values were mentioned = 235-45 = 190 (80.85 %) out of 235 answers
Number of students who answered this question =235 (40.24%)	Out of 180 answers values were quoted in 70 answers (38.89%)

Table 1c Summary of Values Quoted by Students of Classes XI and XII about Class XI Syllabus

Name of the unit	**Values quoted**
Some Basic Concepts in Chemistry	Discipline
Structure of Atom	Logical approach , Organization, Discipline, Good behavior, Try again and again until you succeed, Keep up with family (Family values)
Classification of Elements and Periodicity in Properties	No response

(*Continued*)

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Table 1c	Summary of Values Quoted by Students of Classes XI and XII about Class XI Syllabus (Continued)
Chemical Bonding and Molecular Structure	Sharing, Cooperation, Bonding and relationship with people, Keep up with family, Save nature and its beauty, Donating money from rich to poor, Practice makes a man perfect.
States of Matter	No response
Thermodynamics	Cooperation, Patience, Honesty.
Equilibrium	Nature of equilibrium, Patience, Truthfulness, Family values, Being balanced in life.
Redox Reaction	Save electricity, Good behavior.
Hydrogen	Importance of water for existence.
s-Block Elements	Being regular, Honesty.
p – Block Elements	Being regular, Recording the facts.
Basic Organic Chemistry	Relationship of electronegativity with life situation, Similar people make friendship (Like dissolves like), Patience.
Hydrocarbons	No response
Environmental Chemistry	Save nature and its beauty, Care for environment, Protect environment, Logical approach, Control pollution, Importance of water in daily life.

Similarly, summary of number of responses and values quoted by teachers, teaching class XI is shown in Table 2a and 2b respectively.

Table 2a	Responses Given by Teachers (Teaching Class XI)
Total number of teachers =46	Number of teachers responded that no topic of class XI can transact values = 10 (23.81%)
Number of teachers who did not answer = 04 (8.70%)	Number of teachers who reported about value transaction =32(76.19%)
Number of teachers who answered = 42 (91.30%)	Number of teachers who quoted values =31(96.88%)

Table 2b	Summary of Values Quoted by Teachers (Teaching Class XI)
Name of the unit	**Values quoted**
Some Basic Concepts in Chemistry	No response
Structure of Atom	Coherence with nature, Respect for nature Honesty, Punctuality

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Name of the unit	Values quoted
Classification of Elements and Periodicity in Properties	No response
Chemical Bonding and Molecular Structure	Sharing , Cooperation, Logical reasoning, Stability, Team spirit, Unity, Interaction with family, Unity, Bonding and relationship with people, Objective reasoning, Hard work pays
States of Matter	Hard work
Thermodynamics	No response
Equilibrium	Coherence with nature, Logical reasoning, Scientific attitude
Redox Reaction	No response
Hydrogen	Team spirit, Self- study, Express yourself
s-Block Elements	Cooperation, Team spirit, Self- study, Express yourself
p–Block Elements	Cooperation, Logical reasoning, Team spirit, Self- study, Express yourself , Make plan before proceeding for work
Basic Organic Chemistry	No response
Hydrocarbons	No response
Environmental Chemistry	Scientific attitude, Care for environment, Conserve energy, Self- respect, Cleanliness, Sanitation, Sensitivity towards environment, Sensitivity towards ecological balance, Social values, Ethical values, Aesthetic values, Control pollution.

Similarly, summary of number of responses and responses quoted by Classes XII students about Class XII syllabus have been shown in Tables 3a and 3b respectively.

Table 3a Responses of Class XII Students about Class XII Syllabus

Summary of number of responses of class XII students about class XII syllabus	
Total number of students = 644	Number of students who did not mention about values = 49 (15.12 %) of the 324 answers
Number of students who did not answer the question = 320 (49.69 %) out of 644 students	Number of students who mentioned about values =324-49 = 275 (84.88 %) out of 324 answers
Number of students who answered the question= (644-320=324) (50.31%) of 644 students)	Out of 275 students, 61 students (22.18%) quoted the values

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Table 3b Summary of Values Quoted by Class XII Students about Syllabus of Class XII

Name of the unit	Values quoted
The Solid State	No response
Solutions	Practice makes the man perfect
Electrochemistry	Control pollution, Read thoroughly to understand the topic
Chemical Kinetics	Hard work, Help of elders
Surface Chemistry	Be environment friendly
General Principles and Processes of Isolation of Elements	Environmental issues
The *p*-Block Elements	No response
The *d*- and *f*- Block Elements	No response
Coordination Compounds	No response
Haloalkanes and Haloarenes	No response
Alcohols, Phenols and Ethers	Methanol is hazardous
Aldehydes, Ketones and Carboxylic Acids	No response
Amines	No response
Biomolecules	No response
Polymers	Unity
Chemistry in Everyday Life	Social Values, Harmful drugs should be avoided, Use drugs as medicines, Avoid overuse of drugs, Helpfulness, Taking care of own health, Environmental issues

Tables 4a and 4b show number of responses and values quoted by teachers teaching class XII respectively.

Table 4a Responses of Teachers (Teaching Class XII Students)

Total number of teachers =46	Number of teachers responded that no value transaction is possible through class XII syllabus = 09 (22.50%)
Number of teachers did not answer this question=06 (13.04%)	Number of teachers who reported about value transaction =31(77.50%)
Number of teachers answered this question = 40(86.96%)	Number of teachers who quoted values= 30(96.77%)

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Table 4b Summary of Values Quoted by Teachers (Teaching Class XII)

Name of the unit	Values quoted
The Solid State	Strength of unity (Closer the particles packed in the crystal, Higher the melting point, Difficult to separate particles),
Solutions	Logical applications, Effective communication, Team spirit
Electrochemistry	Environmental issues (pollution), Green world
Chemical Kinetics	Hard work, Help elders
Surface Chemistry	Helping nature
General Principles and Processes of Isolation of Elements	No response
The p-Block Elements	Creative and critical thinking, Plan before proceeding for work, Objective reasoning
The *d*- and *f*- Block Elements	Creative and critical thinking, Objective reasoning
Coordination Compounds	Mutual understanding , Cooperation
Haloalkanes and Haloarenes	No response
Alcohols, Phenols and Ethers	No response
Aldehydes, Ketones and Carboxylic Acids	No response
Amines	No response
Biomolecules	Togetherness (Unity), Respect for plants and animals, To have nutritious diet (Food habits), Self respect
Polymers	Being ecofriendly, Togetherness, Self- respect, Sensitivity about environment, Cooperation, Respect nature, Friendship
Chemistry in Everyday Life	Antifertility drugs (Control population), Social life(Social Values), Togetherness, Self- respect, Non addiction to drugs, Environmental issues, Food habits, Awareness about self and other health issues (Take care of own health).

Classroom Observations

Researchers also observed various classroom processes. It was revealed that teachers were trying to inculcate a number of values while transacting the concepts of chemistry. Some are highlighted below:

- While discussing chapter on Chemical Bonding, discussion on cooperation was held.
- In the chapter Coordination Chemistry, the importance of various donations was highlighted.
- While talking about Surfactants, water pollution was discussed.

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- During p-Block Elements, unity in diversity was talked about.
- In the chapter of Environment Chemistry, discussion on various kinds of pollutants, use of eco-friendly biodegradable materials, how to control pollution etc., was held.
- In the chapter Chemistry in Everyday Life, discussion on Sexually Transmitted Diseases (STDs), AIDS, mood swing, harmful effects of smoking and drugs was held.
- During practical/ experimental work there was discussion about various values such as, honest recording and reporting, accurate measurements, utilisation of time effectively, judicious use of chemicals etc.

Similar information could be revealed from the responses filled in the tools by teachers.

Discussion and Interpretation

As far as transaction of values through Class XI chemistry syllabus is concerned, out of 265 students of Class XI, 89 students (33.58%), did not answer the questions and 61 student(34.66%) were of the opinion that there was no mention of value.

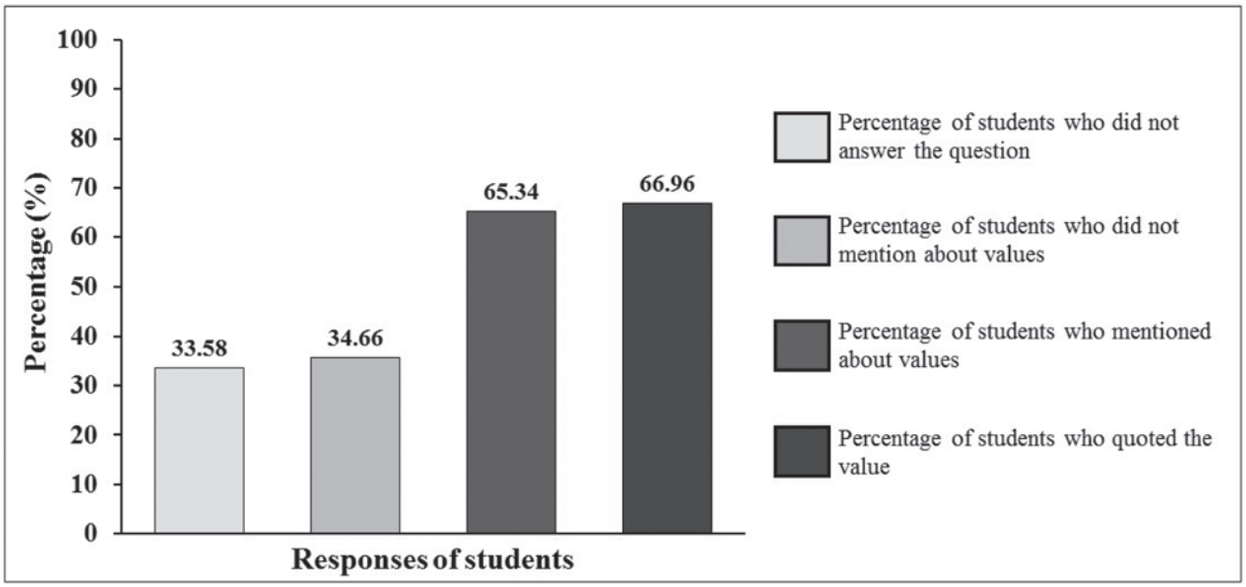


Figure 1

This means **approximately one third of the students either did not answer the questions or were of the opinion that there was no mention about values during teaching-learning process.** Only 115 students (approximately 65.34%) answered that discussion about some values was held during teaching- learning of the Units of Class XI. **Out of 115 students, 77 students (66.96%) quoted the values. However, 10 students mentioned that values were transacted through all the units of Class XI chemistry** (Figure 1).

Similarly, Class XII students in relation to transaction of values through Class XI chemistry syllabus also show similar results. Out of 584 students of Class XII, 349 students (59.76%) did not answer the question, 45 students (19.15%) out of 235 answered that values were not mentioned and 70 students (38.89%) out of 180 quoted the values (Figure 2).

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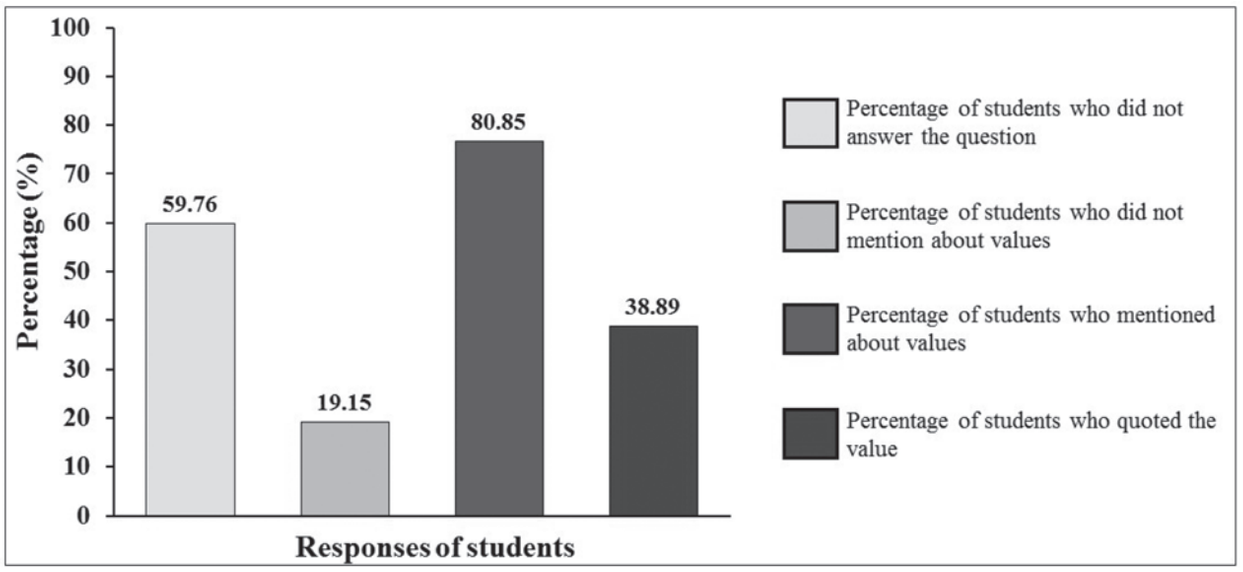


Figure 2

It is important to note that **10 teachers (23.81%) out of 42 teachers, who responded that no value can be transacted through Class XI syllabus** (Figure 3).

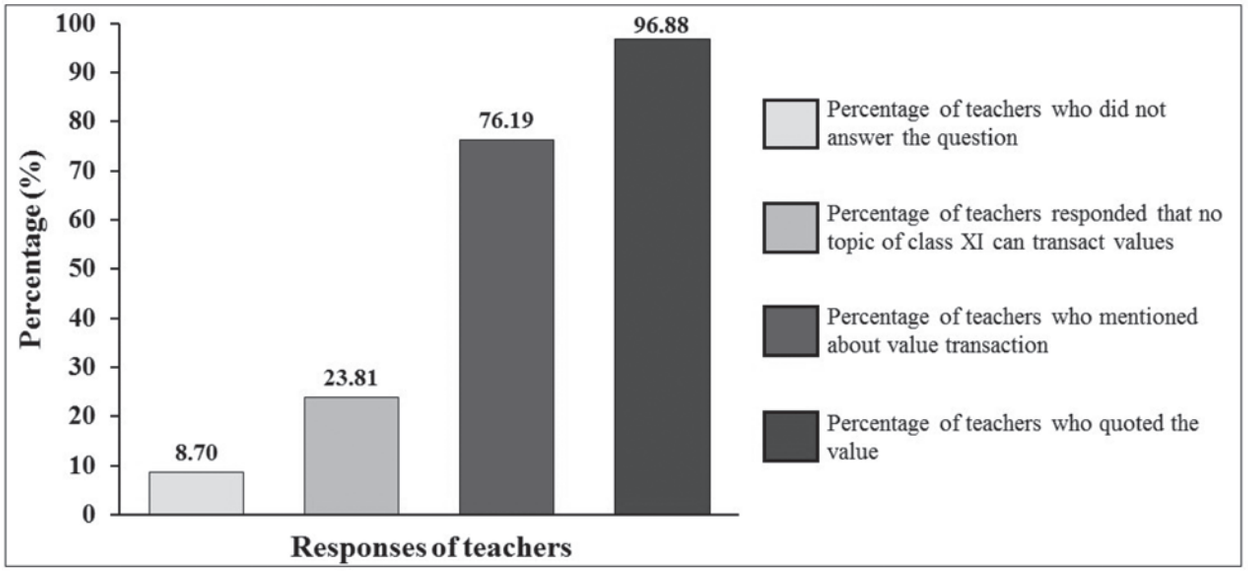


Figure 3

Analysis of data (given in Table- 3a) related to transaction of values through Class XII syllabus shows that out of 644 students, 320 students (**49.69 %)** did not answer the question. 324 students (50.31%) answered the question. Out of 324 answers 08 students answered that values were mentioned in all topics and 49 students (15.12 %) answered that there was no mention about values. 275 (84.88%) answers informed that values was mentioned during teaching –learning process, however, only in 61 answers (22.18%) values were quoted (Figure 4).

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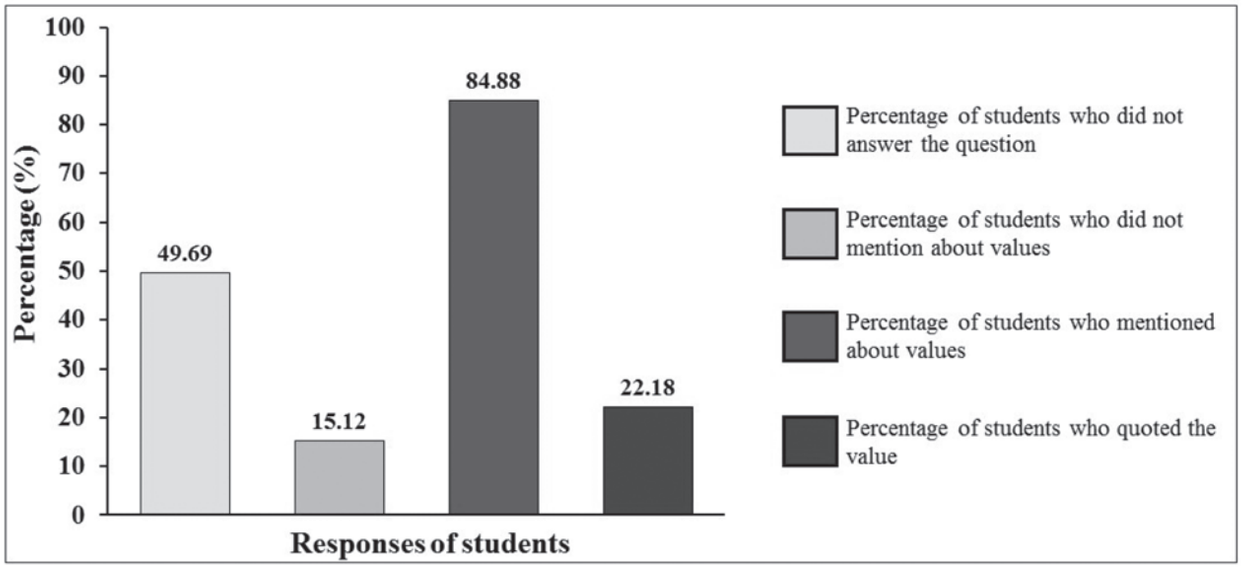


Figure 4

Result of analysis of answers of teachers given in the Table- 4a is more surprising. Out of 46 teachers, 40 teachers (86.96%) answered the question and only 31 teachers (77.50%) reported about the transaction of values. It is noticeable that **09 teachers (22.50%) reported that value transaction is not possible through Class XII syllabus** (Figure 5). **This answer surprises and perhaps supports the answer given by small number of students responding in favor of value transaction during the teaching–learning of syllabus of Class XII.**

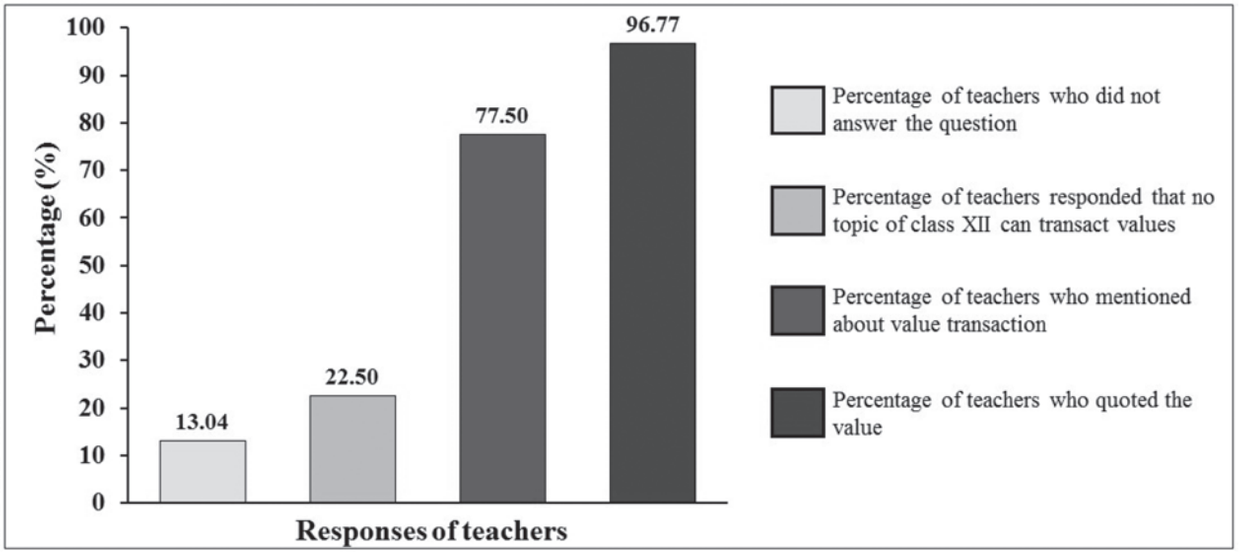


Figure 5

From the data it is very clear that for Class XI, neither teachers nor students quoted values for the chapters such as, Classification of Elements & Periodicity in Properties and Hydrocarbons. Perhaps the values

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- regularity and remaining bound to the family could be transacted through the chapter; Classification of Elements and Periodicity and the values such as – Step wise approach to solve problems and thoughtfulness can be transacted through the Chapter- Hydrocarbons.

However, in Class XII syllabus students have not quoted values for the chapters such as, Solid State, Chemical Kinetics, The *p*-Block Elements, The *d*-and *f*-Block Elements, Coordination Compounds and many of the chapters on organic chemistry The teachers teaching at Class XII had quoted values for most of the chapters except the chapters General Principles and Processes of Isolation of Elements, Haloalkanes and Haloarenes, Alcohols, Phenols and Ethers, Aldehydes, Ketones and Carboxylic Acids. However, they mentioned that values such as, stepwise approach and thoughtfulness can be transacted through organic chemistry.

Some values quoted by teachers and students are worth highlighting. For example, **the concept of catalyst is related to helping nature because according to students catalyst facilitates the reaction; chemical bonding is related to relationship with people; solid state topic motivates for unity and strength; biomolecules encourages for nutritious diet; Rutherford's experiment motivates for try again and again till one get success; structure of polymers inspires for togetherness; environmental chemistry encourages to save and care for environment; chapter on alcohols, phenols and ethers motivates for non- addiction; chemistry in everyday life makes aware about overuse of drugs, side effects of drugs and creates awareness about taking care of one's own health.**

The students have also indicated that while having discussion on any chemistry topic in the class, and also during practical classes--values such as, **humanity, good behavior, manners, discipline, hard work, never give up, truthfulness, duty is worship, power, honesty, friendship, obedience and confidence are being inculcated.** They also quoted that sometimes teachers talk about values even though chemistry topics are not being discussed.

The teachers have revealed that when students are involved in group work such as, project work, practical work in the classroom, values such as, **work with patience, cooperation, concentration, regularity, patience, team spirit, listening skills, understanding skills, unity, belongingness, togetherness, coordination, honesty, hard work, punctuality, scientific attitude, desire for knowledge and thoughtfulness are inculcated among students, which help in overall development of students.**

Conclusion

The study shows that the chemistry subject is repository of values and students not only gain insight into the nature of the subject but also appreciate and imbibe the values associated with the subject. However, opportunities are not being availed fully.

If in the school system, each teacher is equipped with the ability to inculcate values through a particular subject, then **value centric education will become integrated in the lives of students. It will give a positive direction to the students to shape their future and they can become more confident, sensible and above all responsible citizens of 21st century.**

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