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# A Study of Students' Understanding of the Concept of Hybridization in Chemistry

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**Abstract**
The main purpose of this study was to examine National Diploma (ND) students' understanding of the concept of hybridization in chemistry. The design adopted was the correlation survey. The sample for the study comprised of 25 NDI and 25 NDII students randomly selected based on their interest to participate in the study. The instrument for data collection for the study was a four-item multiple choice question. The method of data analysis employed were mean, frequency, percentages and linear regression analysis. Hypothesis was tested at 0.05 level of significance. The study revealed that both NDI and NDII students have a low level of understanding of hybridization in chemistry. Findings were interpreted in terms of the need to devise appropriate ways of teaching abstract concepts in Chemistry to students.

**Key words**: Concept, correlation survey, hypothesis, interest, sample

## Introduction

Concepts are building blocks with which we think and derive meaning from verbal communication. Concepts are ideas and information which we have abstracted about common properties of objects, events, experience and people (Bruner, 1961). According to Socrates' theory of knowledge, knowledge is derived through concepts and that reason is the source of concept.Hence reason is the source of knowledge and a common quality of all people (Erasmus, 2005).

The relationship between concept, reason, and knowledge is shown in the figure below:

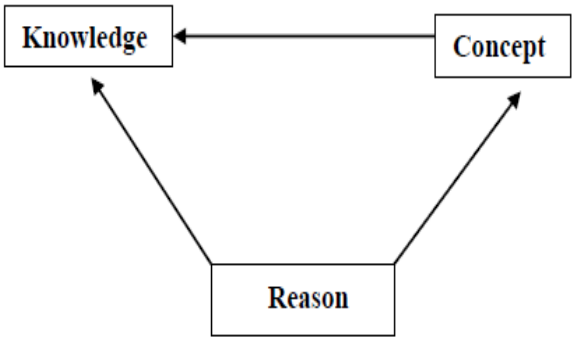


**Figure 1**; Relationship between concept, reason and knowledge.

Concept is defined as the individuals' idiosyncratic mental representation.(Britanica, 1980). Studies have revealed that students bring with them to science lessons certain ideas,

notions and explanations of natural phenomena that are inconsistent with the ideas accepted by the scientific community. These existing ideas are often strongly held, resistant to traditional teaching and form coherent though mistaken conceptional structure (Finn *et al*., 2005). Students may undergo instruction in a particular science topic, and yet do not change their ideas pertaining to the topic even if these ideas are in conflict with the scientific concepts they are taught (Pashler *et al*., 2004).

Concept in science alongside skills and contents etc need a special planning of classroom instruction by incorporating strategies that challenge students' conceptions in order to engender more meaningful understandings. Without concepts, cognition function would be impossible. The very act of grouping, isolating and labeling on the basis of common properties describes basic concept formation.

Concepts differ in many ways, some are based on concrete objects e.g. aero plane, such a concrete concept is easy to learn because the children can see, touch and hear the aero plane. Some concepts are more difficult to learn because they are much abstractly based. Examples include; the concept of justice, kindness, hybridization in chemistry etc. such concepts are learnt through special instruction. Specifically concepts are important because they make possible and meaningful the following: Thinking; Use of language; Communication; Problem solving and creativity (Danjuma, 2005).

It is against this background that this study is being carried out. Such study will provide more light on the job of the teacher to guide the students to clarify their concepts in such a way that their thinking, use of language, communication, problem solving and creativity are made possible and meaningful.

**Statement of the Problem**

The concept of hybridization is abstract in nature and hence difficult learn and yet it is important in chemistry. An attempt was made in this study to find out National Diploma (ND) students understanding of the abstractly based hybridization in chemistry which will provide useful information to teachers in planning of classroom instruction by incorporating strategies that challenge students' conception in order to engender more meaningful understanding.

**Purpose of the Study**

The general purpose of this study is to find out the students' understanding of the concept of hybridization in order to provide useful information to teachers in the planning of classroom instruction that change or modify the scientifically unacceptable conception held by students. Specifically the study attempts to find out NDI and NDII students' understanding of the concept of hybridization in chemistry.

**Objectives of the Study**

The study sought to achieve the following objectives:

To determine the level of NDI students' understanding of hybridization in chemistry.

To determine the level of NDII students' understanding of hybridization in chemistry.

To determine the extent to which ND students' academic level influences their understanding of hybridization in chemistry.

**Research Questions**

1. What is the level of NDI students' understanding of the concept of hybridization?
2. What is the level of NDII students' understanding of the concept of hybridization?
3. What is the extent of influence of ND students' academic level on their understanding of the concept of hybridization in chemistry?

**Hypothesis**

$H_O$ There is no relationship between ND students' understanding of the concept of hybridization and their academic level.

**Significance of the Study**

The result of this study will help teachers to guide the students to clarify their concepts i.e. planning a classroom instruction by incorporating strategies that challenge students' conception in order to engender more meaningful understanding.

**Scope of the Study**
The study covers the concept of hybridization in chemistry at National Diploma level in the Polytechnic.

**Definition of Terms**
Hybridization: The mixing of two or more atomic orbital of different energies to form new (hybrid) orbital with identical energies.
Atomic Orbital: This is a region in space around the nucleus of an atom where electrons are likely found.
ND: National Diploma year one.
NDII: National Diploma year two.
NCE: National Certificate of Education
DLS: Distance Leaning Study.
TTTP: Technical Teachers Training Program.
NERDC: Nigerian Educational Research and Development Council.

**Methodology**

**Research Design**
A correlation survey design is adopted in this study. This is because the study seeks to find out the students' understanding as well as determine whether a linear relationship exists between academic level and students' understanding.

**Area of the Study**
The study was conducted in the Federal Polytechnic Bauchi, Bauchi State.

**Population of the Study**
The target population for the study comprises of NDI and NDII students in the department of Food Science and Technology, Architecture, Nutrition and Dietetics, and Agricultural Technology.

**Sample and Sampling Techniques**
The sample for the study consists of 50 students, 25 NDI and 25 NDII randomly selected based on the students interest to participate in the study.

**Instrument for Data Collection**
The data for this study was collected through the administration of multiple-choice questions developed by the researcher with help of the supervisor and validated by mal. Hussein G. U. of chemistry program, Abubakar Tafawa Balewa University. The instrument covers the basics of hybridization, hybridization and application of hybridization. It contains 24 items of 4 response option.

**Method of Data Collection**
The data was collected through the administration of the multiple-choice questions by the researcher with the help of 3 colleague teachers as research assistants in the Federal Polytechnic Bauchi, Bauchi State.

**Method of Data Analysis**
The methods of data analysis employed in this study are; Frequency, Percentage and Linear Regression Analysis.The frequency and percentage were used to assess the level of students' understanding of the concept of hybridization, while the linear regression analysis was used to determine the relationship between the students' academic level and their understanding of the concept of hybridization in Chemistry.

**Data Analysis**

**Research Question One**
What is level of ND1 students' understanding of the concept of hybridization in chemistry?

**Table 1: ND I & II Students Performance in basics of Hybridization in Chemistry.**

| Test Item | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| % Score | NDI | 22 | 16 | 12 | 32 | 08 | 12 | 08 | 10 |
| | NDII | 21 | 16 | 32 | 16 | 52 | 52 | 54 | 45 |

**Table 2: ND I & II Students Performance in the Concept of Hybridization in Chemistry.**

| Test Item | | 10 | 11 | 12 | 13 | 14 | 15 | 1 6 | 17 |
|---|---|---|---|---|---|---|---|---|---|
| % Score | NDI | 32 | 16 | 08 | 12 | 12 | 08 | 30 | 22 |
| | NDII | 60 | 52 | 52 | 32 | 28 | 44 | 40 | 35 |

**Table 3: ND I & II Students Performance in application of Hybridization in Chemistry.**

| Test Item | | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|
| % Score | NDI | 30 | 33 | 15 | 10 | 12 | 15 |
| | NDII | 55 | 60 | 45 | 40 | 49 | 52 |

ND 1 Students' response to the test instruments; students' understanding of the concept of Hybridization in Chemistry (SUCHC) : The percentage of ND 1 students who ticked the correct option for the 8 test items are 22%, 16%, 12% 32%, 08%, 12% , 08%, and 10% respectively(Table 1). This indicates that ND 1 student have low level of understanding of the concept of hybridization in Chemistry. The result have also indicated that ND 1 students have low level of understanding of the concept of hybridization as the percentage of students who ticked the correct options are 32%, 16%, 08%, 12%, 12%, 08%,30%, and 22% respectively (Table 2). The result also showed that ND 1 students have low level of understanding to apply hybridization to solve problems Table 3, (Frankena *et al*., 2002).

**Research Question Two.**

What is the level of ND11 students' understanding of the concept of hybridization in chemistry?

ND II Students' response to the test instruments; students' understanding of the concept of Hybridization in Chemistry (SUCHC) indicates that student who ticked the correct option for the 8 items were 21%, 16%, 32%, 16%, 52%, 52%, 54% and 45%, respectively (Table 1) The result indicted that NDII students have better understanding of the basics of hybridization than NDI students. The percentage of students who ticked the correct option on hybridization proper are 60%, 52%, 52%, 32%, 28%, 44%, 40% and 35% respectively. The result showed that NDII students have a moderate level of understanding of hybridization in chemistry.

The result from the responses of NDII students to items 19, 20,21, 22, 23 and 24 showed that NDII students have a moderate level of understanding of application of hybridization in chemistry to solve problems, Table 3 (Frankena *et al*., 2002).

**Research Question Three**

What is the extent of influence of ND students' academic level on their understanding of the concept of hybridization in chemistry?

From Tables 1 & 2 above the academic level of the students has significant influence on their understanding of the concept of hybridization in chemistry. The table showed that the level of understanding of the concept of hybridization in chemistry for the 16 items ranges from very low to low level only. But for ND11 the level ranges from low, moderate, and high. Therefore ND11 students have better understanding of the concept of hybridization in chemistry than ND1 students.

**Statistical Test of Hypothesis**

**Hypothesis Ho**

There is no relationship between ND students' understanding of the concept of hybridization in chemistry and their academic level.

**Table 4a & b: Relationship between Academic Level and Students' Understanding of the Concept of hybridization in Chemistry (Linear Regression Analysis).**

**(a) Model Summary**

| Model | R | $R^2$ | Adjusted $R^2$ | Standard Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.090[a] | 0.0081 | -0.035 | 10.7224 |

**(SPSS)**

**(b) ANOVA**

| Model | Sum of Squares | Df | Mean Square | F | Significance |
|---|---|---|---|---|---|
| 1 Regression | 21.465 | 1 | 21.465 | 0.187 | 0.670 |
| Residual | 2644.295 | 23 | 114.969 | | |
| Total | 2665.760 | 24 | | | |

**(SPSS)**

**Table 4: Remark Table**

| Groups | N | R | $R^2$ | F-Calculated | F-Critical | Remark |
|---|---|---|---|---|---|---|
| NDI & NDII | 25 | 0.090[a] | 0.0081 | 0.187 | 2.01 | $H_o$ Retained |

From the linear regression analysis (Table 4), the coefficients obtained were; a = 10.858, b = - 0.456. Hence the linear regression equation y = a + bx is written as

y = 10.858 -0.456x.

The R value was obtained to be 0.090 and $R^2$ value was obtained to be 0.008. The adjusted $R^2$ value was -0.35.

The ANOVA of regression was computed and an F-value of 0.187 was obtained. This value was less than F-critical of 2.01, therefore the null hypotheses is retained. Hence, there is no relationship between ND students' understanding and their academic level.

**Findings of the Study**

1. ND1 students have low level of understanding of the concept of hybridization in chemistry.
2. ND11 students have moderate level of understanding of the concept of hybridization in chemistry.
3. There is no relationship between ND students' understanding of the concept of hybridization in chemistry and their academic level.

**Interpretation of Findings**

The study showed that NDI students have low level of understanding of the concept of hybridization in Chemistry; NDII students have a moderate level of understanding of the concept of hybridization in Chemistry. This was indicated by the frequency and percentage of the correct options. The result indicates that NDI students lack the knowledge of the basics of hybridization, hybridization, and application of hybridization, while NDII students are only better than NDI. This may be due to the dependency of NDI and NDII on each other. This was supported by Huffman (1997) who found that misconceptions pertaining to abstract concepts/phenomena result from some instructional experiences within or outside of the classroom including independent study.

The linear regression analysis showed that there was no significant relationship between ND students' understanding of the concept of hybridization and their academic level. This was indicated by the R, $R^2$ and F values obtained by Linear Regression Analysis of the test scores of NDI and NDII. The observed insignificant relationship between the ND students' understanding of the concept of hybridization in Chemistry and their academic level indicates that the students have poor background in mathematical skill and poor understanding of abstract concepts. This was supported by Adigwe, (1992), Huffman, (1997), Bichi, (2002), and Pashler *et al.* (2004). The authors ascertained that mathematics and mathematical skills are very important in studying and understanding science.

**Conclusion**

Based on the findings of the study the following conclusions were made:

The level of understanding of NDI students is low.

The level of understanding of NDII students is moderate.

There is no significance relationship between ND students understanding of the concept of hybridization in Chemistry and their academic level.

**Recommendations**

The following recommendations were made from the result of the study;

i. The teacher should plan a classroom instruction by incorporating strategies that challenge students' conception in order to engender more meaningful understanding of abstract concepts such as hybridization.

ii. The students are recommended to change their mind, notion, or ideas that are inconsistent with the scientific concepts.

iii. Curriculum planners should evolve a curriculum that is adequate enough to take care of abstract concepts in science.

iv.The government should adequately fund educational institutions to enable them deliver the goals of education.

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