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## CHAPTER 52

# USING MINI- ANCHOR CHART TO ENHANCE STUDENTS WITH VISUAL IMPAIRMENT UNDERSTANDING OF STATES OF MATTER IN CHEMISTRY IN AN INCLUSIVE CLASSROOM

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### **Introduction**

The development of any nation is connected to the educational system in operation. With specific reference to secondary education, it is the intermediary between primary and tertiary education which is responsible for the production of manpower for the overall development of a nation. In a developing country like Nigeria, the importance of science and technology cannot be overemphasized, as science and technology provide the basis for sound socio-economic and structural development of any country. Chemistry is at the center of all science subjects and regarded as the king of most science and technological activities (Achimugu, 2017). Chemistry is one of the science subjects which students are required to pass at credit level at the Senior Secondary School (SSS) level in Nigeria, in order to be admitted into higher institutions to study professional courses like Chemical Engineering, Pharmacy, Medical Laboratory, Petroleum Engineering, Medicine and Industrial Chemistry, among others. Chemistry is a branch of science concerned with the substances of which matter is composed, the investigation of their properties and reactions and the use of such reactions to form new substances. Chemist define matter as anything that has mass and occupies space. Matter and its behavior are studied on what is called the macroscopic level in which observation are made of phenomena. These observations are explained using theories and models. One theory, the kinetic molecular theory, has been particularly powerful in explaining chemical and physical changes. Matter usually exists in three states, solid, liquid and gas in an environment where students with visual impairment live every day. Matter is composed of particles. Differences in solids, liquids and gases can be explained by the proximity and bonding to the students with visual impairment



However, difficulty in learning Chemistry has been established by a number of research works (Woldeamanuel, Atanga and Engid, 2014). The subject has been described as a difficult, complex and abstract subject for secondary school students to learn. Lack of conceptual understanding has been identified as one of the major reasons for students' dismal performance in Chemistry (Gongden & Delmang, 2016). Also, one of the reasons students find gases an aspect of states of matter difficult to relate to is because they are often invisible but found all around. However, Osman & Sukor (2018) opined that students difficulties in Chemistry is as a result of them coming to class with alternative conceptions and perhaps rearrange or refuse them to form new concepts. Despite the importance of Chemistry in national development especially in the area of states of matter the teaching and learning of Chemistry to students with visual impairment for conceptualization of the concepts in the subject has constantly remained unimpressive, Efforts have to be intensified to improve the conceptualization of Chemistry concepts by students with visual impairment, Both Chemistry teachers and special teachers are challenged to search for the most innovative tools to use in teaching Chemistry to students visual impairment in order to achieve the goals of Chemistry education. That is why, it is necessary to enhance the conceptual understanding of Chemistry to students with visual impairment so that they too will contribute maximally to the growth of this country. In this case, in the area of states of matter in Chemistry through the use of mini anchor chart to enhance their conceptual understanding. To enhance, means to intensify or improve the quality of teaching -learning of Chemistry concepts delivered to students with visual impairment. This can be achieved by the use of mini anchor charts in an inclusive classroom. Anchor charts are instructional tools displayed in the classroom for students to reference. They provide information to support a lesson the teacher has taught. Ashley (2021) defined anchor chart as an artifact of classroom learning. The author said, like an anchor, it holds students' and teachers' thoughts, ideas and process in place. Anchor charts can be displayed as reminders of prior learning and built upon over multiple lessons. With the use of the mini anchor chart, the Chemistry teacher and special teacher simply put, an inclusive classroom in a general education classroom where students with or without impairment learn together. It encourages diversity. There are different impairments in human beings. They include: visual impairment, physical impairment, hearing impairment, intellectual impairment etc. This chapter specifically looks at visual impairment only. Visual impairment simply refers to a wide range of vision loss which includes those that cannot see at all total blindness, to those who have some residual sight or low vision (Williams, C. 2016). Visual impairment therefore, has been classified into many groups. It has been classified into low vision and total blindness as stated above. It can take many forms and exist in varying degrees. This is determined through the test of visual acuity of an individual using the Snellen chart result in meters and in feet. The Snellen test result as presented here in meters and its equivalent in feet in brackets state that 20/30 to

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20/60 (6/12 to 1/18) measure is mild visual impairment. A test result of 20/70 to 20/160 (6/18 to 6/60) is moderate visual impairment. Visual acuity of 20/200 to 20/400 (6/60 to 3/60 and worse blindness) is severe visual impairment where WHO ends its classification. Others are visual acuity of 20/500 to 20/1000 is profound visual impairment. Less than 20/1000 is considered as near total impairment. Those that their test result is no light perceptions are considered total impairment or total blindness. Also, when one's visual field is 20 degrees or less remaining is considered legally blind (WHO, 2021). Therefore, when a teacher is preparing to teach students with visual impairment, the teacher would prepare for wide range of students with different categories and degrees of visual impairment. The thesis statement of this paper, includes the following:

Enhancing the conceptual understanding of states of matter to students with visual impairment using the mini - anchor charts.

Benefits of teaching students with visual impairment using mini - anchor charts.

How to use mini - anchor charts to teach students with visual impairment.

Challenges of teaching students with visual impairment in an inclusive classroom.

Implications of teaching students with visual impairment using mini - anchor chart.

### **Enhancing the Conceptual understanding of States of Matter to Students with Visual Impairment using the mini anchor charts.**

Students with visual impairment can do all school activities and tasks that their sighted peers do in all subject areas including Chemistry, except that they do them in different ways, using different methods and materials (Cicerchia, & Freeman, 2022). The medium of reading and writing for those that are totally blind is braille instead of print. Those of them that have low vision use large print. Most often instructions for students with visual impairment are better delivered through experiential learning where real life situations are presented for they are expected to hold and feel any living or nonliving thing that is harmless. (for example, life animal that is harmless is used instead of a model) In the absence of real-life situation, the instruction could be presented through three-dimensional form (model of an animal) rather than from pictures. It is when picture is the only available option, that the teacher converts the picture to embossed form so that the student with visual impairment can feel the embossed picture tactilely.

Several similar efforts have been made to enable students with visual impairment succeed in accessing different subject areas especially in the sciences and particularly Chemistry. Special arrangement in terms of placement of students with visual impairment in the class are made. The student is placed to sit near the teacher as the teacher demonstrates an experiment. Students with visual impairment are given extra time in every task they are given to complete. This is because it takes longer to access information by sense of feeling. Whenever the teacher writes any information for the sighted students on the chalk or blackboard, there should be verbalization of all the writings on the chalkboard by the teacher.



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In other words, each time the teacher writes an information on the whiteboard or blackboard, the teacher says loud what he is writing in the process of the writing. Students with visual impairment are encouraged to make friends with their sighted classmates. This is because there is also the use of sighted reader by the student with visual impairment. The sighted friend can easily access print materials for his friend with visual impairment by reading out for him. All these activities involve accommodation and modification to meet the unique needs of students with visual impairment (Williams, 2016)

Looking at the importance of Chemistry as a subject, one is completely certain that the objectives are laudable to transform the students with visual impairment into logical thinkers to contribute in moving this country forward. Therefore, to ensure the realization of the above objectives, there is need for serious determination by secondary school Chemistry teachers to provide sighted students and their peers with visual impairment with a strong foundation by putting in place a strategic plan towards enhancing the conceptual understanding of Chemistry by the students in Nigerian schools. By so doing, this can meet one of the main objectives of Chemistry instruction in schools, which is the enhancement of conceptual understanding.

Gone are the days when Chemistry teachers just convey facts to students who passively take down notes and memorized to pass their examinations without understanding the concepts involved. In this 21<sup>st</sup> century, students with visual impairment must have to explore the world of Chemistry by understanding the concepts and at the same time be able to apply them in solving their everyday life challenges. This is necessary because these students with visual impairment live in the same society that everyone lives.

Researchers like Vavougios (2016) Watson and Michelle (2020) Grumbin and Alden (2006) and the process of adaptation, modification and accommodation used in teaching students with visual impairment have shown that, there can be great enhancement of conceptual understanding in Chemistry. The teacher creates an embossed Anchor Charts or Model for particles of solid, liquid and gas and display as reminders of prior learning and built upon over multiple lessons to meet the needs of students with visual impairment. The role of the teacher in the use of embossed mini- anchor chart or model of the particles of solid, liquid and gas for interaction with the students is not limited to the content of teaching but extends to a background coordination which stimulates students-teacher and student-student interactions. Perkins School for the Blind (2022) gave an idea by stating that to introduce students with visual impairments to the three states of matter, it could be achieved by examining tactile models illustrating the characteristics of particles in each state. Perkins School for the blind further stated that the diagrams that are used in print books to demonstrate the phases of matter frequently look like round balls or marbles. The particles in a solid are shown in a grid with the particles very close together. In the picture representing a liquid, the balls or marbles have more space between each one, and for gases the balls are drawn with even more space

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between them. This can be presented tactilely for students with visual impairment to touch as shown below:



Tactile representation of Matter by Perkins School for the Blind

#### **Benefits of teaching students with visual impairment using mini-anchor charts.**

- 1 The charts provide great visuals for sighted students and students with visual impairment access it by touch when embossed or presented in a model. This is a great tool for presenting the concept of Matter in Chemistry for both visually impaired and non-visually impaired students.
- 2 Both sighted students and students with visual impairment can be involved in its production. Students with visual impairment can use rubber mats and cello films to produce embossed version which helps them understand the charts better and makes it more likely for them to reference.
- 3 The charts help the teacher focused and organized throughout his/her lesson knowing what his/her anchor chart will look like helps him/her stay focused on the teaching point.
- 4 A mini anchor chart is a valuable re-teaching resource for the teacher, not only will the students refer to it while working but the teacher can re-teach a skill without having to create a new chart.

#### **How to use Mini-anchor charts to teach students with visual impairment.**

- 1 Reference them often, if the teacher references them during lessons as he/she is teaching students will too.
- 2 Keep students accountable - Direct students to relevant chart and embossed chart and models. Ask them to correct their work (for example stating the types of physical and chemical changes sometimes with the support of a sighted guide or special computer software called "Be my eye" where a group of registered expert volunteers all over the world read snapped objects, diagrams or chemical changes sent by persons with



- visual impairment. They are experts in describing exactly what has been sent to them on phone like chemical changes to the person with visual impairment and also punctuation or editing anchor chart).
- 3 Play why chart? Give your students a scenario and ask them to find the chart that may help.
  - 4 Make teaching mini-charts; take a picture of your charts and keep them in a binder keep ones that are relevant to your current lesson in a folder that you can carry with you during teacher/students' conferences with cell phones, today blind persons can take pictures.
  - 5 Make students mini-charts and braille versions for students with visual impairment. You can print out small versions of important charts and have students glue them into their notebooks, symbols and states of matter. These become handy tools for them while they are working.
  - 6 Create a new anchor chart and the embossed version model. At the end of a lesson, display all of the charts and the embossed or models created during that lesson and have students help them condense the points into one new chart or model that will replace all others.

**Changes of Matter**

Physical	Chemical

**States of Matter**

Matter is anything that takes up space. Everything can be categorized into the three different states of matter. Matter can change its state when it experiences a change in temperature and/or pressure.

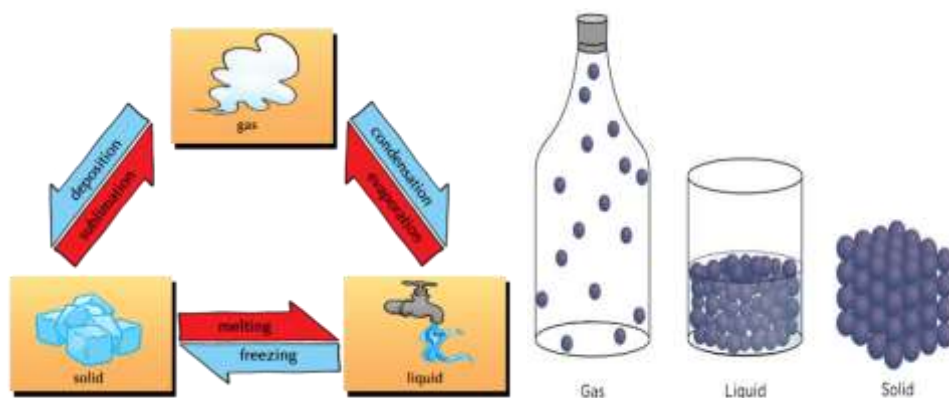
**Liquid**

melting / freezing (to/from Solid)  
evaporation / condensation (to/from Gas)

**Solid**      **Gas**

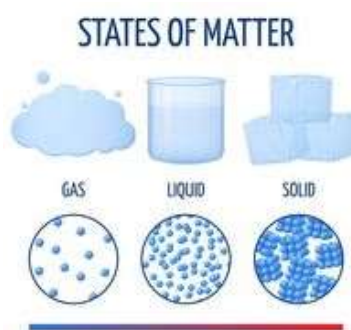
sublimation / deposition (to/from each other)

Solid	Liquid	Gas
A solid has a definitive shape and volume. Its molecules are tightly packed.	A liquid has a definitive volume but it takes the shape of its container. It has loosely packed molecules.	A gas takes the volume and shape of its container. Its molecules are very loosely packed.



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**Mini - Anchor Charts on States of Matter displayed in a Chemistry class. These can be embossed with the support of a resource person**  
Source: (The Weird Science teachers)

**Challenges of teaching students with visual impairment using the mini anchor charts in an inclusive classroom.**

The challenges Chemistry teachers encounter in teaching students with visual impairment include the following;

- 1 Lack braille skills among Chemistry teachers teaching students with visual impairments.
- 2 Lack of the use of innovative teaching strategies that can help the students with visual impairment.
- 3 Safety of students with visual impairment is not guaranteed since they cannot see, therefore can't read the labelled bottles of reagents and some the reagents are harmful example concentrated acid which is corrosive it burn.
- 4 In putting acid inside the burette, students with visual impairments cannot take the burette readings on their own because they cannot see, they have to rely on their sighted class mates which makes them to miss the fun of the exercise.



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## Implications of teaching students with visual impairment using mini anchor charts

The use of mini- anchor charts and communication Technology has brought changes in many ways. It has not only affected how mini – anchor charts are designed and delivered, but also how teachers apply the use of mini –anchor charts in classroom context. Resourcepersons having successfully designed appropriate charts, it will make learning real and also facilitates the learning process. This implies that students with visual impairment will understand the concept of matter and other chemistry concepts better. This may motivate them to take Chemistry and or other science courses at the higher education level of education.

### Conclusion

States of matter is a very important pre-requisite for understanding other chemical concepts such as Boyle’s law, Charles law, Gay Loussac’s law, Avogadro’s law, and ideal behavior, empirical derivation of gas equation, Avogadro’s number and ideal gas equation and Chemical thermodynamic. Past research evidences in teaching Chemistry have shown that the use of mini- anchor chart has critical inputs into the teaching of Chemistry (states of matter) to students with visual impairment. Chemistry teachers can use mini – anchor charts combined with talking tools, embossment and models because of the visual impairment to perfectly teach states of matter in Chemistry with the major goal of assisting students with or without disabilities learn as much as possible in states of matter and all Chemistry lessons.

### Suggestions:

- 1 The Chemistry teacher and the special teacher are to teach together cooperatively in the inclusive classroom,’
- 2 The Chemistry teacher and the special teacher are to use mini anchor charts to teach in the inclusive classroom.
- 3 The Chemistry teacher and the special teacher are to display many mini anchor charts in the inclusive classroom,
- 4 The apparatus should be calibrated in such a way that the students with visual impairment can touch and feel.

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