

SCHOOL VISIT REPORT

UPS DAMTA, UTTARKASHI



AVNEESH SHUKLA



CONTENTS

- 1 Concept of Solute, Solvent and Solution**
- 2 Types of Solution**
 - Dilute and Concentrated Solution**
- 3 Dilution as Relative term**
- 4 Solute-Solvent Interaction**
- 5 Miscellaneous**
 - What is Air?**
 - What is Water?**
- 6 Way forward....**

Introduction

School visit is one of core engagement for Onsite support, self-capacity enhancement as well as teacher's mobilization. By visualizing it, as one of the most important and effective mode of engagement, I have planned to demonstrate a session on solute, solvent and solution chemistry. Performing activities with low cost and easily available resources & also learning by doing concept were the core approach of the work so that the core element of science teaching-learning processes can be fulfilled. It has been enormously learning experience of mine as well as it motivated me to work with full enthusiasm and passion in an attempt to enhance the conceptual understanding of the learner as well as developing process of Science. Perhaps this endeavor will provides ample opportunity to make classrooms practices more effective and innovative.



Solute, Solvent and Solution

Day 1st (27 July 2016)

After almost one and half month break I got an opportunity to visit Upper Primary School Damta to work & understand teaching-learning as well as co-curricular activities happening in schools. When I reached to the school I saw all three teachers were busy in classroom teaching-learning processes and one in checking the notebooks of the students. Without any disturbance I sit with her (4th teacher). Firstly she greeted me, I also and as time spent she aware me about the current practices (15 August preparation, extra classes for identified students etc.) happening in schools and challenges which she is facing during teaching the topic map in social studies. It was about 10 am when the bell rang for MDM, students came outside from their classes with their *Thali* (plates) and *Chammach* (spoon). When students saw me a wave of smile and unison sound of *Good Morning Sir!* Scattered in all the direction. After taking lunch I shared my planned activity on “**Solute, Solvent and Solution**” with Durgesh ma’am as well as tried to know her understanding about the same. During discussion she expressed her idea of demonstration with both the classes i.e. 7 and 8 by visualizing the importance of the theme. By appreciating her view, I endorsed her idea and aware her that this theme start from 7th grade and little bit deals in 8th grade. By concluding this discussion here I demonstrated this concept with the 7th and 8th grade students. Before demonstrating the activity, I arranged the following materials and reading resources in preparatory area:

- Soil
- Sand
- Sugar
- Salt
- 10 plastic disposer cups
- Wooden stick
- Water
- Indigo neel (Ujala)
- Chalk pieces
- Reading resources for developing initial sketch or flow of the session and also for enhancing my understanding:
 - Uttarkhand State text book
 - NCERT text book
 - YOUTUBE video
 - Sandarbh articles

Context Setting –

When I entered to the classroom, I saw both the classes 7th and 8th sat together and they stand in their position and greeted me with the unison voice of *Good Morning Sir!* I also greeted them with Good Morning and asked them to sit. Then I asked them what you did or are doing nowadays? They replied we are preparing for Independence Day, reading all subject in schools and so. After sharing this some students ask *sir aapne to bola tha jaldi aayenge aur aap itne time baad school aa rahe (you have promised to come school soon but you are coming after a long time)*. For instant I lost myself in deep thinking zone and then I tried to explain them about the constraints.

Activity –

After this I initiated the activity by dividing students in 4 groups and by asking “*there are several substances around us from them some are those which dissolve in each other for example in making a juice lemon dissolve in water, salt in water etc. can you list down such kind of substance?*” Students worked on the same for 10 minutes and shared their opinion, some of them were as follows:

- Sugar in water
- Salt in water
- Milk in water
- Sand in water
- Soil in water
- Ink in water
- Juice in water
- Chalk in water
- Alcohol in water
- Cold drink in water
- Tea leaves in water
- Detergent in water
- Shampoo in water
- Sugar cane with water
- Mango shake with water
- Honey in water
- ORS in water
- Blood in water
- Ujala in water
- Oil in water

After appreciating the responses of the students we little bit discussed about the above given list. In some cases students have different views as some were in favor of oil dissolve in water some were not, similarly detergent, honey, sand were also confusing cases. We hold that discussion there and asked them to think about these case, later we will discussed on those. Then I gave similar materials for two groups and asked them for mixing and note down their observation.

Group 1st and 2nd: Sand, Soil, Water and 2 plastic disposer cups

Group 3rd and 4th: Sugar, Salt, Water and 2 plastic disposer cups

Students mixed sand in water, soil in water, sugar in water and salt in water and shared their group observations some were as follows:

- We took some amount of water in plastic cup and then added few amount of soil suddenly the water becomes brownish.
- When we added sand in water it settled down after some time and color of water changed to grayish.
- First we took small amount of sugar in cup and then added water on it the color were little bit change.
- We took water and then added salt in it on doing this the large amount of salt got dissolved in water but some amount were left. We stirred it through pen and then the total amount got dissolved. The color were approximately similar to water.
- When we added salt in water it does not dissolve so we used pen for stirring purpose.

By taking their views we took these four samples (***solutions***, at that time I did not introduced this term with students) and asked them in the above four samples we were able to see soil and sand in water but unable to see sugar and salt so can we say...



Sugar and Salt disappear when we added them in water?

I sound of confusion scattered there and students started murmuring with each other's. After few minute someone told that *"YES, we can say sugar and salt disappear from there, SOME told no we can't say this and rest of them told we are Confused and without performing anything we can't say disappear or not."*

Then I gave a clue to suppose a blind person is outside the classroom or anyone from you is outside with closed eyes so can s/he say you are invisible? Most of the students replied no s/he can't say because that is his/her vision constraint. Few students replied if h/se is unable to see us so we can recognize that as we are invisible to him/her. Immediately one student replied invisible or disappear nothing but meant *us jagah se puri tarah se hat jaana, wo cheej wahan par nahi hai (totally eliminate from there and that thing is not presented there)* if we make sound at that time s/he will unable to see us but by hearing s/he will definitely sense someone's presence it means we are not invisible for his/her. By appreciating her



responses I again asked ***now what do you think?*** Can we say sugar and salt disappear when we added it in water? All the students replied “*No, Sir! This is our eye limitation for which we are unable to see.*” Then I tried to understand that it might be due to the very small size of sugar and salt particles in sample (solution) for which we are unable to see them. If we will use any instrument then maybe they become visible.”

After this wonderful discussion I probe them for giving their views related to the used quantity of sugar, salt, soil, sand and water. All the group responded that we took small amount of sugar, salt, soil and sand & added them in large amount of water. Again I asked them, if we take more amount of sugar, salt, soil and sand in water then what will happens? Some told *ghol gaada ho jaayega* (solution will become dense) then I ask all the group for performing the same and noting down the observations. All the group did same activity with increased amount and found the sample become dense, color become dark than previous, the level of sample in cup increases and so. Then I noted down their observation in display board and asked them to focus and share their views on same. The observations are written as:

Case 1st:

Amount of species		Final sample
Less	More	
Soil	Water	Soil + water
Sand	Water	Sand + water
Sugar	Water	Sugar + water
Salt	Water	Salt + water

(Table 1)

Case 2nd:

After increasing the amount:

Amount of species		Final sample (gaada ghol)
Less (more than 1 st case)	More	
Soil	Water	Soil + water
Sand	Water	Sand + water
Sugar	Water	Sugar + water
Salt	Water	Salt + water

(Table 2)

Note: *The amount of soil, sand, sugar and salt were more than 1st case but overall it was less than the amount of water taken.*

The responses of the students are as follows:

- In first case we took soil, sand, sugar and salt all in less amount and water in more amount
- While in second case we increases the amount of soil, sand, sugar and salt
- We used water for mixing
- When we added soil in water, sugar in water and others it becomes *ghol* (solution)

- All things which we used in less amount are solid and which we used in larger amount that is water mean liquid

After performing the activity I asked them a brain storming question for thinking that....



“Can we separate out sugar, salt, soil and sand from their respective ghol (solution) in water?”

Some told “Yes, some no and some were confused.” I hold this discussion there and asked them to think, and find then moved forward for our discussion (*I asked this question for creating a bases for next session which will separation techniques*). Then I initiated the discussion by asking, for *ghol formation* what we need? They replied two things are necessary for *ghol formation*. As per the above activity we understood that *for sugar ghol sugar and water, salt ghol salt and water are necessary*. By appreciating their views and by capturing all the points I tried to explain them that in ghol we took one matter in small amount and another in large amount. The matter or substances which is in small amount is known as **Solute**, which is in large amount is known as **Solvent** and after mixing what we get is known as **Solution**. Generally we talk things and ghol but scientifically we use the term matter or substance and solution.

By explaining this I asked them to identify the solute, solvent and solution in above performed activity. Without losing a second they replied *in first case in which we took sand, soil, sugar and salt in small amount these are solute and water in large amount that is solvent and final product is their solution respectively. In second case when we increases the amount but that were less than the amount of water so solute and solvent are similar*. Then I asked if we reverse the process i.e. water in less amount and sand, soil, sugar and salt in more amount then what will we say? They replied solution will become very thick and in this case water will be solute and sand, soil, sugar and salt will be the solvent (*here I hold myself for discussing on that is solution or not. That will deal in mixture part*). By appreciating their views I told from this ***we can infer that solute and solvent can change and which depends on their used amount in solution***. We can understand as:

Solute	Solvent	Solution
Sand	Water	Sand solution
Soil	Water	Soil solution
Sugar	Water	Sugar solution
Salt	Water	Salt solution

(Table 3)

Again I probed them that in above process all the substance (solute) which we added in water are solid, ***so it can be liquid/gases or not?*** After thinking a while they replied juice in water, cold drink in water, ink in water and alcohol in water are the example of solutions in which solute are liquid. By appreciating that I asked can we think for gases. Students thought on this but they didn’t get anything concretely so I gave them a clue by asking *is there (room) air or not?* They replied YES then I asked if we light the incenses sticks in this room what will happens? They replied the fragrance

will spread throughout the room. So is it gases solution? For thinking a minute they told *Yes, it is and smoke, fog and hydrogen, oxygen, carbon dioxide gases in air are the examples of solution in which solute are gases*. Then I told them here we used water as solvent which is in liquid state but we can use other solvent too, having different state of matter. From this we infer that solute and solvent may be solid or liquid or gases form.



In first case we took less amount of solute and added in large amount solvent (water) while in second case we increases the amount of solute and added in solvent and the solution becomes dense as you said initially. The solution in which solute is in more amount is known as **Concentrated Solution** (*gaada, Sandra vilyan*) and solution in which solute is in less amount is known as **Diluted Solution** (*tanu vilyan*). Then I asked them during performing activities we used water as solvent and you have listen or see, mostly we use water as solvent so have you ever think off why we used this? For thinking a minute they replied since water is easily available, present in excess amount and low cost that's why we used it. By appreciating their significant responses I repeated all concluded by adding single point that since most of the substance dissolve in water that's why we used water as solvent but sometimes we also used other solvents if some substance didn't dissolve in water. Then we wind up the first day activity by drawing light on key points of the day as solute, solvent, solvent, concentrated and dilute solutions etc.

Day 2nd (28 July 2016)

On 27 July evening I again went through the initial sketch of the designed session and try to see the alignment between the planned session and implemented process. I found myself in satisfactory zone by looking at the planning, approach and aligned execution of the activity. Then I planned for the next day activity in which I went through some video related to concentrated and diluted solution, solutions v/s mixture and also collected Ujala from market. Next day on 28 July morning I reached to the school before morning assembly. I joined morning assembly which runs for almost 30 minutes including attendance of the students. Then I discussed with Durgesh ma'am about

today's activity and then entered in the classroom in which both the classes of 7th and 8th sat together. Before going with today's activity I asked them about the previous day activity which we did and discussed. It gave me humbling feeling that students explained all the concepts very well.

I initiated the second day activity¹ (*took four plastic cups having equal amount of water and then add one, two, three and four drop of Ujala in 1st, 2nd, 3rd and 4th cup respectively. Try to observe the process and noted down which one is concentrated & which one is the diluted solution*) by asking five students for demonstrating the activity. They added the decided drop in particular cup and shared their views after demonstration which were as follows:

- In all the cases Ujala is solute since it is in less quantity
- Water is solvent since it is used in more quantity
- The color difference is easier to see i.e. 1st have light color but 4th cup have dark blue color
- Among all these 4th one cup which having four drops will be the concentrated solution and 1st one having single drop will be the diluted solution



By taking their views I took 1st cup (having single drop) and 2nd cup (having two drops) and asked who is concentrated and who diluted solution is. All replied in unison as first one is having less amount of solute than second that's why the first sample is diluted and second one is concentrated solution. Then I took 2nd cup (having two drops) and 3rd cup (having three drops) and asked the same. Without losing a second they replied 2nd solution is diluted and 3rd one is concentrated solution. Then I asked....



Previously 2nd solution were concentrated now it is diluted, how is it possible?

¹ This activity were taken for the assessment of the students and knowing the effectiveness of the session

Students got confused for a second and a low voice came with extraordinary answer that “*sir phele humne 1st aur 2nd solution liya phir 2nd aur 3rd solution liye to yahan jisse tulna karni thi wo solution change ho gye isliye 2nd solution jo pehle concentrated tha 1st ki tulna main wo ab 3rd ki tulna maih diluted ho gya (the comparing solution have been changed therefore 2nd become diluted with respect of 3rd solution which were concentrated with respect to 1st solution)*”. By appreciating this wonderful explanation of the learners I told from this we can infer that every solution will be consider concentrated or diluted only with respect of other i.e. without reference no one will be concentrated and no one will be diluted.



Then I asked to the students we added sugar, salt in water but actually what happened there?

Students replied sugar and salt dissolve in water, the color were little bit changed and so. Again I asked but actually what happens there and where the sugar and salt goes? One of the student from 8th grade tried to speak that water have formula H_2O it means it is made of hydrogen and oxygen. When we added sugar or salt on it they might be went somewhere with H_2O (water molecule). I was wonder to listen this marvelous explanation of her and for more conceptual understanding I asked two students to come in central position and demonstrate the activity (take a single plastic cup with large number of chalk pieces and then add small amount of salt on it and observe the process & note down the observations). I remind them that we took large number of chalk pieces it means it represent solvent and took salt in small amount it means it represent solute molecule. Then both the students demonstrated the activity and asked to other students what you have observed? Students replied there were some gap between chalk pieces when we added salt on it, salt took that empty spaces. Then I asked to the students now what about sugar and salt in water? Frequently they replied similar phenomenon occurs during mixing of sugar and salt in water. That students which gave previous explanation stood and told sir water having formula H_2O having spaces between two H_2O molecule and when we add sugar and salt on it, they took empty spaces between the H_2O molecules. This was again her extraordinary explanation which can definitely wonder anyone. Then I tried to explain the same phenomena with the rest of the students and again questioned, here is air or not? All replied in unison voice YES, HERE IS AIR. Then I asked we are also here then why we are not mixing or dissolving in air? All the students laugh hysterically and one of them replied *Sir, size bhi matter karta hai, aur humara size itna hai hi nahi ki hum air ke beech ke space main fit ho paaye (the size of the particles also matter and substance will mix or dissolve if and only the size will appropriate)*. I was again got surprised to listen this voice and were thinking all the surprises are happening today AAAHHHHAAAA!! And



explained some other factor as size, nature of solvent (*generally we used water but if some substance does not dissolve in water we use other solvents*) etc. are responses for solubility. For building good connection we screened a video (Solute and Solvents | Solution | Chemistry) which shows the same phenomenon happening during the mixing of substances in water.

After this I wrote all the opinion of the students which they gave in first day as:

Sugar in water	Juice in water	Shampoo in water
Salt in water	Chalk in water	Sugar cane with water
Milk in water	Ujala in water	Mango sake with water
Sand in water	Cold drink in water	Honey in water
Soil in water	Tea leaves in water	ORS in water
Ink in water	Detergent in water	Blood in water

(Table 4)

And then again I asked them to categorize the above mentioned list according to solute and solvent? Without losing a second all responded water as a solvent and discussed about the solute in groups. After discussion in groups the consolidated responses are as follows:

Solute	Solvent	Solution
Sugar	Water	Sugar solution
Salt	Water	Salt solution
Ink	Water	Ink solution
Chalk	Water	Chalk solution
Sand	Water	Sand solution
Soil	Water	Soil solution
Ujala	Water	Ujala solution
Tea leaves	Water	Tea leaves solution
Juice + sugar + flavor + coloring agent	Water	Juice solution
Cold drink + sugar + flavor + coloring agent	Water	Cold drink solution
Blood + water + hemoglobin	Water	Blood in water

(Table 5)

Solution having more than one solute



After this I asked to the students that in sugar solution, salt solution there are only one solute (sugar and salt) is there any example where the number of solute are more than one. After thinking some of the responses of the students were as follows:

- Sugar + salt in water (sugar + salt)
- Juice in water (juice + sugar + flavor + coloring agent)
- Cold drink solution in water (cold drink + sugar + flavor + coloring agent)
- Blood in water (blood + water + hemoglobin)

- Tea (tea leaves + sugar + milk)

Then I asked to the students what is ***WATER AND AIR?*** Students got puzzled and murmured with each other's so I probed them to think about the composition of the water and air and the quantity factor in mind for the categorization of solute and solvent. After thinking for a while they replied air have different gases as oxygen, carbon dioxide, nitrogen, methane and other & water have only water or H₂O molecule. In air nitrogen gases have higher percentage (solvent) and other have less (solute) so air is solution. And water have only water molecule so it is not a solution. We took a bottle of KINLEY water bottle and told students to see the composition of water mentioned in bottle. They look and found mineral added water is mentioned on bottle. Suddenly one of the student replied water contain minerals (sodium, potassium in less amount, *here we don't discussed more about mineral*) so it is also solution. Here I tried to lighten on the same and since it was around 12:50 pm we concluded and ended two day activities by touching initial perception about solute and solvent, responses of the students, describing the whole process and highlighting the key & core concept of the solute, solvent and solution chemistry.

Precautions during activity/experiment:

- All the activities should be guided in the presence of any guide or facilitator.
- Don't taste any substances it can be harmful for health.
- Before experiment ensure yourself that all the using apparatus are clean.
- Don't stir the solution with pen (which children did in this activity that can change your results) if possible use the glass rod.
- Don't mix the matters with the hand directly but use individual paper for this purpose.
- After performing one activity clean your hands and apparatus for minimizing the errors.
- After performing experiments clean your hands with soap or detergent.

Overall learnings

- Opportunity to express, to think, to respect ideas, to perform, to share, to predict are the key and fundamental aspects of learning.
- Initiating activity with prior understanding and experiences of the students always be meaningful for creating background for the activity and connecting students with the processes.
- This was the first implementation or experimentation of the planned thought experiment which gave me a lot of learnings, insights and dimensions for understating Solute, Solvent and Solution Chemistry.
- During planning I did not expect such kind of marvelous thoughts and explanation of the students which they gave during activity. Those low voices ideas were like wonder for me.
- If you involve yourself with the whole process it gives you a lot of working dimensions, scope for understanding alternate ideas, scope for developing low and easily available resources and to experience the process as well as understanding nature of science.

Solution vs Mixture

Here we discussed about solute-solvent-solution, interaction between solute and solvent, dilution i.e. concentrated or diluted solution as relative term and so as. We tried to build a fundamental conceptual understanding regarding Solute, Solvent and Solution Chemistry. We performed activities by using numerous substances and categorized them under Solution but perhaps they might be mixture or anything else. We glow the spark for learners thinking, finding and exploring the different Separation Techniques for the separation of various substances as separation of sugar from sugar solution, separation of salt from salt solution etc. In the next part we will discussed on Different Separation Techniques, criteria of separation and later on Mixture and comparative study for mixture and solution. Till now you can explore on your own.

