

## Full Length Research Paper

# Effective strategies for teaching chemistry

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The main objectives of this study is forwarding the important strategies( method of teaching and instructional media) that are commonly encounter to teach science subjects especially chemistry at Debre Markos College of Teacher Education, Ethiopia. The study is conducted by comprising the research results conducted before and also including class room observation and exchanging ideas from the colleagues. The study tried to asses all the possible strategies widely used to teach chemistry subject.

**Key words:** Chemistry, method of teaching, instructional materials, classroom observation, science subjects.

## INTRODUCTION

The reform of chemistry curricula is both promising and challenging as past teaching methods are examined in light of more current educational goals. In the past, many chemical educators chose a traditional lecturing style as it allowed for maximum content coverage and it was the mode with which they were most familiar. In recent years, the effectiveness of the traditional unbroken lecture method has come under the scrutiny of science educators for its inability to reach students with a wide range of abilities and learning styles, and the passive atmosphere it creates in a classroom. When an instructor chooses to use an alternative pedagogy, there is often concern about whether portions of the course content are sacrificed. This is a common concern, though it is our impression that many faculty involved in curriculum reform feel that the benefits provided by alternative instruction (for example, active learning methods) outweigh the loss of course content, and we support this view. Following are some active teaching strategies in chemistry instruction.

### Start from learning objectives

Activity: a) Comment on the following lesson objectives.

- i) At the end of this lesson, you should be able to understand ionic bonding
  - ii) At the end of this lesson, you should be able to accurately state Arrhenius theory.
  - iii) At the end of the lesson, you must know about rate of reaction.
- b) How frequently do you tell the objectives of a lesson to your students? Discuss this issue.

Learning objectives are important in all aspects of the teaching and learning process. Learning or instructional objectives are concrete statements of the goals towards which instruction is directed. Objectives provide a genre for choosing subject matter content, sequencing topics and for allocating teaching time. Learning objectives also guide in the selection of materials and procedures to be employed in the actual teaching process. Further they provide standards as well as criteria for evaluating the quality and efficiency of teaching and learning activities.

### Use models during teaching

Activity: Much of the chemistry lesson can be represented with models, pictures, graphs etc. Discuss this idea.

Represent the reaction  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$  with models.

Make your own pictorial representations to discuss an acid-base reaction.

Mainly the subject Chemistry deals with atomic and molecular phenomena that cannot be observed in the high school classroom. To help students understand these abstract concepts, teachers use analogical models to make concepts more accessible to the learners. The models are more than communication tools; they provide means for exploring, describing and explaining scientific and mathematical ideas; they help to make science relevant and interesting and worth learning. Models should be used with care in teaching and learning because they may expose learners to interpretations that often lead to unexpected alternative conceptions. Glynn

as quoted by Harrison and Treagust, (2000:354) highlighted the need for educators to help learners identify the positive and negative aspects of an analogy. They do not comment on a third and also important aspect of an analogy: the neutral aspect. Hesse (1966) stated that the neutral aspects of an analogy are neither obviously correct nor clearly wrong. These neutral aspects can stimulate new ideas and provide topics for research.

Educators' explanations and learners' mental models interact. How learners interpret these models, depends on the learners' prior experience, knowledge, language skills and thinking strategies (Harrison and Treagust, 2000:355). These authors pointed out that experienced educators recognise, value and encourage these interactions. According to Harrison and Treagust (1998:422), models can only act as aids to memory, explanatory tools and learning devices. Harrison and Treagust (1998:422) also state that educators need to plan the use of models in their lessons. The focus involves pre-lesson planning in which the educator focuses on the concept's difficulty, learners' prior knowledge and ability and the model's familiarity.

Drawings are models of mental models and this lengthening of the reasoning chain may increase the likelihood of learner confusion. This gives rise to questions such as: "what influence does the representational form of models have on the effectiveness of model based learning?" "How can educators decrease their reliance on pictures of models in ways that enhance the learners' thinking and modeling skills?" It is likely that effective analogical models will be developed by educators and writers that appreciate the variability of learners' models and that are experienced with learners' models during learning.

### **Use ICT**

Activity: think of some ways that ICT can help you improve your teaching.

Information and communication technology (ICT) opens up a new educational world of creativity for students and teachers. ICT plays an important role in planning lessons and in their management (Grimaldi and Rapuano, 2009). The use of ICT could be divided into two groups: in the first group a computer is used as a tool for finding information, communication and multimedia and in the second group the computer is a scientific tool such as a virtual laboratory, interactive simulation, computer-assisted laboratory work (Šorgo et al., 2007).

The use of computers in science subjects, particularly chemistry, has some specific advantages. Cognitive psychologists assume that the understanding of chemistry includes the ability to think on three levels: the macroscopic level, the symbolic level and the level of particles (Johnstone, 1991). Pupils and students have the

most difficulties in understanding the submicroscopic level - the level of particles because it reaches beyond their experience. In these cases the interactive multimedia can be used as an effective tool. Multimedia demonstration of experiments must not replace other methods of work in teaching chemistry. Virtual laboratory can eliminate uninteresting and boring parts of the experiments. It helps students understand higher cognitive levels of analysis, synthesis and evaluation (Kirscher and Huisman, 1998). The use of multimedia and virtual laboratories for teaching chemistry improves teaching because it allows the integration of the three levels of understanding of chemistry, visualization and simulation of processes. Some experiments are too dangerous or impractical to be included in the hands-on laboratory curriculum. Such experiments and demonstrations may be viewed in classrooms capable of displaying video. Thermite reactions, for instance, could be witnessed on a screen, eliminating the associated danger and required safety equipment. It is important to emphasize that hands-on laboratory experiences are critical to a quality high school chemistry program and that technology should not be seen as a replacement for the laboratory, but rather as an enhancement. Various forms of computerized formative assessment allow students and teachers to obtain immediate feedback on the progression of students' conceptual understanding of chemistry. These technologies allow teachers to make appropriate changes to the curriculum, as needed. Some technologies can be used in class to provide opportunity for real-time adjustments to a lesson, while others alert students to errors in their thinking. Many assistive technologies are available to enhance the learning experience for students with disabilities. Educational technology has the power to enhance communication. With a laptop computer and an Internet connection, students and teachers may access research and resources beyond the walls of their school and share paperless reports that are rich in content and appearance. Teachers can respond to students at any time from any location via e-mail and social networks. Teachers can, if desired, interact online with colleagues throughout the world, in real time, from their classroom desks; engage in professional development and conference calls, complete with audio and video components. High school teachers are strongly encouraged to take advantage of such opportunities, as appropriate. Finally, teachers must stay current on the ever-evolving tools of educational technology and choose those that are most useful in terms of the value they might add to the chemistry curriculum.

### **Use assessment and evaluation**

Activity: What is assessment? What is evaluation? How do you assess your students' performance?

Regardless of the lesson format that is chosen, teachers must prepare appropriate questions in advance to assess student understanding during each phase of the lesson. These questions include an engaging question at the beginning of a lesson to determine what students already know, probing questions during the lesson to guide student learning, and end with closing questions to gauge what students learned at the end of the lesson. The opening questions should be answered by students with the understanding that the purpose of answering the questions is to confront students' initial ideas, not for students to have the "right" answer. For example, a lesson about intermolecular forces could begin with a question about how pollutants (and other substances) dissolve in water. Often these questions uncover native ideas or misconceptions which will be addressed later in the lesson. During the lesson, effective questioning techniques help students develop their critical thinking skills, as well as their ability to solve problems. The questions should help students make connections to other learning. To determine what students truly understand, open-ended questions are much more effective than questions that have only one answer.

Student engagement may begin with a provocative question related to students' lives, or a puzzling discrepant event to challenge prior conceptions. Many chemistry teachers enjoy beginning a lesson with a demonstration or video clip that makes students think about the topic in a different way. Sometimes even a simple demonstration paired with a good question is sufficient to spark student learning. For example, asking "What are the bubbles made of?" while pouring water from a pitcher into a beaker will encourage students to think more deeply about everyday experiences. This can be followed by heating the beaker of water on a hot plate and discussing the difference between the small bubbles viewed initially and the large bubbles produced when the water boils. Asking students how they can test their ideas about the composition of the bubbles lead to a much deeper understanding than providing them with a step-by-step lab procedure, or telling them the answer. Chemistry students must be good problem solvers. Solving problems is an active, messy process, which is often frustrating, but the process can be rewarding. Thomas Edison didn't invent the light bulb by following a recipe. He developed more than 1,000 faulty light bulbs during the process. Students must learn to explore problems and understand that taking a "wrong" step is often as valuable as following the correct path. Students should be observant during the problem-solving process to evaluate whether they are getting closer to, or farther from, the desired solution. When modeling problem solving, teachers should model their own thinking to help students see how experts think through a problem, starting with the given information and ending by determining if the answer is reasonable. Cooperative learning strategies could be employed to help students solve meaningful real-life problems. To avoid cries of

"Why do we have to know this?" from students, teachers should develop a context for learning. For example, students could work in teams to investigate local air quality, learn the nutritional value of their favorite foods, or discover the effects of fertilizer on water quality. Finally, providing students with time to reflect on their new learning through journaling or searching for real-world examples will help ensure their understanding endures past the closing bell. One popular strategy is to ask students to complete exit cards with prompts, such as "Today I learned . . .," "I would still like to know more about . . .," or "I still don't understand. . . ." Another idea for student reflection is to ask them to write a letter to a relative or a friend explaining in nontechnical terms what they learned in chemistry that week.

In chemistry, well-planned lessons include effective questions, student interaction with new ideas, and student reflection—all focused on the conceptual learning goal. Chemistry teachers should capitalize on the importance of chemistry in everyday life to engage their students, and then follow through with opportunities for them to actively explore newly introduced concepts. Advance planning will reap big payoffs in student motivation and deepen their understanding of topics in chemistry. An assessment is not a "test"; however, a test is one form of an assessment. An assessment incorporates a wide variety of tools for informing and improving instruction, for helping teachers and students improve their understanding of content, and for evaluating student performance and establishing grades. Teachers have a responsibility to not rely on only one or two major assessment tools in their chemistry course. Some students excel in writing, some in math; while others may be strong speakers or artists. Some students are pressured by written exams, and some are not. The evaluation of student learning must use a combination of different assessment tools along with the corresponding planning and follow-up activities.

Teachers must first answer a very important question: "Do you want to know how well your students are learning?" Teachers who really want to know what their students know and understand will assess and reflect every day. Teachers should welcome evaluations of all types. Proper assessment will be used to continually adjust the classroom environment to improve learning. Teachers must recognize that even excellent programs can be improved. An assessment of a chemistry lesson can be measured using a quiz, lab practical exam, written exam, or student satisfaction survey (formal); or can be evaluated through observations or conversation. A formative assessment is accomplished during the learning process (as knowledge is "formed"), which includes observing classroom and laboratory activities, posing questions during a lesson, taking a poll, or having an informal conversation. A summative assessment is performed at periodic intervals to assess a collection of knowledge at a particular point in time.

A summative assessment includes quizzes, exams, lab

reports, and term papers. Personal journals may be used to encourage periodic self-reflection to help students assess their progress. Local assessment tools are often very good for measuring locally identified student outcomes. Local tools are often designed by the teacher or a colleague and can be formatted any way that is desired. They do not compare students beyond the local boundary and can require much time and effort to develop. Third-party assessment tools have the advantage of being unbiased and statistically valid. It is usually easy to administer and requires little preparation time. Some tools, such as those from the ACS Exams Institute, can provide objective national or regional ranking of performance. Many schools track the performance of their students who take subsequent chemistry courses at a post secondary institution. This can provide an unbiased comparison of local students with a general population of college chemistry students. A third-party assessment can be expensive. It may provide only one aggregate score and may not be ideal for measuring local outcomes.

A complete assessment involves four essential components: planning, gathering, analyzing, and action. A credible assessment of a chemistry program will be based on information from a wide variety of assessment tools over a span of several years. The gathered information must be carefully examined and must be used to enhance student learning and to improve the program.

### POINTS FOR DISCUSSION

- Discuss the primary objectives of testing (examining) students.
- Comment on the following Questions:
  - Helium is not an unreactive gas. (TRUE/FALSE)
  - Carbon dioxide is A) acidic B) basic C) neutral D) amphoteric
- iii) Which of the following noble gases is used in electric light bulbs? A) Mg B) Ar C) W D) He
  - Which of the following is/are transition metal(s) A) lead B) Cu C) gold D) Sb
  - What is the volume of 22.4g CO<sub>2</sub> at STP? A) 11.2 L B) 22400mL C) 22.4dm<sup>3</sup>
  - How often do you give comments to students about their performance on tests, assignments, home works etc.?
- Use the school chemistry laboratory
- Activity: After reading the following story, express your feelings of learning through practice.

Ira Ramsen (1846-1927), wrote his memories as a child experiencing a chemical phenomenon as follows:

While reading a textbook of chemistry, I came upon the statement, 'nitric acid acts upon copper'...and I [was] determined to see what this meant. Having located some nitric acid....I had only to learn what the words 'act upon' meant.... In the interest of knowledge I was even willing to sacrifice one of the few copper cents then in my possession. I put one of them on the table; opened the bottle marked 'nitric acid' poured some of the liquid on the copper; and prepared to make an observation. But what was this wonderful thing which I beheld? The cent was already changed, and it was not a small change either. A greenish blue liquid foamed and fumed over the cent and the table. The air... became colored dark red.... How could I stop this? I tried by picking up the cent and throwing it out of the window...I learned another fact; nitric acid... acts upon fingers. The pain led to another unpremeditated experiment. I drew my fingers across my trousers and discovered nitric acid acts upon trousers....I tell it even now with interest. It was revelation to me. Plainly the only way to learn about such remarkable kinds of action is to see the results, to experiment, to work in the laboratory. (Adopted from Gutman, 1940).

The chemistry laboratory represents a wonderful opportunity for making the connection between the unseen microscopic world and the observable macroscopic world in which we live. Laboratory experiences provide opportunities for team building, inquiry-based learning, hands-on activities, and exposure to standard laboratory equipment and technology. Though an excellent laboratory experience will certainly require hours of behind-the-scenes work on the part of the teacher, a laboratory need not have the latest technology to be effective. Many, if not most, of the concepts and principles common in high school chemistry courses can be demonstrated or discovered through experiments performed with simple apparatus. Of course, all experiments should be evaluated carefully for scientific accuracy, and appropriate safety guidelines and warnings, prior to use in the classroom. Within any given chemistry curriculum, teachers should develop instruction that is student-centered and emphasizes concrete examples of the concepts and principles to be learned. Student-centered lessons place emphasis on the students' learning rather than on the teachers' activities and teaching.

Chemistry is a laboratory science and cannot be effectively learned without robust laboratory experiences. Indeed, the identification, manipulation, and general use of laboratory equipment are integral parts of the subject of chemistry. A high school laboratory should have the equipment necessary to conduct meaningful demonstrations and experiments. The physical laboratory environment must be accessible to all students. Teachers must understand that students with limited strength or mobility can have a full laboratory experience with appropriate accommodation, such as a lab assistant. Instruction that is student-centered and emphasizes the

role of laboratory demonstrations and experiments is the best method to ensure that students develop these essential skills in science. Laboratory exercises should come in three phases: the pre-lab, the lab procedure, and the post-lab. In the pre-lab, students consider the concept or principle to be investigated. They predict and hypothesize. Effective pre-lab questions can prompt students to review and recall previously learned material that is pertinent to the lab. In the lab experience, students learn to plan their actions, and to identify and control variables; they observe measure, classify, and record. The post-lab challenges students to analyze and interpret data, evaluate the effectiveness of the procedure, formulate models, and communicate their findings in written and oral formats. In the post-lab, students can also relate or compare the results and concepts to known phenomena. When conducting a laboratory exercise, it is important that the students not know the outcome beforehand. For this reason, it is often appropriate to carry out a laboratory activity before the related concept is presented.

Laboratory experiences, whether demonstrations or true experiments, must emphasize and model the investigative nature of science. Students should experience science as it is and not as a simple verification of concepts and principles already taught or assessed. Laboratory exercises should not be in the form of a "magic show," which is not specifically linked to particular concepts and principles of chemistry.

Teachers should consider a variety of factors to make the chemistry as "green" as possible when they are designing or choosing a laboratory activity. This would include consideration of the scale of quantities used, the amount and category of waste generated, and the proper in-class disposal methods for chemical wastes. A number of green chemistry resources are available to help teachers choose experiments most appropriate for the learning objectives, with minimal environmental impact (ACS Green Chemistry Institute (GCI), 2011).

The laboratory should be arranged so that instruction and lab skills may be practiced safely and effectively. Classrooms devoted to science instruction containing scientific equipment and supplies should not be used for other activities or non-science courses. The classroom/laboratory needs to be vacant one period per day for safe lab setup and proper cleanup. Teachers must have adequate preparation time. Lab activities should only be conducted in a science classroom/lab that is outfitted with proper hardware and safety equipment. Each laboratory should contain a fully equipped teacher station suitable for demonstrations and lab work. Student workstations should be arranged throughout the remaining work area.

The chemistry laboratory may contain moveable lab stations or fixed lab stations. The latter allows for a more productive use of time because the facility is always available.

### **Possess Professional Preparations and highly qualified teacher characteristics**

Activity: Mention ten qualities and ten responsibilities of a good teacher.

### **Discuss the following points**

Teacher's voice does matter on the behavior of students in the class room.

Knowing students by name contributes to the well being of the class room.

The teacher's wearing style has some effects on the students' behavior.

Research showed that students learn more from teachers with certain Characteristics. Teachers differ greatly in their effectiveness, but teachers with and without different qualifications differ only a little. Berry (2002) posits that while these teacher qualities are indeed important they appear to have a "singular focus on content knowledge". Highly qualified teachers must also know "how to organize and teach their lessons in ways that assure diverse students can learn those subjects. Highly qualified teachers don't just teach well-designed, standards-based lessons: They know how and why their students learn.

Most people would agree that good teachers are caring, supportive, concerned about the welfare of students, knowledgeable about their subject matter, able to get along with parents...and genuinely excited about the work that they do....Effective teachers are able to help students learn. A teacher who is excited about the subject being taught and shows it by facial expression, voice inflection, gesture, and general movement is more likely to hold the attention of students than one who does not exhibit these behaviors. This is true whether or not teachers consciously perceived these behaviors in themselves.

Research on enthusiasm of the teacher is strongly connected to student success. Cruickshank, Jenkins and Metcalf (2003) report that effective teachers are enthusiastic, have warmth, and possess a sense of humor.

### **Fairness**

As humans, we possess an ingrained sense of fair play. Whenever we are dealt with by someone in a manner that violates what we think constitutes fairness in the situation, we react negatively. Any semblance of favoritism, or lack of fairness, can leave scars that last a lifetime. While feelings and competition between classmates can be intense, the memories of unfair teachers are reported by our students in great detail, even

after many years have passed since those negative school experiences.

### **Positive Attitude**

Borich (2000) suggests that effective teachers are those who use meaningful verbal praise to get and keep students actively participating in the learning process. Cruickshank, Jenkins and Metcalf (2003) write that effective teachers are generally positive minded individuals who believe in the success of their students as well as their own ability to help students achieve. As we all know, there are people in life who are inclined to see the glass half empty and there are others who usually see it half full. It is important to “catch students doing things right” rather than “catching them doing something wrong.” Effective teachers develop ways to remind themselves to do this, and the impact on students can last many years. Our students often recall praise and recognition that teachers gave them as young students, and they point to the confidence and direction that often resulted in their lives.

### **Preparedness**

It is easy for students to tell if a teacher is prepared for class. Even young children know when a teacher is organized and ready for the day's lessons. According to informal surveys, nothing frustrates a student more than to come to class and be assaulted by a teacher who has no idea what he or she is doing. Competence and knowledge of the content area being taught is something that our students have always mentioned about their favorite teachers and is strongly supported by current literature. Students pointed out that in classrooms where teachers were well prepared, behavior problems were less prevalent. The well-prepared teacher is more likely to be able to take time during lessons to notice and attend to behavioral matters, and is less likely to miss the beginnings of potentially disruptive activity. If, on the other hand, teachers have not invested sufficient time in planning and preparation, they tend to be so focused on what they are doing that they miss the early signs of misbehavior. This ultimately results in frequent disruption, waste of valuable instructional time, and student frustration.

### **Personal Touch**

Students have always mentioned the fact that their favorite teachers are connected with them in a personal way. Teachers who convey a personal touch with their students call their students by name, smile often, ask about students' feelings and opinions, and accept

students for who they are. Teachers who bring their lives and stories into the classroom build trust with their students. Teachers who tell stories of events in their own lives which relate to subject matter currently being taught, captivate student interest and promote bonding with the students. Additionally, teachers who have gotten close to their students have done so by finding out as much about their students as possible. Teachers who show interest in their students have interested students.

### **Sense of humor**

Students fondly remembered teachers for their sense of humor. If a teacher has a quick wit and the ability to break the ice in difficult situations with the use of humor, this is an extremely valuable asset. According to McDermott and Rothenberg (2000), students enjoy teachers with a sense of humor and found those teachers made learning fun. As long as it is not at any individual's expense, good teachers can occasionally enjoy a laugh with the class and they can also laugh at themselves. Students recognize the strength reflected in teachers who are not threatened by foolish or silly mistakes that they make. Since students sometimes find themselves in similarly embarrassing situations, good teachers can provide a wonderful model for how to deal with an embarrassing situation effectively.

### **Creativity**

Many of our students remembered unusual things that their teachers did in their teaching and the creative ways that they decorated the classroom or motivated the students. For example, one teacher was remembered for an old bathtub painted green and fills with pillows and books designated the “Reading Tub”. Another teacher was remembered for an igloo that she had in the back of her room. Constructed out of plastic bottles glued together in the shape of an igloo, it provided an enclosure into which children who earned the privilege could go and work quietly on puzzles and word-finds.

Other teachers had large trunks in their elementary room full of dress-up clothes, offering a fun activity for rainy days. Some teachers were remembered specifically for their unique ways of motivating their class. One teacher had challenged the class to reach a particular academic goal. If they did, she promised to kiss a pig. They reached the goal and she kissed the pig!

### **Willingness to admit mistakes**

Something that we all appreciate in others is their willingness to admit mistakes, and it is also long remembered by students. Like everybody else, teachers

make mistakes. Unfortunately, some teachers think that their authority in the classroom can be undermined by these mistakes and they try to let them go unnoticed or cover over them quickly. Students quite obviously have a different opinion. They are fully aware of the times when teachers make mistakes, especially when they somehow suffer from them. Teachers who recognize their mistakes and apologize for them when they affect the students provide an excellent model to give students, and a great way to be remembered as a favorite teacher.

### **Forgiving**

Most of us have a bad habit of labeling others, and those labels can sometimes stick for as long as we know the person. They become “lififers” for us, and our interactions with these students are consistently colored by what we expect to see. All those associated with education know that there are frequently personality conflicts between teachers and students. It is often blamed on bad “chemistry.” Whatever the cause, it can have a disastrous effect on the child caught in this relationship, and can result in a year of frustration and academic failure. Our students had plenty of memories of teachers who “had it in for” one student or another, but their accounts of favorite teachers reflected a willingness to forgive students for misbehavior and a habit of starting each day with a clean slate.

### **Respect**

Teachers universally wish for their students to respect them. We have found from discussions with our students that those who are given the highest amount of respect are those who give respect to their children. Favorite teachers were remembered for keeping grades on papers confidential, for speaking to students privately after misbehavior or when the teacher needed some clarification, in contrast to public rebuke. Favorite teachers were remembered for showing sensitivity for feelings and for consistently avoiding situations that would unnecessarily embarrass students. Such behavior is obviously appreciated by students, and according to those in our classes, repaid with respect and love for the teacher.

### **High expectations**

Our students often have mentioned the expectations that their favorite teachers held for them. According to Irvine (2001) “students defined caring teachers as those who set limits, provided structure, held high expectations and pushed them to achieve” (p. 6-7). Teachers with positive attitudes also possess high expectations for success. Gill

and Reynolds (1999) report that students of teachers with high expectations learn more as teachers’ expectations rise. Teachers’ expectation levels affect the ways in which teachers teach and interact with students. In turn, these behaviors affect student learning. Generally, students either rise to their teachers’ expectations or do not perform well when expectations are low or non-existent. The best teachers were remembered as having the highest standards. They consistently challenged their students to do their best. Many of our students reported that they had little confidence in themselves as youngsters. Parents or siblings had told them that they were dumb and the children believed it to be true. When their teachers expressed the fact that they believed in their ability, it served to energize them and encourage them to reach new heights. Some ended up choosing careers in areas that they were originally encouraged in by these teachers. Expectations are often self-fulfilling, and must therefore be expressed with care and consideration. Favorite teachers apparently have a talent for doing that.

### **Compassion**

Hopefully, school is a place where children can learn and be nurtured in an emotionally safe environment. The reality of most classrooms, and in fact just about any gathering of youngsters, includes a significant amount of cruelty and hurt feelings. All insensitive, uncaring, or deliberately malicious behavior cannot be eliminated from such situations, but a caring teacher can have a tremendous impact on its frequency. Students have related numerous stories over the years about how the sensitivity and compassion of a favorite teacher affected them in profound and lasting ways. Cruickshank, Jenkins, and Metcalf (2003) reported that effective teachers are supportive to students in multiple ways and help to meet their needs for belonging and success. These teachers were remembered for noticing when children were left out of games on the playground and for taking action to prevent such things from happening. Such simple actions eliminated the embarrassment that many children have to face every day. And from our students’ recollections, it was clear that such wise behavior was remembered vividly years later.

### **Sense of belonging**

One thing repeatedly mentioned by students was the fact that they felt like they belonged in the classrooms taught by favorite teachers. They recalled that these teachers developed a sense of family in their classrooms. A variety of strategies, long used by teachers in the classroom, were remembered. Classroom pets, random act of kindness awards, class picture albums, and cooperative

class goals were employed to build a sense of unity and companionship. In addition, emphasis was placed on maintaining an emotionally safe classroom. Good teachers also took strong measures to prevent mean and hurtful behavior like teasing and bullying. Effective teachers know well that when children feel emotionally, as well as, physically safe, they learn far better.

### **Be a member of Professional Organizations and Resources**

Membership and active participation in professional organizations provide chemistry teachers with a host of opportunities to network with other education professionals on multiple levels. This can be accomplished through active membership, use of online resources, and attendance at local, state, and national conferences associated with professional organizations.

### **Participate in Extracurricular Activities**

Chemistry teachers seek out opportunities for their students to connect classroom learning to the world around them. By extending the focus of chemistry beyond the classroom, teachers will be positioned to provide students with enriching activities designed to ignite the interest and imagination of the participants. A few examples of extracurricular opportunities sponsored by the ACS available to chemistry teachers and their students include the ChemClub, Chemistry Olympiad, Project SEED, ChemMatters magazine, the Scholars Program, college planning resources, and summer research programs for students and teachers.

The ACS ChemClub provides fun, authentic, and hands-on opportunities to experience chemistry beyond the classroom. The Chemistry Olympiad competition brings together the world's most talented high school students to test their knowledge and skills in chemistry. Project SEED is a summer research program for economically disadvantaged students. Also, teachers may consider encouraging his/her students to apply to one of the many summer programs that provide students with academic enrichment and real-world experience in higher institution chemistry laboratories.

### **CONCLUSION**

Chemistry is the central part of all science subject due its special language. But, to make chemistry easy, funny to learn, important and applicable we always need to find strategies that make the above parameters are well addressed.

Among the mechanisms method of teaching and using appropriate instructional materials are the important strategies used to make chemistry effective.

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