

## AWARENESS OF NANOSCIENCE AND NANOTECHNOLOGY AMONG SCIENCE TEACHERS IN SCIENCE AND TECHNICAL SCHOOLS IN FEDERAL CAPITAL TERRITORY ABUJA, NIGERIA

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**Abstract:** This study seeks to explore the awareness of Nanoscience and Nanotechnology among science teachers in science and technical schools. A survey lookup layout was adopted for the study. Two research questions and two hypotheses were defined to direct the examination. The populace comprised of 224 science educators and this likewise fills in as the example size for the examination. Instrument titled “Awareness of Science Teachers about Nanoscience and Nanotechnology Questionnaire)” with a reliability coefficient of 0.96 was used. Simple percentage and frequency counts were utilized to respond to the examination questions while Analysis of variance (ANOVA) was utilized to test the hypotheses. The findings from this investigation uncovered that science educators in science and technical schools are not aware of Nanoscience and Nanotechnology (NSNT). Similarly, the study additionally uncovered that science instructors in science and technical schools are not aware of the fundamental ideas upon which Nanoscience and Nanotechnology (NSNT) are based upon. Hence both hypotheses were rejected. In the light of this, it was recommended among others that the government, ministry of education, board of science and technical schools, stakeholders and policymakers in the education sector should organize programs like the K-12 Nanoscience and Nanotechnology project to train science teachers in secondary schools and science and technical colleges on NSNT and how to teach NSNT and its fundamental ideas in the classroom.

**Keywords:** Awareness, Science Teachers’, Nanoscience, Nanotechnology.

### 1. INTRODUCTION

Nanoscience and Nanotechnology is one of the quickest and most recent developing orders in the field of science resulting from Science, Technology, Engineering and Mathematics (STEM). STEM encompasses and embrace a variety of subjects or discipline that falls into each of the term in the acronym STEM.

Nanoscience and Nanotechnology (NSNT) can be educated all through most significant modules including material science, science, science, building, material sciences, medication and pharmaceuticals. The incorporation of major parts of NSNT in the study hall or instructive area may address, for instance, the physical universe of size, power, properties and time, however instructors should know.

Awareness is the capacity to straightforwardly know and see, to feel, or to be aware of occasions. All the more comprehensively, it is the condition of being aware of something (Smith, 2011). The degree of awareness about a relatively new field like Nanoscience and Nanotechnology depends critically, among other factors, such as the literacy rate of the population, Awareness created among different segments of the society by the scientific

community through different channels of communication and the general attitude of the public towards technical innovations.

The need to raise open and expert familiarity with Nanoscience and Nanotechnology (NSNT) has been surveyed in various investigations (Batt, Waldron and Broadwater 2008, Craig Cormick, 2009). In any case, none of these examinations tested the information on the degree of attention to science educators about Nanoscience and Nanotechnology in science and Technical schools and how to teach NSNT and its fundamental ideas in the classroom. The fundamental ideas of NSNT are reflected or contained in the current curriculum of science and Technical schools in Nigeria. Based on these Ideas it is possible to teach Nanoscience and Nanotechnology in Science and Technical Schools in order to facilitate a teaching learning sequence for Science and Technical schools' students. Hence, it is therefore important to carry out study on awareness of science teachers in science and technical schools about Nanoscience and Nanotechnology in F.C.T Abuja.

### **1.1 Statement of the Problem**

The need to raise student and academic staffs awareness about Nanoscience and Nanotechnology (NSNT) has been assessed in a variety of studies Bendala, Mehemed and Eid,(2014), Ahmed, Imdad, Yaldram and Raza,(2015). However, none of these researches probed into the expertise of the level of awareness on Nanoscience and Nanotechnology among science teachers in science and technical schools and its fundamental ideas in the classroom. Nigeria a developing country should not be left behind in the field of Nanoscience and Nanotechnology (NSNT) Education at the secondary school level. The awareness of science teachers about Nanoscience and Nanotechnology and its disciplinary perspective becomes highly necessary that is why this study was carried out.

### **1.2 Objective of the study**

The examination planned to accomplish the accompanying targets (i) To determine the level of awareness of science teachers about Nanoscience and Nanotechnology (NSNT).

(ii) To determine if science teachers are aware of the fundamental ideas of Nanoscience and Nanotechnology (NSNT).

### **1.3 Research questions**

1. What is the level of awareness of Science teachers about Nanoscience and Nanotechnology?
2. What is the level of awareness of Science teachers about the fundamental ideas upon which Nanoscience and Nanotechnology is based on?

### **1.4 Research Hypotheses**

The study tested the following null hypothesis at 0.05 levels of significances:

**HO<sub>1</sub>:** There is no significant difference in awareness of Science teachers about Nanoscience and Nanotechnology.

**HO<sub>2</sub>:** There is no significant difference in awareness of Science teachers about the fundamental ideas upon which Nanoscience and Nanotechnology is based upon.

## **2. LITERATURE REVIEW**

Zenner & Crone, 2008; Stevens et al., 2009 revealed that the most common concern is the impending lack of researchers, science teachers, engineers and different specialists with

specialization in Nanoscience and Nanotechnology. In many cases, however, the want for NSNT Education has been expressed with reference to scientific and/or technological literacy on concepts that have remained fantastically influential in curriculum development projects global (Holbrook, 2010). Educators and Researchers to have a multidisciplinary, interdisciplinary and Transdisciplinary perspective. The challenge before science teachers is that should NSNT be taught in the classroom as a multidisciplinary, interdisciplinary or Transdisciplinary modus. Identifying what principles to train is the job of the syllabus or curriculum, however the nature and structure of every concept, and how linked concepts relate to the real world, are usually poorly described and are left up to the teacher to decipher. Knowledge of disciplinary content, how to current and scaffold information, and appreciation about NSNT desires of college students and the persons within every type characterizes the complex, interwoven practice of teaching. Hence it is also essential in the context of exploring implications for instructing and mastering to reflect and represents a good sized shift in the way NSNT must be taught.

**3. METHOD / PROCEDURE**

A survey lookup design used to be used to discover out the level of attention of science teachers about Nanoscience and Nanotechnology (NSNT) in science and technical school in Abuja. The population consisted of 224 science teachers from five (5) Science and Technical Schools Purposive sampling techniques was used for selecting the schools for the study since the schools are few, widely spread across the various municipal councils in the Federal Capital Territory (FCT) Abuja and the schools can be conveniently covered, he tool for data collection became the questionnaire on awareness of Science teachers about Nanoscience and Nanotechnology in Science and Technical schools with reliability coefficient of 0.96. Simple percentage and frequency counts were used to answer the research question while Analysis of variance (ANOVA) was used to test the hypothesis.

**4. FINDINGS / RESULTS**

Table 1: % Response of Science Teachers Level of Awareness about Nanoscience and Nanotechnology

| S/<br>N | STATEMENT  | Nanotechnology                                    |   |   |   |   |                                       |
|---------|--|---|---|---|---|---|---------------------------------------|
|         |  | Ne<br>gat<br>ive<br>res<br>po<br>nse<br>(N.<br>A) | %<br>Ne<br>te<br>gat<br>ive<br>res<br>po<br>nse | Mo<br>de<br>te<br>resp<br>ons<br>e<br>(M.<br>A) | %<br>M<br>od<br>era<br>te<br>res<br>po<br>nse | Posi<br>tive<br>resp<br>ons<br>e<br>(A+<br>H.A<br>) | %<br>Posi<br>tive<br>resp<br>ons<br>e |
| 1.      | I have heard about the term Nanoscience and Nanotechnology | 14  | 75.0  | 3   | 1.6   | 43  | 23.1                                  |
| 2.      | I have not heard about Nanoscience and nanotechnology      | 17  | 96.9  | 1   | 0.5   | 6   | 3.2                                   |

|    |  |         |          |   |      |    |          |
|----|--|---------|----------|---|------|----|----------|
| 3. | Science teachers are aware of Nanoscience and Nanotechnology   | 14<br>5 | 78.<br>0 | 6 | 3.2  | 35 | 18.<br>8 |
| 4. | Science teachers are not aware of Nanoscience and Nanotechnology   | 17<br>1 | 91.<br>9 | 8 | 4.3  | 7  | 3.8      |
| 5. | Nanoscience and Nanotechnology cut across traditional sciences such as Physics, Chemistry, Biology, material science and so on.        | 13<br>8 | 74.<br>2 | 6 | 3.2  | 42 | 22.<br>6 |
| 6. | Nanoscience and Nanotechnology do not cut across traditional sciences such as Physics, Chemistry, Biology, material science and so on. | 17<br>9 | 96.<br>2 | 4 | 2.2  | 3  | 1.6      |
| 7. | The Nano is equivalent to one billionth $\frac{1}{1000,000,000}$ or 10 <sup>-9</sup>   | 13<br>5 | 72.<br>6 | 0 | 0    | 51 | 27.<br>4 |
| 8. | The Nano is not equivalent to one billionth $\frac{1}{1000,000,000}$ or 10 <sup>-9</sup>   | 18<br>6 | 10<br>0  | 0 | 0    | 0  | 0        |
| 9. | The nanometer is equivalent to one billionth of a meter $\frac{1}{1000,000,000}$ m or 10 <sup>-9</sup> m?                              | 13<br>5 | 72.<br>6 | 0 | 0    | 51 | 27.<br>4 |
| 10 | The nanometer is not equivalent to one billionth of a meter $\frac{1}{1000,000,000}$ m or 10 <sup>-9</sup> m?                          | 18<br>5 | 99.<br>5 | 0 | 0    | 1  | 0.5      |
|    | Average % of positive, moderate and negative response  | 85.65   |          |   | 1.50 |    | 12.84    |

Table 1 shows 12.84%, 85.65% and 1.50%. This indicates that science teachers in science and technical schools are not aware of Nanoscience and Nanotechnology.

Table 2: % Response of Science Teachers Level of Awareness about the fundamental Ideas upon Which Nanoscience and Nanotechnology is Based On

| S/<br>N | STATEMENT | Neg<br>ativ<br>e<br>resp<br>ons<br>e<br>(N. | %<br>Neg<br>ative<br>resp<br>onse | M<br>od<br>era<br>te<br>res<br>po<br>nse | %<br>Mo<br>de<br>ra<br>te<br>resp<br>ons<br>e | Po<br>siti<br>ve<br>res<br>po<br>nse<br>(A | %<br>Posit<br>ive<br>resp<br>onse |
|---------|-----------|---|-----------------------------------|--|---|--|-----------------------------------|
|---------|-----------|---|-----------------------------------|--|---|--|-----------------------------------|

|   |     | A)   |    | (M .A) |    | +H .A) |  |
|---|-----|------|----|--------|----|--------|--|
|   | F   | %    | F  | %      | F  | %      |  |
| 1. Science teachers are aware of the fundamental ideas of Nanoscience and Nanotechnology  | 136 | 73.1 | 6  | 3.2    | 44 | 22.7   |  |
| 2. Science teachers are not aware of the fundamental ideas of Nanoscience and Nanotechnology  | 177 | 95.2 | 8  | 4.3    | 1  | 0.5    |  |
| 3. The fundamental ideas of Nanoscience and Nanotechnology cuts across traditional science such as Physic, Chemistry, Biology and many more.        | 136 | 73.1 | 5  | 2.7    | 45 | 24.2   |  |
| 4. The fundamental ideas of Nanoscience and Nanotechnology do not cuts across traditional science such as Physic, Chemistry, Biology and many more. | 180 | 96.8 | 5  | 2.7    | 1  | 0.5    |  |
| 5. The fundamental ideas of Nanoscience and Nanotechnology are interdisciplinary  | 135 | 72.6 | 5  | 2.7    | 46 | 24.8   |  |
| 6. The fundamental ideas of Nanoscience and Nanotechnology are not interdisciplinary  | 178 | 95.7 | 8  | 4.3    | 0  | 0      |  |
| 7. The fundamental ideas of Nanoscience and Nanotechnology do not cut across traditional science  | 173 | 93.6 | 10 | 5.4    | 3  | 1.6    |  |
| 8. The fundamental ideas of Nanoscience and Nanotechnology present a challenge to curriculum planners, designers and developers                     | 151 | 81.2 |    | 3.2    | 29 | 15.6   |  |
| 9. The fundamental ideas of Nanoscience and Nanotechnology do not present a challenge to curriculum planners, designers and developers              | 170 | 91.4 | 5  | 2.7    | 11 | 5.9    |  |

|    |   |     |       |   |      |    |      |
|----|---|-----|-------|---|------|----|------|
| 10 | The interdisciplinary nature of the fundamental ideas of Nanoscience and Nanotechnology calls for curriculum inclusion of Nanoscience and Nanotechnology          | 140 | 75.3  | 4 | 2.2  | 42 | 22.6 |
| 11 | The interdisciplinary nature of the fundamental ideas of Nanoscience and Nanotechnology does not calls for curriculum inclusion of Nanoscience and Nanotechnology | 178 | 95.7  | 4 | 2.2  | 4  | 2.2  |
| 12 | The ideas of Nanoscience and Nanotechnology are the fundamental basis for Nanoscience and Nanotechnology  | 139 | 74.7  | 8 | 4.3  | 40 | 21   |
| 13 | The ideas of Nanoscience and Nanotechnology are not the fundamental basis for Nanoscience and Nanotechnology  | 179 | 96.2  | 3 | 1.6  | 4  | 2.2  |
|    | Average % of positive, negative and moderate responses  |     | 85.70 |   | 3.20 |    | 11.1 |

Table 2 shows 11.1%, 85.70% and 3.20%. This indicates that science teachers in science and technical schools are not aware of the fundamental ideas upon which Nanoscience and Nanotechnology is based on.

Table 3: ANOVA comparison of the level of awareness of Science teachers about Nanoscience and Nanotechnology

| Source variation | Sum of Squares | df  | Mean Square | F     | Sig. |
|------------------|----------------|-----|-------------|-------|------|
| Between Groups   | 731.298        | 5   | 146.260     | 3.653 | .004 |
| Within Groups    | 7206.164       | 180 | 40.034      |       |      |
| Total            | 7937.462       | 185 |             |       |      |

Table 3 presents ANOVA results that yielded an F- value of 3.653 and a P-value of 0.004 ( $P < 0.05$ ). The result shows significant difference in awareness of Science teachers about Nanoscience and Nanotechnology because  $P < 0.05$ . Therefore, hypothesis one ( $H_{O1}$ ) was rejected.

Table 4: ANOVA comparison of the level of awareness of Science teachers about the fundamental ideas upon which Nanoscience and Nanotechnology is based on

| Source of variation | Sum of Squares | Df  | Mean Square | F     | Sig. |
|---------------------|----------------|-----|-------------|-------|------|
| Between Groups      | 869.931        | 5   | 173.986     | 2.956 | .014 |
| Within Groups       | 10595.730      | 180 | 58.865      |       |      |
| Total               | 11465.661      | 185 |             |       |      |

Table 4 presents ANOVA results that yielded an F- value of 2.956 and a P-value of 0.014 ( $P < 0.05$ ). The result shows significant difference in awareness of Science teachers about the fundamental ideas upon which Nanoscience and Nanotechnology is based on because  $P < 0.05$ . Therefore, hypothesis two ( $H_{O2}$ ) was rejected.

## 5. DISCUSSION OF FINDINGS

This study explored the awareness of Nanoscience and Nanotechnology among science teachers in science and technical schools in Abuja. The level of awareness of Science teachers about Nanoscience and Nanotechnology and also the level of awareness of Science teachers about the fundamental ideas upon which Nanoscience and Nanotechnology is based on was the concern of the study. The findings from this investigation uncovered that, science educators in science and technical schools are not aware of Nanoscience and Nanotechnology (NSNT). Similarly, the study additionally uncovered that science instructors in science and technical schools are not aware of the fundamental ideas upon which *Nanoscience and Nanotechnology (NSNT)* is based upon. This study is not in concurrence with the findings of Ahmed, Imdad, Yaldrum and Raza, (2015) who examined the level of awareness and the attitude towards Nanotechnology (NT) among the students and teachers of some higher Educational institutions of Islamabad, Pakistan which revealed a high level of awareness about Nanoscience and Nanotechnology both among teachers and students. This is a true reflection of the ignorance of science teachers about Nanoscience and Nanotechnology (NSNT). The implication of this is that, science teachers might be ignorant of the incorporation of major parts of NSNT in the study hall or instructive area may address, for instance, the physical universe of size, power, properties and time, however instructors should know. This study has increased the level of awareness of science teachers in Nanoscience and Nanotechnology (NSNT) and it is hope that science teachers will put more efforts in teaching Nano-related science concepts due to its importance in the 21<sup>st</sup> century. The degree of awareness about a relatively new field like Nanoscience and Nanotechnology depends critically, among other factors, such as the literacy rate of the population, Awareness created among different segments of the society by the scientific community through different channels of communication and the general attitude of the public towards technical innovations. In Nigeria the education environment is not favorable for new innovations of this kind at the secondary levels however this study is an attempt to create awareness and move forward to motivate instructor to look in that direction of teaching students Nano related concepts due to its enormous importance.

## 6. CONCLUSION

In this study it is cleared that the awareness among science teachers of Nanoscience and Nanotechnology (NSNT) at the secondary school level is absent therefore affecting Nano-related science concepts dissemination which in turn hinders Nanoscience literacy. The need to raise open and expert familiarity with Nanoscience and Nanotechnology (NSNT) since the fundamental ideas of NSNT are reflected or contained in the current curriculum of science and Technical schools in Nigeria. Based on these Ideas it is possible to teach Nanoscience and Nanotechnology in Science and Technical Schools in order to facilitate a teaching learning sequence for Science and Technical schools' students. Hence, it is therefore important to carry out study on awareness of science teachers in science and technical schools about Nanoscience and Nanotechnology in F.C.T Abuja

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