Research Article

Deep understanding skills and their relationship to mathematical modelling among fifth graders

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Abstract: The aim of the current research is to identify (the relationship between deep understanding skills and mathematical modeling among fifth grade students) the research sample consisted of (411) male and female students of the fifth grade of biology distributed over the General Directorates of Education in Baghdad / Al-Rusafa / 2 / and Al-Karkh / 1 /, and two research tools were built:
1- A test of deep understanding skills, consisting of (20) test items and a scale for two skills.
2- The second test consists of (24) test items distributed among (18) essay items and (6) objective items.
The psychometric properties of validity, stability, discriminatory strength, and effectiveness of alternatives were verified for the two tests for students.
The descriptive, analytical and inferential research method was used, and three statistical hypotheses were formulated for the research, which are as follows:
1- There is a statistically significant difference at the significance level (0.05) between the hypothetical mean and the arithmetic mean of the students' scores in general in the tests of deep understanding skills.
2- There is no statistically significant difference at the level of significance (0.05) between the hypothetical mean and the arithmetic mean of the students' scores in general in the tests of mathematical modeling skills.
3- There is no statistically significant relationship at the significance level (0.05) between the skills of deep understanding and the skills of mathematical modeling among the students of the fifth scientific grade in general.
These hypotheses were tested by statistical methods (parametric and non-parametric methods) test, estimates of the effect coefficients according to the simple non-linear regression model of the cubic polynomial, Pearson's simple correlation coefficient, half-segmentation method, non-parametric Mann-Whitney test, (Ki-test). Square), and this was achieved by using the ready-made statistical package (SPSS), and the search results were as follows:
1- There is a similarity in the low level of students' responses in general in the skills of deep understanding.
2- A low level of students' responses in general to the test of mathematical modeling skills was achieved.
3- There is a correlation according to the polynomial model used between the effect of mathematical modeling skills on the dimension function of deep understanding skills for the two groups of male and female students.
In light of the results of the research, the researcher recommended several recommendations, including: the inclusion of the mathematics curriculum with exercises, activities and exercises that require employing mathematical modeling skills and deep understanding skills, and working to increase the qualification and training of mathematics teachers by preparing special training courses for this purpose related to introducing them to mathematical modeling and its importance and how to implement it in the classroom , the researcher suggested several proposals, including: Conducting a study to reveal the ability of mathematics teachers on mathematical modeling skills.

Keywords: deep understanding skills, mathematical modeling

Chapter One:

First: Research Problem: Through the researcher's work as a free lecturer in teaching mathematics for the fifth scientific grade during the two years (2016-2017) and through the results of achievement tests, it was found that there was a decrease in students' levels in questions that need explanation, interpretation and clarification, and this predicts the existence of a problem in understanding and after surveying the opinions of a number of teachers in the

field of mathematics teaching after presenting to them the concepts for this stage about students' possession of deep understanding skills and mathematical modeling skills,, it was found that (75%) indicated that there is a weakness in the skills of deep understanding, and that (70%) indicated that there is a weakness in the skills of mathematical modeling, and they indicated that the students resort to memorizing information and memorizing it as postulates without operating the mind and understanding it, this prompted the researcher to think about ways and skills to develop students' deep understanding by making connections between the topics of the educational material as a whole and between the parts of a single topic, based on the foregoing, the study problem is summarized in the following question:

What is the relationship between deep understanding skills and mathematical modeling among fifth-grade science students?

Second: Research Importance: It represents what research can add to scientific knowledge from an applied point of view, which is:

1- To highlight the role of mathematics in solving real-life problems.

2- It helps teachers in the preparatory stage to know these skills and how they directly affect the achievement of their students.

Third: Research Aims: The current research aims to:

1- Revealing the deep understanding skills of the fifth scientific grade students.

2- Revealing the mathematical modeling skills of the students of the fifth scientific grade.

3- Revealing the relationship between deep understanding skills and mathematical modeling skills among fifth-grade students.

Fourth: Research Hypotheses: In order to achieve the aim of the research and answer, the following null hypotheses were developed:

1- There is no statistically significant difference at the significance level (0.05) between the hypothetical mean and the arithmetic mean of the students' scores in general in the tests of deep understanding skills.

2- There is no statistically significant difference at the level of significance (0.05) between the hypothetical mean and the arithmetic mean of the students' scores in general in the tests of mathematical modeling skills.

3- There is no statistically significant relationship at the significance level (0.05) between the skills of deep understanding and the skills of mathematical modeling among the students of the fifth scientific grade in general.

Fifth: Limitations of the research: The current research limited to:

Fifth grade scientific students in preparatory and secondary schools, affiliated to Baghdad Governorate, from the general directorates of my education (Karkh and Rusafa / first and second) for the 2020-2021 school year, and the scientific material for the third intermediate and fourth scientific grades was determined based on (the previous knowledge of students) and other sources that benefit in this aspect.

Sixth: Defining Terms:

1- Deep understanding: It is a set of interrelated abilities that are developed and deepened through questions and lines of inquiry that arise from reflection, discussion and use of ideas. Therefore, deep understanding does not consist in mere knowledge of the facts, but rather in knowing the cause and the method." (Jaber, 2003: 286)

2- Mathematical modeling: It is a mathematical representation of a shape, a model, or a relationship to a situation, and the strength of mathematics and its distinctive position in its ability to model life and material situations in forms, equations or mathematical relationships." (Abo Zina, 2010: 39)

Chapter two: theoretical background and previous studies

First: Deep Understanding:

Zeitoun stresses that the teacher should focus on depth instead of horizontal expansion, according to the slogan, "A little knowledge that you learn in depth is better than a lot of superficial knowledge." (Zeitoun, 2002: 62), and deep understanding is determined by the student's ability to process information at the deepest level based on meaning, allowing him to find some kind of relationships between the elements or components of the material "the subject of learning", as well as organizing and planning information, and self-reflection in the process of understanding which leads to more retention and permanence of this information. (Al-Talaba, 2009: 111)

Wiggins & McTighe (2005) identifies six skills for deep understanding:

1- **Explanation:** It can be explained through generalizations or principles, which provide justified and systematic accounts of the facts and statements of phenomena, create insightful links and provide illuminating examples or illustrations.

2- Interpretation: He can interpretation - and provide appropriate translations that provide a revealing dimension to ideas and events, that make the goal of understanding personal, or accessible through pictures, representations, and models.

3- Application: The student can effectively apply what he knows and adapts in a variety of real-world contexts.

4- Perspective: critical insightful perspectives.

5- Empathy: can empathize - and find value in what others might find strange.

6- Self-knowledge: You have self-knowledge - awareness of metacognition and projection of personal style, prejudices, expectations and mental habits that shape and impede our understanding, thinking about the meaning of learning and experience. (Wiggins & McTighe, 2005: 84)

Second: Mathematical Modeling

Mathematical modeling deals with a question that arises from outside the field of mathematics and moves it to mathematical methods, which can be used to shed some light on the original question, mathematical modeling is a complete process starting from the original real problem situation and then to building a model and using the model being tested to make predictions and the mathematical model is a class of assumptions as well as a class of relationships that are used to solve real or life problems. Stacey, 1996: 14))

The criteria (CCSSM, 2010, 72) define the mathematical modeling process in six steps:

1- Understanding the problem: It means identifying the variables and choosing what represents the basic features of the situation.

2- Building a model: formulating a model by creating and choosing representations that describe the relationships between variables.

3- Mathematical processing: It means the analysis and implementation of operations on these relationships to draw conclusions.

4- Interpretation: It means the interpretation of the mathematical results through the original position.

5- Verification: Validating the conclusions by comparing them with the situation, and then accepting the model.

6- Prepare a report: write the conclusions and the logical justifications that support them.

Previous studies:

A- Previous studies on deep understanding:

(Adam and Abdel Hamid, 2017)study: It aimed to employ differentiated education through an electronic book in teaching engineering to develop higher achievement levels, mathematical communication skills and deep understanding among second year preparatory students. The study found that the experimental group outperformed in the higher achievement levels test, the mathematical communication skills test, and the deep understanding test.

B- Previous studies on mathematical modeling:

(Al-Sharari, 2014)study: It aimed to identify the impact of the mathematical modeling strategy in understanding mathematical generalizations and solving the mathematical problem in the light of the mathematical self-concept of mathematics teachers in the Saudi Arabia, and a measure of the mathematical self-concept was adopted, the results showed that there was a statistically significant difference in the teachers' achievement in the tests of comprehension of mathematical generalizations and solving the mathematical problem due to the mathematical modeling strategy in favor of the experimental group.

Chapter III:

First: Research Methodology: The researcher adopted the descriptive method, due to its relevance to the research objectives.

Second: Research Community and its Sample: The research community consists of all fifth grade students in government morning schools for the academic year (2020-2021), on a sample consisting of (411) male and female students, divided into (223) male and (188) female students.

Third: Research Tools: a test that measures deep understanding skills, and the other is a test that measures mathematical modeling skills.

Stages of building a test of deep understanding skills and a test of mathematical modeling skills:

1- The objectives of the two tests were determined:

2- Identification of skills: after reviewing the literature from books and studies that dealt with deep understanding, such as the book (Jaber, 2003) which were defined as (explanation, interpretation, application, perspective, empathy and self-knowledge), and mathematical modeling skills were determined by adopting a classification (CCSSM, 2010, 72), The skills are: (understanding the problem, building a mathematical model, mathematical treatment, interpretation, verification and preparing a report).

3- Presenting the skills to a number of specialists: The skills were presented to a number of specialists in the field of mathematics and their teaching methods to show their suitability, as the skills of deep understanding achieved an agreement (85%) from their opinions, while mathematical modeling skills obtained an agreement (82%) of their opinions, and in light of this, the appropriate skills for research were identified.

4- Determining the scientific material: The scientific material for the third and fourth grades has been determined based on (students' prior knowledge) and other sources useful in this aspect.

5- Formulation of test items: The deep understanding skills test consisted of (20) items, and a scale for two skills, distributed into (10) essay items and (10) objective items, to measure four skills (explanation, interpretation, application and perspective), and a scale to measure each of the skill (empathy and self-knowledge), and the mathematical modeling skills test items were formulated as (24) test items, distributed between (18) essay items, (6) objective items according to their relevance to skills

6- Formulating the instructions for the two tests: by defining the goal for each of them and how to answer the test items.

7- Apply the two tests:

A- Application on the information sample: The two tests were initially applied to a sample of the fifth-grade biological science students in the General Directorate of Education in Baghdad, Karkh First, on Wednesday 3/3/2021, as their number reached (60) male and female students, distributed to (30) male students and (30) female students, to find out the possibility of students answering the two test paragraphs, as well as determining the answering time for the two tests, as a time was calculated for each of them by calculating the average time for the first six students and the last six students, so the time taken to answer was (70) minutes to test the skills of Deep understanding, and the time taken to answer the Mathematical Modeling Skills Test (75) minutes.

B- Application to the statistical analysis sample: After the instructions were clear and the time determined through the preliminary exploratory sample, they were applied to the statistical analysis sample of the fifth-grade bioscientific students in the Karkh and Al-Rasafa directorates / first and second on Sunday 3/14/2021. 411 male and female students distributed 223 males and 188 females.

8- Correction of the test: Exemplary answers were developed for the paragraphs of each of the two tests, and each paragraph took its appropriate degree, which ranged between (1-6) degrees, and the total degree of the deep understanding skills test is (72) degrees, while the degrees of the modeling skills test ranged Sports between (1-6) degrees, and college is (64) degrees.

Psychometric properties of the test:

1- Test validity: Two types of validity were found:

A- Apparent validity: It was verified by presenting the two tests in their initial form to a number of specialists in the field of mathematics and its teaching methods in order to verify the suitability and representation of the items for the field you measure, and it obtained an agreement percentage (82%) for testing deep understanding skills and (80%) for testing Mathematical modeling skills regarding the final version of the two tests after containing the appropriate modifications to them.

B- Construction validity: The construction validity of the two tests was verified by the following methods:

3-1 Correlation coefficients: (the relationship of the items to the total output of the axis)

Table (1): Estimation of the correlation coefficients between the items of deep understanding skills with the total axis according to the simple correlation coefficient index of (Pearson)

S	Dimensions	Items	correlation coefficient	Indication level	Flee(*)
1	Explanation	Explanation - Q1	0.426	0.000	HS
2		Explanation - Q2	0.288	0.000	HS
3		Explanation - Q3	0.441	0.000	HS
4		Explanation - Q4	0.185	0.000	HS
5		Explanation - Q5	0.424	0.000	HS
6	Interpretation	Interpretation - Q1	0.295	0.000	HS
7		Interpretation - Q2	0.385	0.000	HS
8		Interpretation - Q3	0.278	0.000	HS
9		Interpretation - Q4	0.431	0.000	HS
10		Interpretation - Q5	0.408	0.000	HS
11	Application	Application - Q1	0.153	0.001	HS
12		Application - Q2	0.17	0.000	HS
13		Application - Q3	0.305	0.000	HS
14		Application - Q4	0.257	0.000	HS
15		Application - Q5	0.237	0.000	HS
16	Perspective	Perspective - Q1	0.094	0.028	S
17		Perspective - Q2	0.179	0.000	HS
18		Perspective - Q3	0.458	0.000	HS
19		Perspective - Q4	0.404	0.000	HS
20		Perspective - Q5	0.254	0.000	HS
21	Empathy scale	Empathy Scale - Q1	0.448	0.000	HS
22		Empathy Scale - Q2	0.212	0.000	HS
23		Empathy Scale - Q3	0.352	0.000	HS
24		Empathy Scale - Q4	0.183	0.047	S
25		Empathy Scale - Q5	-0.128	0.046	S
26	self-knowledge scale	Self-knowledge scale-Q1	0.351	0.000	HS
27		Self-knowledge scale-Q2	0.205	0.000	HS
28		Self-knowledge scale-Q3	0.286	0.000	HS
29		Self-knowledge scale-Q4	0.156	0.030	S
30		Self-knowledge scale-Q5	0.426	0.000	HS

It clearly shows the degree of strength of the relationship between the mentioned axis in general and with a significant significance less than the approved significance level of 0.05.

Table (2): Estimation of the correlation coefficients between paragraphs of mathematical modeling skills with the total axis according to the simple correlation coefficient index of (Pearson)

S	Dimensions	Mathematical modeling skills	correlation coefficient	Indication level	Flee(*)
1	Understand the	Understanding the problem - Q1	0.156	0.001	HS

(*) HS: highly significant, less than 0.01; S: significant with a function of less than 0.05

(*) HS: highly significant, less than 0.01; S: significant with a function of less than 0.05

2	**problem**	**Understanding the problem - Q2**	**0.096**	**0.025**	**S**
3		**Understanding the problem - Q3**	**0.123**	**0.006**	**HS**
4		**Understanding the problem - Q4**	**0.154**	**0.001**	**HS**
5	**Building a mathematical model**	**Building a Mathematical Model - Q1**	**0.255**	**0.000**	**HS**
6		**Building a Mathematical Model - Q2**	**0.11**	**0.013**	**S**
7		**Building a Mathematical Model - Q3**	**0.091**	**0.033**	**S**
8		**Building a Mathematical Model - Q4**	**0.206**	**0.000**	**HS**
9	**Mathematical Processing**	**Mathematical Processing - Q1**	**0.155**	**0.001**	**HS**
10		**Mathematical Processing - Q2**	**0.198**	**0.000**	**HS**
11		**Mathematical Processing - Q3**	**0.17**	**0.000**	**HS**
12		**Mathematical Processing - Q4**	**0.177**	**0.000**	**HS**
13	**Interpretation**	**Interpretation - Q1**	**0.501**	**0.000**	**HS**
14		**Interpretation - Q2**	**0.354**	**0.000**	**HS**
15		**Interpretation - Q3**	**0.305**	**0.000**	**HS**
16		**Interpretation - Q4**	**0.4**	**0.000**	**HS**
17	**Verification**	**Verification - Q1**	**0.228**	**0.000**	**HS**
18		**Verification - Q2**	**0.218**	**0.000**	**HS**
19		**Verification - Q3**	**0.215**	**0.000**	**HS**
20		**Verification - Q4**	**0.207**	**0.000**	**HS**
21	**Prepare a report**	**Prepare a report- Q1**	**0.169**	**0.000**	**HS**
22		**Prepare a report- Q2**	**0.136**	**0.003**	**HS**
23		**Prepare a report- Q3**	**0.316**	**0.000**	**HS**
24		**Prepare a report- Q4**	**0.517**	**0.000**	**HS**

It clearly shows the degree of strength of the relationship between the mentioned axis in general and with a significant significance less than the approved significance level of 0.05.

3-2 Statistical analysis of test items

First: Discriminatory power: The method adopted by (half-splitting):

Table (3): The discriminatory power of the paragraphs of the axis of deep comprehension skills with the mid-section

S	Dimensions	Items	Z . statistic	Morale level	Significant*
1	**Explanation**	**Explanation - Q1**	**-14.056**	**0.000**	**HS**
2		**Explanation - Q2**	**-14.051**	**0.000**	**HS**
3		**Explanation - Q3**	**-14.866**	**0.000**	**HS**
4		**Explanation - Q4**	**-14.866**	**0.000**	**HS**
5		**Explanation - Q5**	**-14.866**	**0.000**	**HS**
6	**Interpretation**	**Interpretation - Q1**	**-14.021**	**0.000**	**HS**
7		**Interpretation - Q2**	**-14.385**	**0.000**	**HS**
8		**Interpretation - Q3**	**-14.866**	**0.000**	**HS**
9		**Interpretation - Q4**	**-14.739**	**0.000**	**HS**
10		**Interpretation - Q5**	**-14.866**	**0.000**	**HS**
11	**Application**	**Application - Q1**	**-13.915**	**0.000**	**HS**
12		**Application - Q2**	**-13.941**	**0.000**	**HS**

* The nonparametric test (Mann Whitney).

HS: Highly Significant at a significance level of less than 0.01

13		**Application - Q3**	**-14.086**	**0.000**	**HS**
14		**Application - Q4**	**-14.195**	**0.000**	**HS**
15		**Application - Q5**	**-14.17**	**0.000**	**HS**
16	**Perspective**	**Perspective - Q1**	**-13.892**	**0.000**	**HS**
17		**Perspective - Q2**	**-14.03**	**0.000**	**HS**
18		**Perspective - Q3**	**-14.866**	**0.000**	**HS**
19		**Perspective - Q4**	**-14.866**	**0.000**	**HS**
20		**Perspective - Q5**	**-14.866**	**0.000**	**HS**
21	**Empathy scale**	**Empathy Scale - Q1**	**-14.739**	**0.000**	**HS**
22		**Empathy Scale - Q2**	**-14.866**	**0.000**	**HS**
23		**Empathy Scale - Q3**	**-14.739**	**0.000**	**HS**
24		**Empathy Scale - Q4**	**-14.866**	**0.000**	**HS**
25		**Empathy Scale - Q5**	**-14.113**	**0.000**	**HS**
26	**Self-knowledge scale**	**Self-knowledge scale-Q1**	**-14.739**	**0.000**	**HS**
27		**Self-knowledge scale-Q2**	**-14.801**	**0.000**	**HS**
28		**Self-knowledge scale-Q3**	**-14.496**	**0.000**	**HS**
29		**Self-knowledge scale-Q4**	**-14.866**	**0.000**	**HS**
30		**Self-knowledge scale-Q5**	**-14.123**	**0.000**	**HS**

Summarizing the above, it can be said that the level of discriminatory power of the paragraphs of the skills of deep understanding and mathematical modeling has achieved a high level of discrimination and a very high moral degree through the low values of the level of significance calculated to approximate three decimal places, which confirms the state of paramount importance for the generality of the paragraphs of the mentioned skills

Table (4): The discriminatory power of the paragraphs of the axis of mathematical modeling skills by segmentation

S	Dimensions	Mathematical modeling skills	Z . statistic	Morale level	Significant *
1	**Understand the problem**	**Understanding the problem - Q1**	**-13.812**	**0.000**	**HS**
2		**Understanding the problem - Q2**	**-13.796**	**0.000**	**HS**
3		**Understanding the problem - Q3**	**-14.866**	**0.000**	**HS**
4		**Understanding the problem - Q4**	**-14.866**	**0.000**	**HS**
5	**Building a mathematical model**	**Building a Mathematical Model - Q1**	**-14.866**	**0.000**	**HS**
6		**Building a Mathematical Model - Q2**	**-14.866**	**0.000**	**HS**
7		**Building a Mathematical Model - Q3**	**-14.866**	**0.000**	**HS**
8		**Building a Mathematical Model - Q4**	**-14.866**	**0.000**	**HS**
9	**Mathematical Processing**	**Mathematical Processing - Q1**	**-14.288**	**0.000**	**HS**
10		**Mathematical Processing - Q2**	**-13.978**	**0.000**	**HS**
11		**Mathematical Processing - Q3**	**-14.801**	**0.000**	**HS**
12		**Mathematical Processing - Q4**	**-14.004**	**0.000**	**HS**
13	**Interpretation**	**Interpretation - Q1**	**-14.866**	**0.000**	**HS**
14		**Interpretation - Q2**	**-14.866**	**0.000**	**HS**

* The nonparametric test (Mann Whitney).

HS: Highly Significant at a significance level of less than 0.01

15		**Interpretation - Q3**	**-14.866**	**0.000**	**HS**
16		**Interpretation - Q4**	**-14.866**	**0.000**	**HS**
17	**Verification**	**Verification - Q1**	**-14.085**	**0.000**	**HS**
18		**Verification - Q2**	**-14.027**	**0.000**	**HS**
19		**Verification - Q3**	**-13.819**	**0.000**	**HS**
20		**Verification - Q4**	**-13.869**	**0.000**	**HS**
21	**Prepare a report**	**Prepare a report- Q1**	**-13.871**	**0.000**	**HS**
22		**Prepare a report- Q2**	**-14.001**	**0.000**	**HS**
23		**Prepare a report- Q3**	**-14.866**	**0.000**	**HS**
24		**Prepare a report- Q4**	**-14.866**	**0.000**	**HS**

Statistical methods: Appropriate statistical methods have been used and applied as follows:

First- descriptive statistics methods

The discriminatory power of the items of the two scales of Mathematical Modeling Skills and Deep Understanding Skills by the Half-Display Method

Second: Methods of inferential statistics: In order to make a decision regarding the rejection or acceptance of the statistical hypotheses of the research sample, the following methods were used:

Significance tests of the discriminative strength index according to the nonparametric Mann-Whitney test.

Table (5): Samples of the elected functions to study the impact of the quality of conciliation in choosing the optimal sample

Sample	Mathematical formulas for hypothetical Sample
Linear	**Model whose equation is Y = b0 + (b1 *x). The series values are modeled as a linear function of time.**
Logarithmic	**Model whose equation is Y = b0 + (b1 * ln (x)).**
Inverse	**Model whose equation is Y = b0 + (b1 / x).**
Quadratic	**Model whose equation is Y = b0 + (b1 * x) + (b2 *x**2). The quadratic model can be used to model a series which "takes off" or a series which dampens.**
Cubic	**Model defined by the equation Y = b0 + (b1 * x) + (b2 * x**2) + (b3 *x**3).**
Compound	**Model whose equation is Y = b0 * (x**b1) or ln (Y) = ln (b0) + (b1 * ln (x)).**
Power	**Model whose equation is Y = b0 * (b1**t) or ln(Y) = ln(b0) + (ln(b1) * x).**
S	**Model whose equation is Y = e**(b0 + (b1/x)) or ln(Y) = b0 + (b1/x).**
Growth	**Model whose equation is Y = 1 / (1/u + (b0 * (b1**x))) or ln(1/y-1/u)= ln (b0) + (ln (b1)*x) where u is the upper boundary value. After selecting Logistic, specify the upper boundary value to use in the regression equation. The value must be a positive number, greater than the largest dependent variable value.**
Exponential	**Model whose equation is Y = e**(b0 + (b1 *x)) or ln (Y) = b0 + (b1 * x).**
Logistic	**Model whose equation is Y = b0 * (e**(b1 *x)) or ln (Y) = ln (b0) + (b1 * x).**

Chapter Four: Presentation of Objective Indicators

Axes of deep understanding skills and mathematical modeling skills:

Table (6): Descriptive statistics and significance tests to assess the overall results of students in general on the axes of deep understanding skills and mathematical modeling skills in its various dimensions

Axis	Sample	م ش%	نع م ش%	م ف م	Significant*

*HS: Highly Sig. at P<0.01.

Deep understanding skills	**411**	**41.892**	**11.148**	**50**	**t= -14.745 P=0.000 HS**
Mathematical modeling skill	**411**	**31.3822**	**9.842**	**50**	**t= -38.351 P=0.000 HS**

In light of the foregoing, it is clear that the response levels are low with regard to the axes of deep understanding skills and mathematical modeling skills on the percentage scale in general.

Analyzing the relationship between deep understanding skills and mathematical modeling skills in general:

Table (7): The results of the quality of reconciling models of estimation functions of deep understanding skills with the effect of mathematical modeling skills in the combined formula in general

Equations	coefficient of determination	degree of freedom	Statistics test	significance level	Constant b0	Constant b1	Constant b2	Constant b3
Linear	**0**	**409**	**-0.001**	**0.973**	**42.19**	**-0.002**		
Logarithmic	**0.001**	**409**	**0.25**	**0.619**	**39.28**	**0.84**		
Inverse	**0.002**	**409**	**0.96**	**0.329**	**43.07**	**-26.06**		
Quadratic	**0.007**	**408**	**1.53**	**0.217**	**34.25**	**0.5**	**-0.0073**	
Cubic	**0.009**	**407**	**1.22**	**0.301**	**29.06**	**1.07**	**-0.0257**	**0.0002**
Compound	**0**	**409**	**0.14**	**0.705**	**39.68**	**1**		
Power	**0.004**	**409**	**1.65**	**0.2**	**33.43**	**0.06**		
S –Shape	**0.012**	**409**	**4.86**	**0.028**	**3.75**	**-1.51**		
Growth	**0**	**409**	**0.14**	**0.705**	**3.68**	**0**		
Exponential	**0**	**409**	**0.14**	**0.705**	**39.68**	**0**		
Logistic	**0**	**409**	**0.14**	**0.705**	**0.025**	**1**		

(*)S: Sig. at P<0.05

It is clear by reviewing the results of the significance levels of the analysis of variance for regression that the high quality of the fit of the simple non-linear model represented by the letter: (S-Shape) to study and analyze the behavior of the function and its significance at a level less than (P<0.05), and Table No. (8) includes the results Simple nonlinear regression estimates according to the mentioned linear model.

Table (8): Simple nonlinear regression analysis of the deep understanding skills function with the effect of mathematical modeling skills in the generally combined formula

The Dependent Variable: Dimensions of Deep Understanding Skills (Method of Analysis: S-Shape Model)					
simple correlation coefficient	**0.10835**	**Significant and with a level of significance less than 0.05**			
F-statistic for analysis of variance for regression	**4.85878**	**F-Significance**	**0.0281**		
Estimated response equation coefficients					
Impact components in the model	**Impact Parameter**	**Standard error**	**Standard Impact Parameter**	**Statistics T**	**Significance level**
Mathematical modeling skills	**1.51228-**	**0.071686**	**-0.2538**	**-2.204**	**0.0281**

Constant	**3.75344**	**0.028875**	**-**	**129.988**	**0**

(*) HS: Highly Sig. at P<0.000

It is clear that the relationship between the effect of mathematical modeling skills on the function of the dimensions of deep understanding skills, where the results of the correlation coefficient (0.10835) were recorded according to the matching model, which is with a significant degree and less than the significance level P < 0.05, and a significant effect and a significance less than the significance level P < 0.05, where The values of the impact factor amounted to (-1.51228) on the unit of measurement of the level of response and according to the conciliator model, and Figure No. (1) shows the general trend line (Long term trend) between the results of the change in the mathematical modeling skills scale, which resulted in a significant change in the results of the response in the indicator scale dimensions of deep understanding skills research sample.

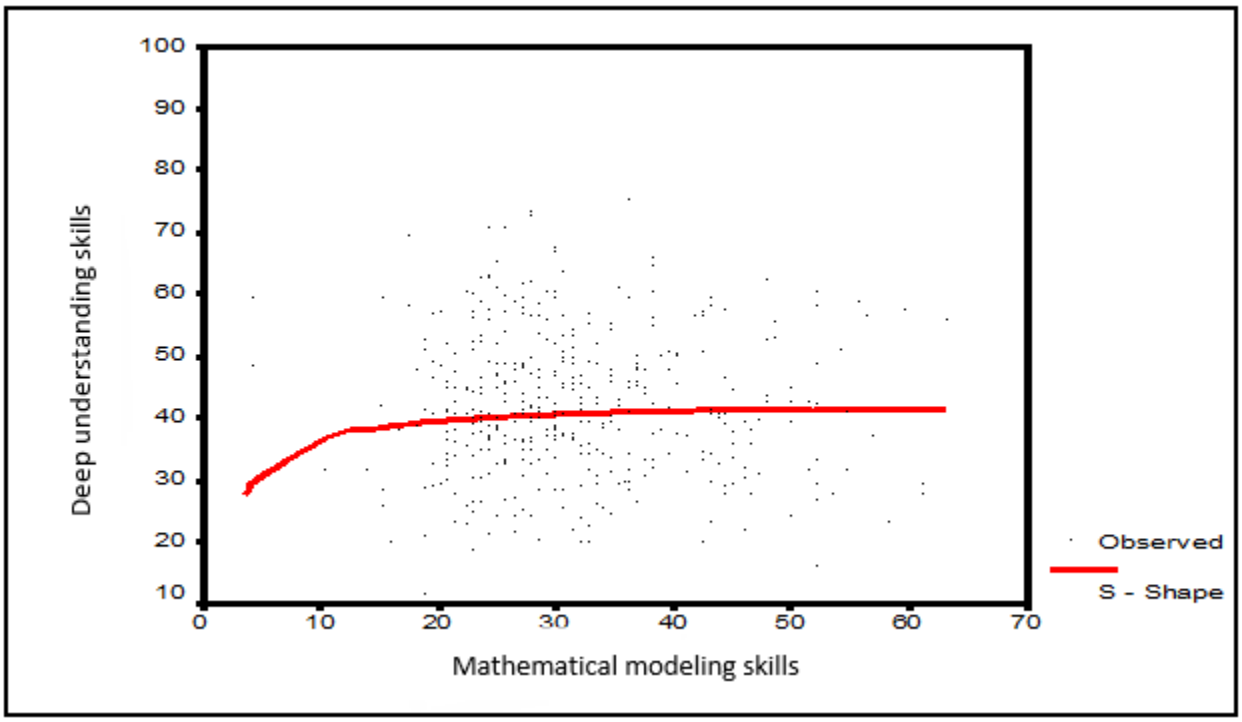

Figure (1): The general trend line of the effect of the responses observed by the group of respondents in general according to the dimension function of deep understanding skills with the effect of the dimensions of mathematical modeling skills

Conclusions:

1- There is a similarity in the low level of students' responses in general in the skills of deep understanding.

2- A low level of student's responses in general to the test of mathematical modeling skills was achieved.

3- There is a correlation according to the polynomial model used between the effect of mathematical modeling skills on the dimension function of deep understanding skills for the two groups of male and female students.

Recommendations:

1- Directing fifth grade math teachers to pay attention to developing mathematical modeling skills and deep understanding skills among their students.

2- Work to increase the qualification and training of mathematics teachers by preparing special training courses for this purpose related to introducing them to mathematical modeling and its importance and how to implement it in the classroom.

Suggestions:

1- Conducting similar studies to investigate the effect of other variables and their relationship in developing deep understanding skills.

2- Conducting a study to find out the impact of other factors such as teaching methods and the teacher's experience to find out the weakness of students in mathematical modeling skills and deep understanding skills to give a vision to the Ministry of Education to address the causes of this weakness.

Sources:

- Abo Zina, Farid Kamel (2010): **Developing and Teaching School Mathematics Curricula,** 1st Edition, Dar Wael for Publishing, Amman, Jordan.
- Al-Sharari, Salman Manoukh Tareb (2014): The effect of the mathematical modeling strategy on understanding mathematical generalizations and solving the mathematical problem in the light of the mathematical self-concept of mathematics teachers in the Kingdom of Saudi Arabia. **PhD thesis** published in the College of Graduate Studies, University of Jordan.
- Jaber, Abdul Hamid Jaber (2003): **Multiple Intelligences and Understanding. development and deepening.** Cairo: Dar Al-Fiker Al-Arabi.
- Zeitoun, Kamal. (2002): **Teaching Science to Understanding a Constructive Process**, Cairo, Alam Al-Kutub for Publishing and Distribution.
- Talba, Ihab. (2009): The effect of the interaction between the analogical thinking strategy and the levels of information processing in achieving conceptual understanding and solving physical problems among first-year secondary students. **Thirteenth Scientific Conference**. (Practical Education, the teacher, the curriculum, and the book are an invitation to review) - Egypt, p. 109 - p. 189.
- Statistical Analysis and Findings results were supervised by Emeritus Prof. (Dr.) Abdulkhaleq A. Ali Ghalib Al-Naqeeb, Statistician at College of Health and Medical Technology, Middle Technical University Baghdad – Iraq.
- Wiggins, G. & McTighe, J. (2005): **Understanding by Design**, 2nd Edition, Alexandria, VA: Association for Supervision and curriculum Development.
- Eel, R. I, "Essentials of Educational Measurement", New York, Prentichall, p555, 1972.
- Ghisell, Campbell, " Measurement Theory for behavioral sciences", San Francisco, 1981.
- Susana, Anstasi, Anne & Urbina, "Psychological Testing" New Jersey, Prentice, p148, 1997.
- NCTM (2000) Principles And Standards for School Mathematics. Reston, The Council.
- NGACBP:CCSSM (2010): Common Core State Standards for Mathematics.
- **PISA** and the V.S. **Common Core state standards for Mathematics.**
- Stacey, R. (1996). **Complexity and creativity in organizations** (1sted.) San Francisco: Berrett - Koehler publishers.