# EXPERIENCE OF TEACHING ABOUT THE COMPONENTS OF THE AIR AT THE ELEMENTARY LEVEL

**Anjni Koul**
*Assistant Professor*
Department of Education in Science and Mathematics
National Council of Educational Research and Training
New Delhi

While teaching in Class VIII of a rural Government Middle School during a field visit, the author found that students were confused between air and oxygen. This paper shows the attempt made to help the students realise that the air is a mixture of various gases. The major components of air are nitrogen, oxygen, carbon dioxide, water vapour and various other gases. These components have special characteristics. Although air is invisible, it is possible to show how each component of the air can be identified by performing activities.

## Introduction

During a field visit, the author decided to go to a rural school in Haryana for a period of three months to transact the concepts given in the science textbooks, developed by NCERT in the light of National Curriculum Framework (NCF-2005). The author wanted to observe whether children are able to comprehend the concepts given in the textbooks, which would have actually given feedback about the textbooks and ultimately would have been helpful in revising these textbooks.

In a Government Middle School in Haryana, the author interacted with children of Upper Primary Stage, i.e., Classes VI–VIII. In the present paper the author wants to share one of her experiences while interacting with Class VIII students on the topic[16] Components of Air" (NCERT, 2006).

## Interaction with Class VIII Students– A View

During the discussion I asked the students, "Do we inhale the air while breathing?"

**Students**: No, we inhale only oxygen and exhale carbon dioxide.

**Me:** From where do we get oxygen?

**Students:** The air

**Me:** Does this mean our noses have masks which filter oxygen from the air, which we breathe?

**Students:** (Laughing) "No madam".

I noticed that students are confused between the air and oxygen, because they were not realising that oxygen is one of the components of the air.

Here I was concerned about their understanding of the components of the air. However, components and composition of the air are usually covered in Class VI textbook.

**Me:** Do you know which components make up the air?

**Students:** (Saying with hesitation) Carbon dioxide and oxygen.

**Me:** You are right but along with carbon dioxide and oxygen, there are other gases also which the are present in the air. Let us find out.

I decided to discuss about the composition of the air and demonstrate the presence of various components of the air.

Next day I went to the class with the following materials:

Candles, beaker, copper sulphate, calcium hydroxide, testtube, straw, rubber cork with hole, match box, glass tumbler, water and ice.

## Presence of Oxygen in the Air

I lighted two candles [Fig.1] and placed them on the table and asked the students "Which component of the air helps in burning?"

**Students**: The air

**Me:** (Reinforcing) but which component of the air?

**Students**: (Silence..... No answer).

[Here, it was important for me to tell them that it is oxygen present in the air which helps in burning].

**Fig.1: Burning of candles**

**Me**: What will happen to the burning candle if we do not supply air/oxygen? Let us find out.

**Fig.2: Beaker Placed Over Burning Candle**

Rahul (a student) placed a beaker over one of the burning candles [Fig. 2].

**Sunder:** Oh! It is still burning.

**Puja:** (A few seconds later) It got extinguished (Fig.3).

**Fig.3: Candle got extinguished**

**Me:** Why did it take a few seconds for a candle to extinguish?

**Jaychand:** May be some air was trapped inside the beaker.

**Rahul:** I think oxygen which was present in the air is over. That is why the candle got extinguished.

**Me:** Very good. So what have we understood from this activity.

**Students:** Oxygen is present in the air and it helps in burning.

**Me:** Good. So, you all will agree that this proves that oxygen is one of the components present in the air. Now, can you think is there anything else present inside the beaker?

**Students:** There is nothing inside the beaker except candle.

Here I deliberately did not want to talk about other components of the air. I wanted them to explore themselves, so I continued further.

## Air Contains Carbon dioxide

**Me:** You have said earlier that the air contains carbon dioxide and we also exhale carbon dioxide. Let us prove it.

I took a little amount of lime water (which I prepared by dissolving calcium hydroxide in distilled water) in the test tube and set up the apparatus as shown in the Fig. 4.

**Fig.4: Testtube Containing Lime Water**

I asked children to exhale air into the test tube containing the lime water (Fig.5).

**Fig.5: Exhaling Air in Lime Water**

**Students**: Wow! It is turning milky (Fig.6).

**Fig. 6 : Lime Water Turning Milky**

**Fig. 7: Testtube Containing Milky Lime Water**

**Me:** Lime water turned milky (Fig.7). This shows the presence of carbon dioxide in exhaled air.

I also told students to leave freshly prepared lime water outside for few hours. Next day they were surprised to see that lime water turned milky. This shows presence of carbon dioxide in the air.

## Presence of Water Vapour in the Air

I told children to take half a glass of water and clean it from outside with a piece of cloth. I asked them to add some pieces of ice into the water and told them to observe carefully.

**Fig.8: Appearance of Water Droplets on Outer Surface of Glass Tumbler Containing Iced Water**

**Me:** Can you see any changes on the outer surface of the glass tumbler?

**Students:** We can see some water droplets on the outer surface of glass tumbler (Fig.8).

**Me:** From where do water drops appear on the outer surface of glass tumbler?

**Sunder:** From the water contained in the glass tumbler.

**Laxmi:** May be from the air.

**Me:** Yes. The cold surface of the glass tumbler containing iced water cools the air around it and the water vapour of the air condenses on the surface of the glass tumbler.

I performed one more activity by involving children to prove that water vapour is present in the air.

I took copper sulphate crystals in a test tube (Fig.9) and heated it (Fig.10) and asked children to observe carefully.

Fig.9: Testtube Containing Copper Sulphate

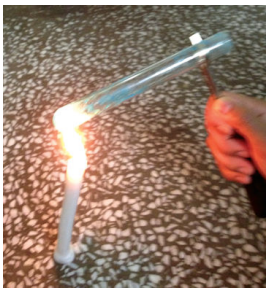

Fig.10: Heating Copper Sulphate

**Students**: Blue colour of copper sulphate is disappearing and it is turning white (Fig.11).

**Me:** Good. Can you observe anything else in the test tube?

Most of the students said "Nothing", except one student.

Fig.11: Disappearance of Blue Colour of Copper sulphate

**Rahul**: Yes, I can see some drops of water on the inner surface of the test tube (Fig.12)

**Me**: Where have these drops of water come from?

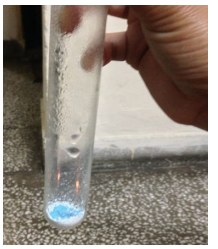

Fig. 12: Showing Presence of Water Drops

**Students:** Most of the students had blank looks.

**Pooja:** From the atmosphere

**Students**: Yes. Pooja is right.

They repeated what Pooja said "From the atmosphere"

**Me**: Can you think of any other answer?

**Manju**: May be the material that you have taken in the testtube contains water.

**Me**: Great. Water molecules are present in copper sulphate crystals. You will study about this in detail in higher classes. On heating copper sulphate, this water is removed which you could see in the test tube. On removing water, copper sulphate crystals turned white in colour.

**Me**: Is it possible for copper sulphate crystals to get the water back? Let us find out. Keep this copper sulphate in open for some time and observe.

**Students**: It is changing its colour and is retaining its original blue colour back.

**Me:** Can you give reason for what you have observed?

**Students**: May be it is getting its water back.

**Me**: Yes, but from where?

**Laxmi**: May be from the air.

**Me**: Well done. Copper sulphate has trapped water from the air. Since this is a rainy day, copper sulphate took less time to retain its colour. Otherwise it takes little longer.

This proves that the air contains water vapour.

After this discussion, I told one of the students to write all the components of the air which we have identified so far on the blackboard. To show students responses, I also drew a pie chart of air composition on the blackboard (Fig.3.13).

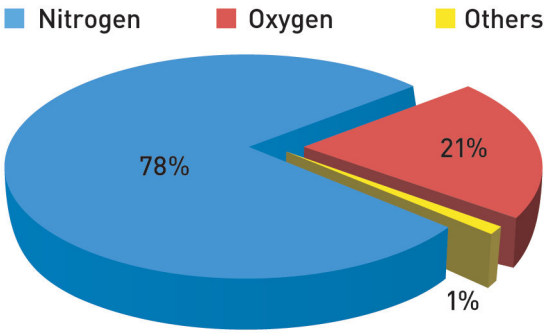


**Fig.13 : Composition of the Air**

**Students:** Madam you have shown in the Fig. 13 that the air contains nitrogen which we have not identified so far.

**Me:** Nitrogen and other gases, such as argon are non-reactive gases. Recall the activity "Burning of Candle", where oxygen gas was used in burning. However, nitrogen and other gases do not help in burning.

I showed them bloated packet of potato chips and asked them "Can you guess which gas is present in this packet?"

**Students**: The air. We mean oxygen


**Me:** It is filled with non-reactive gas such as nitrogen. It is a major component of air as you can see from the Fig. 3.13. If we fill this packet with air, the oxygen present in this air will make the oil rancid present in the chips and these will taste bad. To keep these chips fresh they are flushed with nonreactive gas, such as nitrogen.

After this discussion students did not give me time to ask and they concluded that major components of the air are nitrogen, oxygen, water vapour, carbon dioxide and other gases.

**Pooja:** Oh! Now I have understood that oxygen gas was used for burning candle and the other gases which were present inside the beaker could be nitrogen, carbon dioxide, water vapour, etc.

I could see the confidence on their faces and the joy of learning more and this journey on the path of education continued.

# References

NCERT. 2005. *National Curriculum Framework*. NCERT, New Delhi.

___. 2006. *Science* for Class VI. NCERT, New Delhi.