



Research Article

THE EFFECTIVENESS OF APPLYING THE BYBEE STRUCTURAL MODEL IN THE LEARNING ACHIEVEMENT AND TRENDS TOWARD SCIENCE AMONG THE STUDENTS OF THE FIRST INTERMEDIATE CLASS (EXPERIMENTAL STUDY IN AFIF PROVINCE)

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ABSTRACT

The study aimed at experimenting The Effectiveness of Applying Bybee Structural Model in the Learning Achievement and Trends toward Science among the Students of the first Intermediate Class in Afif Province. There were 60 students divided into two groups.

An experimental group consisting of 30 students taught using Bybee structural model. A controlling group consisting of 30 students taught using traditional methods.

The researcher prepared an achievement test, and a test measuring attitudes towards science to evaluate how both groups benefit from the used teaching methods. The study concluded the following results:

- There are statistically significant differences in a significance Level (0.05) between the Arithmetic averages experimental group students in the post and pre achievement test for the side of the post test.
- There are statistically significant differences in a significance Level (0.05) between the Arithmetic averages of the experimental and controlling groups in the post achievement test for the side of the experimental group.
- There are statistically significant differences in a significance Level (0.05) between the attitudes of the experimental group students towards science in the pre and post tests for the side of the post test.
- There are statistically significant differences in a significance Level (0.05) between the attitudes of the experimental and controlling groups in the post attitude measuring test for the side of the experimental group.

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INTRODUCTION

People experience a great development of different life aspects these days, and this affects what schools provide its students with to help them meet their needs and hopes. This development is a reflection of the cognitive explosion in all different fields of modern science and techniques. Therefore, a country is considered to be developed according to modern scientific methods. Nasr (1997: 125-126) said that the last ten years witnessed scientific and technological changes in different life aspects, which made the world as a small village. Thus, any society doesn't go along with other societies, is considered to be isolated and backward.

These days, the goal of the educators in teaching modern sciences is to look for the best methods and strategies of teaching science since they are means of improving sciences in modern science. (Nashwan: 1898- 19)

Educators confirm that a good science teacher can compensate any possible lack in curriculum, books, activities, school programs, and other potentials. (Zaitoon, A'yesh, 1994:22)

The great role of the teacher will be clear if we know that teaching, in general, and teaching science, in particular is not directed to providing learners with knowledge, but to providing them with opportunities of thinking, creativity, acquiring self- learning skills, continuous learning, and making use of the acquired knowledge, skills, attitudes, values and thinking of solving problems they may face. This led many educators to continue their efforts to improve curriculum and teaching methods to make the learner in the Centre of education process. Many modern educators believe that knowledge is built in learners' mind by the learners themselves. This idea represents the base of structural philosophy. (Zaitoon, 2002.p.378).

We can say that structural theory is an educational theory saying that the learner form his knowledge whether individually or societal according to his current knowledge and previous experience. The learner chooses and transfers information and makes his decisions depending on conceptual structure enabling him to do this (Al- Khalili, 1996, p.255) There are many models for the structural approach, which application are different. Bybee structural modes is one of these models. It stands for helping learners on forming their

knowledge by themselves using their previous knowledge by doing the activities of the structural model. (The Caliph, Motawe' 2015, p.220)

The studies about structural models included: (Lord, 1999)

He made his study in France aiming at discovering the effect of the modified learning course that consists of 5 stages (engagement, exploration, interpretation, expanding, and Evaluation) on academic achievement. The sample consisted of four sections, two of them consisted of (45-46) students forming the experimental group, while two groups are the controlling group consisting of (46-48). There was a level test for the two groups, and the Arithmetic means was the same for the two groups. A teacher taught the two groups. A questionnaire was also prepared to discover students' attitudes towards these two strategies. In addition, the two groups had a multiple choice test at the end of the study application. The results showed that there are statistically differences in attitude and achievement for the side of the experimental group. The questionnaire also showed that 80% of the experimental group said that the class became more interesting. (Odom & Kelly, 2001)

It aimed at discovering the effect of a suggested strategy combining teaching cycle and concept maps on acquiring concepts of Proliferation and osmotic for students of biology department at a secondary school. The study sample consisted of 4 sections. The first section is taught using teaching cycle strategy, while the second is taught using concept maps. The third section is taught by explanation, and the fourth is taught by teaching cycle strategy and concept maps. The researchers applied an achievement test, and another delayed for 7 weeks after finishing the experiment. The suggested strategy combining teaching cycle and concept maps won over the other teaching methods. Moreover, the study showed that there are no statistically significant differences between teaching cycle strategy and the other teaching methods. (Scolavino, 2002)

It aimed at identifying teachers' effectiveness before service within science teachers' collaborative program in MACSTEP, in applying teaching cycle strategy. The researcher used a quantity of methods to collect data including questionnaires for analyzing and measuring the quantity of knowledge about teaching cycle strategy learners have before service and techniques of open questions before joining the program. A computer program was also used to write down answers and responses. In addition, videos were recorded during the application of the strategy in teaching. The study concluded that using the strategy is effective. (Nayef Assophiani, 2010)

He studied the effect of using teaching cycle in teaching physics, on improving academic achievement and creative thinking for tenth grade students. The design of unequal controlling group with pre and post test, which is one of Quasi-experimental designs, was used. The study sample consisted of (100) students randomly divided into two group, (50) student experimental group, and (50) student controlling group. The researcher also prepared an achievement test, and used Torans's creative thinking test. The results of the study showed that there are statistically significant differences between the controlling and the experimental group in the academic achievement in the levels of, (remembering, understanding, application, and total sum) for the side of the experimental group, and statistically significant differences

between the experimental and controlling group in the creative thinking in the level of, (Fluency, flexibility, authenticity, and total sum) for the side of the experimental group. (Al-Banna, 2011)

The study aimed at discovering the effect of using the modified teaching cycle in teaching mathematical concepts for tenth graders. The researcher used the experimental approach. The study sample consisted of 60 students divided into (30) student experimental group, and (30) student controlling group. The researcher also prepared a post achievement test, and ambition scale. The results showed that there are statistically significant differences in (0.05) level between the achievement of the two groups, and their ambition for the side of the experimental group. (Ashahrani, 1436)

The study aimed at discovering the effectiveness of teaching cycle strategy for first Intermediate class students in science. The researcher used the experimental approach through two groups, an experimental and a controlling group. The study sample consisted of two groups, with (17) students for each. Group "B", the experimental, was taught using teaching cycle strategy. On the other hand, group "A" was taught using the traditional method. The results showed that there are statistically significant differences in the point (0.05) for the side of the experimental group in the levels of, "remembering, understanding, and application". From the study results, we can conclude that using teaching cycle is effective in improving academic achievement of first intermediate class students in science.

Comment

This study agrees with Lord and Ashahrani in the importance of using Bybee model in the academic achievement in science. This pointed out that all experimental groups in the previous studies won over the controlling groups since they are taught using Bybee model.

This study is different from (Adom and Kelly) since it confirmed the effectiveness of the strategy combining teaching cycle and concept maps. It is also different from (Schollaphino) that applied teaching cycle strategy in teaching, and (Naief Assophiani) studying the effect of using teaching cycle in teaching physics on improving academic achievement and creative thinking skills, in addition to (Al-Banna) studying the effect of using the modified teaching cycle in teaching mathematical concepts on tenth grade students, and on their ambition.

This study is distinguished since it is the first in Afif Province showing the effectiveness of Bybee structural model in developing attitudes towards science, in addition to its effectiveness on academic achievement in science. The researcher made use of the previous studies in designing the study tools and applying them in addition to the statistic analysis of the results.

Study Problem

The researcher noticed teachers' focus on teaching methods focusing on the material, and leaving methods focusing on the learner as the core of teaching process. By supervising education students, the researcher noticed the decrease of academic achievement in science, and low turnout to learn this subject. This may be due to teachers' use of teaching methods focusing on the material rather than the student.

Looking at the reasons, using modern teaching methods as Bybee model in teaching science may lead to improving science teaching methods and raise students' academic achievement in this subject. There is no doubt that the main goal of teaching is continuous improvement to help students reach accuracy and achieve most of the educational objectives. Therefore, this research investigates the effectiveness of using Bybee structural model on academic achievement and attitudes of first intermediate class students in Afif Province towards science.

The study problem can be summarized by the following question: To what extent is using Bybee structural model effective in academic achievement and attitudes of first intermediate class students in Afif Province towards science.

Study Questions:

The study aims at answering the following questions

1. To what extent is using Bybee structural model effective in first intermediate class students' academic achievement in science?
2. To what extent is using Bybee structural model effective in improving first intermediate class students' attitudes towards science?

Study Objectives

Discovering the effectiveness of using Bybee structural model in first intermediate class students' academic achievement in science.

Discovering the effectiveness of Bybee structural model in improving positive attitudes of first intermediate class students towards science.

Study Hypotheses

1. There are statistically significant differences in a significance level (0.05) in the Arithmetic average of the experimental group students' marks in the pre and post achievement test.
2. There are statistically significant differences in a significance level (0.05) in the Arithmetic average of the experimental and controlling group students' marks in the post achievement test.
3. There are statistically significant differences in a significance level (0.05) in the attitudes of the experimental group students' attitudes towards science in the pre and post scale.
4. There are statistically significant differences in a significance level (0.05) between the experimental and controlling group students' attitudes towards science in the post attitude scale.

Study Importance

Guiding curriculum planners and developers to the importance of preparing science curricula in Kingdom of Saudi Arabia intermediate level suiting Bybee Structural Model.

It may provide some suggestions related to helping teachers to build their knowledge by themselves using their previous knowledge.

This model is considered to be a response for what educational experts wanted related to being updated with

teaching methods, in general, and science teaching methods, in particular.

Study Tools: the researcher used the following tools:

1. Achievement test prepared by the researcher to discover the effectiveness of using Bybee structural model in academic achievement and attitudes towards science.
2. Attitude scale to discover first intermediate class students' attitudes after using Bybee model.

Study Sample

The study sample consisted of An experimental group consisting of 30 students taught using Bybee structural model.

A controlling group consisting of 30 students taught using the traditional methods.

Study Borders

1. Spatial Borders: First Intermediate School in Afif Province.
2. Temporal Borders: the Second academic term for the year 1436/1437
3. Scientific Borders: topics of a unit from the first intermediate class science's book in Saudi Arabia entitled (Cells are Life Base)

Study Procedures

To answer the study questions, and prove its hypotheses, the researcher followed the following procedures:

1. Checking the previous studies related to Bybee structural model to discover the basis and methods of designing lessons according to that model, and how to measure academic achievement and attitudes towards science.
2. Choosing the topics of the unit entitled (Cells are Life Base) from the first intermediate class science book in Saudi Arabia and designing it according to Bybee structural model.
 - A. An achievement test measuring academic achievement in the topics of the unit entitled "Cells are Life Base" from the first intermediate class science book and checking its validity and reliability.
 - B. A scale of attitudes towards science and checking its validity and reliability.
3. Preparing the study tools including:
4. Dividing the study sample into two groups: an experimental group taught using Bybee structural model, and a controlling group taught using the traditional methods.
5. Applying the study tools to ensure equivalence of the two groups.
6. Teaching the experimental group decided topics using Bybee structural model, and the controlling group using the traditional methods.
7. Post application of the study tools to measure students' academic achievement of the experimental and controlling groups, and the attitudes towards science according to Bybee structural model.
8. Collecting data, concluding results, statistically treating and interpreting them.
9. Provide suggestions according to the study results.

Study Terms

Effectiveness

The achievement of objectives. In other words, it shows the increase achieved by the students (Al- Qala and Nasir, 2001). It is a scale measuring to what extent students master the objectives of the unit entitled, (Cells are Life Base) by Bybee structural model.

Teaching Structural Model

There are many structural models, which applications in teaching are different, and though which was possible to change the philosophy of the structural theory into real teaching procedures. Structural Teaching Model, Structural Analysis Model, Structural Teaching model, V Model (Jowin), Conceptual Change Model, Bybee Model, Figotesky's Model, Cognitive Teaching Model and Social Structural Teaching Model are examples of the models that are commonly used.

(Anajdi Ahmed *et al*, (2003:306) defined it as, " A model helping students to form their scientific Concepts and knowledge following four stages (Invitation, Discovering, Suggesting solutions and decision making). These stages are delivered from the three reaching steps."

Bybee Structural Model

Bybee Model 5 E's Model) is a teaching model focusing on the students and helping them to be part of learning knowledge and scientific concepts using their previous knowledge of the topic. It consists of five levels, engagement, discovering, expanding, interpretation and evaluation. This model is used in this study to teach the experimental group (Bybee *et al.*, 1989)

Attitude

(Rashid Ali *et al* (2002, p.89) defined it as, " person's consistent feeling that identifies his response to a specific topic or issue whether with acceptance or refusal". In this research, attitude towards science is defined as the students' belief or interest in teaching science whether with acceptance or refusal as measured by attitude towards science scales. It is also expressed by the total mark a student gets in the scale.

Intermediate Level

The level between preparatory and secondary levels.

Theoretical Part

Bybee Structural Model

This model was introduced by Troberdge and Bybee. It is named by different names such as learning teaching model or Constructive Oriented Teaching Model. In this model, the learner is the core of teaching process, since he is considered to be able to form his knowledge by himself by collecting data, forming hypotheses, concluding results, discussing ideas and solution, and applying what they agreed on in new situations. The learner is the core of teaching process Zaitoon, Hassan, Zaitoon Kamal (2003: 221-222).

Al- Huthaifi (2003: 137-138) and Khaireyya Saif, (2003: 134-135) said that this model was modified and developed by Susan Louck – Horsely in 1990. Al- Khalifa and Motwe'e (2003, p. 230-231) said that Bybee model consists of five stages called (Fifth Teaching Circle), which are:

Attraction Level

In this level, the teacher identifies the learners' previous knowledge about the topic, attract and motivate them to think of the topic of the lesson.

Discovering

In this level, teaching focuses on the learners who is active, and required to discover the concept by a series of activities. Moreover, earners are given instructions to collect data by direct movement experiences to realize the meaning of the concepts they learn. Discovering level focuses on the learner, while the teacher's role is only to give instructions and suggest materials related to the topic supposed to be discovered, but the instructions mustn't include what learners are supposed to learn, or interpret the concepts that is supposed to be learnt.

Interpretations and Suggesting Solutions

It aims at directing learners thoughts towards collaborative learning by the teacher. The teacher also asks students to show methods they used, and what they concluded of solutions and interpretations. He also ask them to differentiate between the suggested solutions to choose the best. Therefore, false understanding of learners will be corrected.

Detailed Expanding Thinking

In this level, learners expand their thinking of aspects of the topic, and all of them share thinking which improves their investigation skills, and gives them opportunities to organize their new knowledge with similar experiences. It also helps to ensure the right scientific understanding of the concept.

Evaluation

In this level, solutions and ideas are evaluated using tests, notices and interviews. This is not the final evaluation, but it is supposed to be continuous and may be done in any level of the structural model.

Teaching Planning according to Bybee Structural model

Teaching Planning according to Bybee Structural model requires the main processes mentioned by (Zaitoon, 2002) and (Ashahrani, 2015: p. 17-22):

Choosing the lesson topic and analyzing its content. When choosing the topic, it must be directly related to students' reality and social and personal life.

Forming Lesson Objectives

Lesson objectives be sentences describing learners' activities during teaching process, or their products, but not behavioral objectives describing the expected product of the learner.

Planning for the Activating situation

In this level, the learner is put in a learning situation motivating him to learn the lesson topic and activating his thoughts and impressions about the topic in addition to doing a discovering exercise.

Choosing the discovering Activities

They are the activities done by learners in the discovering level aiming at getting solutions and answers, and practicing scientific research. Choosing them is previously planned.

Planning for choosing the expanding Activities

These activities are done by the students to enrich their knowledge of the topic, or application of the knowledge they get in their life, and problem solving in addition to decision-making.

Identifying learning resources and required materials and tools in addition to getting them.

Previous planning for identifying learning resources such as, books, references and movies to understand the activities and achieve them, in addition providing an enough number of devices for students are important issues for discovering and expanding levels.

Estimating teaching time

Teaching time is distributed over the levels of the Fifth Teaching Circle according to each level's need. Discovering and expanding levels are given enough time to enable teachers to form and apply the concept.

Preparing Classroom Environment

Students are divided into groups that are unequal in academic abilities. It is better to have suitable space between groups, so that the teacher can easily move and supervise them, and there will be less noise. After good planning by the teacher, application level starts.

Lesson Application (Activation level)

This level starts with putting students in an educational situation causing a problem or a question that makes students feel confused. Then, he asks them to interact and from their answers, he discovers their previous knowledge about the new topic, and any false information. After this, the teacher directs them to a discovering activity.

Lesson Application (Discovering Level)

In this level, students do discovering activities collaboratively trying to find a solution. They also write down activities and results. This usually requires direct interaction with surrounding things, classifying, expecting, measurement, forming hypotheses and other processes.

The role of the teacher in this level is to explain the goal of the activity for the students and what should be achieved, and then he gives them the opportunity to plan for the application of the activity0 he also motivates each group and helps them if they need.

Lesson Application (Expanding Level)

In this level, the teacher provides the students with activities related to the new topic aiming at expanding their knowledge of it or helping them to transfer the effect of learning it into new situations through applying that knowledge in solving real problems related to their life or taking decisions using it. Students usually use to practice activities collaboratively (Zaitoon, 2002).

The Procedural Part

To make sure of the effectiveness of using Bybee structural model on academic achievement and attitudes towards science for the first intermediate class students, the researcher followed the following procedures:

- Identifying the experimental and controlling groups.

- Identifying the pre- test to achieve equivalence between the two groups in the academic level.
- Experimental application using Bybee structural model that includes science lessons for the first intermediate class. These lessons are from a unit entitled, " Cells are Life Base". Eight classes distributed over February with two classes for a week were spent in teaching these topics using Bybee structural model.
- The controlling group was taught using traditional teaching methods.
- Preparing post- test for the two groups to discover the effectiveness of students' academic achievement in the topic and the effectiveness of using Bybee structural model in teaching.
- Preparing a scale for attitudes towards science and applying it.
- Collecting data, concluding and analyzing the results using the suitable statistic analysis.
- Preparing statistic comparison to ensure having statistically significant differences between the two groups in the academic achievement test and attitudes towards science.
- Study Community and Sample:
- The study community includes the first intermediated class students in Afif Province. The sample was chosen from the 500 students.
- The study sample consisted of two groups of the first intermediate class students, one of these groups formed the controlling group that consisted of 30 students, while the other formed the experimental group, that consisted of 30 students.

Table 1 shows the number of students in the controlling and experimental groups:

| School | Gender | Group | Number |
|--------------------|--------|--------------|--------|
| First Intermediate | Female | Experimental | 30 |
| | | Controlling | 30 |

Rationing Study Tools

1st. the researcher prepared a group of topics according to Bybee structural model, and she prepared questions about the topic. She also discussed the lesson and explained its idea (appendix 1) for the experimental group. On the other hand, She taught the controlling group using the traditional methods.

2nd. The test:

The researcher prepared an achievement test about the lessons to be applied at the end of teaching process using Bybee mode (appendix 2)

Reliability and Validity Coefficient:

For test rationing, the researcher applied it on an exploratory sample consisting of 20 students randomly chosen from the experimental and controlling group. After this, correlation coefficient was calculated using Pearson coloration coefficient, and stability was calculated using the following equation:

$$\text{Stability} = 2r / 1+2r$$

R= coloration coefficient

$$\text{Stability} = 2*0.96 / 1+ 0.96$$

$$1.92/ 1.96 = 0.98$$

By the above application, stability coefficient was (0.98), and self- validity coefficient was (0.99). This means that the test is highly valid and stable, which ensures that it can be applied on the study sample.

Groups Equivalence

To know how the two groups are equivalent in the academic achievement in science, the researcher used T test for other two samples, the results of the test are shown in the following table:

Table 2 shows the results of T test for two independent samples to compare the Arithmetic average marks of the experimental and controlling groups in the pre- test.

| Test | Comparison Groups | number | Average | Standard Deviation | T Value | Freedom Degree | Potential Value | Result |
|----------|-------------------|--------|---------|--------------------|---------|----------------|-----------------|----------------|
| Pre test | Experimental | 30 | 9800 | 2.74678 | 0.4450 | 58 | 0.658 | No differences |
| | Controlling | 30 | 10.1000 | 2.46842 | | | | |

In the table above, it is clear that "T" value, that is calculated is less than "T" value that is in the statistic tables with 58 freedom degree and under 0.05 level that equals 2.01. This shows that there are no statistically significant differences between the Arithmetic average of marks of the experimental and controlling groups in the pre- test. This result also shows the equivalence of the academic achievement of the first intermediate class students in science.

2nd: Attitude Scale:
The Exploratory Study:

After the arbitration of the scale in appendic (3), the researcher applied it on a random sample consisting of 20 students randomly chosen from the controlling and experimental groups.

Internal Consistency

To get the internal consistency, the researcher found cooleration coefficient of each term mark, and the total mark of the term. Look at table (3).

Table 3 shows coloration coefficient of the terms and the total mark of the scale

| Term | Coloration coefficient | Term | Coloration Coefficient |
|------|------------------------|------|------------------------|
| 1 | (**)0.674 | 9 | (**)0.834 |
| 2 | (**)0.865 | 10 | (**)0.879 |
| 3 | (**)0.872 | 11 | (**)0.758 |
| 4 | (**)0.898 | 12 | (**)0.898 |
| 5 | (**)0.809 | 13 | (**)0.939 |
| 6 | (**)0.899 | 14 | (**)0.830 |
| 7 | (**)0.907 | 15 | (**)0.930 |
| 8 | (**)0.859 | - | - |

Significance Level: 0.01
significance Level: 0.05

From the table, we can notice that coloration coefficients of all terms are positive and statistically significant in 0.05 significance level.

Stability and Validity Coefficient of the scale:

To ensure self- validity and stability of the scale, the researcher applied Fakropnakh equation on the data of the exploratory sample. Stability coefficient was (0.97), and validity coefficient was (0.98). getting these values, it is clear that the scale is highly valid and stable, and this shows that it

can be used to measure the positive attitudes of the first intermediate class students in Afif Province towards science.

Data statistic Processing

To process the data, the researcher used the suitable processing of .)SPSS ,(Statistical Package For Social Sciences).

The Results

1st: Achievement Test Results:

The First Hypothesis:

To ensure the correctness of the first hypothesis saying, " there are statistically significant differences in 0.05 significance level between the Arithmetic average of the experimental group students' marks of the pre and post achievement tests. The table above shows that the calculated "T" value is more than "T" values shown in the table with 30 freedom degree, and under 0.05 significance level equaling 2.04. This shows that there are statistically significant differences in the results of the experimental group students in the pre and post tests for the side of the post test. This result also shows that using Bybee structural model is effective on raising the academic achievement of the first intermediate class students in Afif Province in Saudi Arabia.

The Second Hypothesis

To insure the correctness of the second hypothesis saying, " there are statistically significant differences in 0.05 significance level between the marks of the experimental and controlling groups students in the post achievement test. The table above shows that the calculated "T" value is more than that is in the statistical tables with 58 freedom and under 0.05 significance level equaling 2.000. this shows that there are statistically significant differences between the Arithmetic averages of the marks of the experimental and controlling groups in the post test for the side of the experimental group. This shows the effectiveness of using Bybee structural model on raising the academic achievement in science for the first intermediate class students in Afif Province in Saudi Arabia comparing with the traditional methods.

2nd: Results of Attitude Scale

The Third Hypothesis

To ensure the correctness of the third hypothesis saying, "there are statistically differences in 0.05 significance level between the experimental group students' attitudes towards science in the pre and post measurements. The researcher used MAN and TENNY test to know the differences in the average grade of the experimental group in the pre and post tests. This step resulted in the following table:

Table 4 shows the results of (T) test for two related samples to compare the Arithmetic average marks of the experimental group in the pre and post tests:

| Group | Comparison Tests | Number | Average | Standard Deviation | T Value | Freedom Degree | Potential Value | Results |
|--------------|------------------|--------|---------|--------------------|---------|----------------|-----------------|---|
| Experimental | Post | 30 | 15.7000 | 3.06425 | 7.853 | 29 | 0.000 | There are differences for the side of the post test |
| | Pre | | 9.8000 | 2.74678 | | | | |

Table 5 shows the results of "T" test of two independent samples, to compare the Arithmetic average marks of the experimental and controlling group in the post test"

| Test | Comparison Groups | Number | Average | Standard Deviation | "T" Value | Freedom Degree | Potential Value | Result |
|----------|-------------------|--------|---------|--------------------|-----------|----------------|-----------------|--|
| Pre Test | experimental | 30 | 15.7000 | 3.06425 | 5.709 | 58 | 0.0000 | There are differences for the side of the experimental group |
| | controlling | 30 | 11.3333 | 2.85673 | | | | |

Table 6 shows the result of MAN and TENNY test to discover the differences between the average grades of the experimental group students' attitudes towards science before and after applying the model:

| Group | Grade Average of the pre-measurement of attitudes | Grade Average of the post-measurement of attitudes | "Z" Value | Potential Value | Interpretation | Result |
|--------------|---|--|-----------|-----------------|----------------|--|
| Experimental | 25.37 | 35.63 | 2.278 | 0.023 | Significant | There are differences for the side of the experimental group |

From the table above, it is clear that grade average of the post measurement of attitude was 25.37, grade average of the post measurement of attitudes was 35.63, and "Z" value was 2.278. this shows that there are statistically significant differences between the experimental group students' attitudes towards science in the pre and post test. this confirms that the attitudes of the students in the pre measurement is more positive than in the post measurement, and also proves the effectiveness of using Bybee structural model in developing attitudes of first intermediate class students.

The Fourth Hypothesis

To make sure of the correctness of the fourth hypothesis saying, "there are statistically significant differences in 0.05 significance level between the attitudes of the experimental and controlling group towards science in the post attitude measurement", the researcher used MAN and TENNY test to discover the differences in grade average of the two groups in the post measurement. This step resulted in the following table:

Table 7 shows the results of MAN and TENNY test to know the differences in grade average of the experimental and controlling group students towards science in the post measurement (after using the model):

| Measurement | Grade Average of the experimental group | Grade Average of the controlling group | "Z" Value | Potential Value | Interpretation | Result |
|----------------------------|---|--|-----------|-----------------|----------------|--|
| Attitudes post measurement | 34.98 | 26.02 | 1.990 | 0.04 | Significant | There are differences for the side of the experimental group |

Form the table above, it is clear that grade average of the experimental group in attitudes post measurement was 34.95, and it was 26.02 for the controlling group. In addition, "Z" value was 1.99. This result shows that there are statistically significant differences between the attitudes of the experimental and controlling group attitudes towards science in the post- measurement.

Thus, experimental group students have more positive attitudes towards science than the controlling group. This result confirms the effectiveness of using Bybee structural model in developing the experimental group students' positive attitudes towards science.

RESULTS DISCUSSION AND INTERPRETATION

- A. The nature and advantages of the subject make some educational models more effective than others. Bybee structural model is one of the most effective models since it gives the students opportunities of more interaction and more different activities.
- B. The study shows that there are statistically significant differences between the Arithmetic average of the experimental group students' marks in the pre and post tests for the side of the post test in 0.05 significance level. This result shows the effectiveness of Bybee structural model on raising the academic achievement in science for the first intermediate class students in Afif Province in Saudi Arabia.
- C. There are statistically significant differences between the Arithmetic averages of the marks of the students of the experimental and controlling groups in the post test in 0.05 significance level for the side of the experimental group. This result confirms the effectiveness of using Bybee structural model in raising the first intermediate class students'

achievement in science compared with using the traditional methods in Afif Province in Saudi Arabia.

- D. In 0.05 significance level, there are statistically significant differences between the attitudes of the experimental group students towards science in the pre and post measurements. This results shows that students' attitudes in the post test are more positive than those in the pre- test. This confirms the effectiveness of using Bybee structural model in developing the first intermediate class students in Afif Province towards science.
- E. In 0.05 significance level, There are statistically significant differences between the experimental and controlling group students' attitudes towards science in the post measurement. This shows that the experimental group students have more positive attitude towards science than the controlling group students. This result confirms the effectiveness of using Bybee structural model in developing the positive attitudes of the first intermediate class students in Afif Province towards science, when compared with using the traditional methods.
- F. Using suitable teaching methods helps to achieve the lesson objectives and make students more interactive with the educational situation. Using Bybee structural model confirmed this result.

Recommendations and Suggestions

1. Preparing science curriculum and books using Bybee structural model.
2. Doing more studies about the effectiveness of other teaching models in the academic achievement and developing attitudes such as Conceptual Change Model (Bosner), V model (Daniel Nell- Charles Anderson) and Social Structural teaching model.
3. Providing teachers with the suitable way of preparing science lesson using different teaching models.
4. Holding training courses for teachers about how to use modern teaching models as Bybee structural model.

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