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A case study in Math Education: Mathematics Education to Adult and Young students in a same classroom at IAU

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Abstract

In this paper, we argue about some important and effective factors on quality of mathematics Education and Learning. Also, we study some problems in math teaching regarding the different conditions of students in a same classroom at the Islamic Azad University (IAU). Some conditions such as age of students (adult and young students), employment (employee and non-employee students), programs of prior education and etc. In order to improve the quality of teaching and learning, determining the differences of students and their points of view about the methods of math education, can be useful and efficient. This paper is one of the outputs of an academic research project at the Islamic Azad University of Toyserkan. IAU is a great non-governmental university in Iran which has different students with regard to age, employment and etc. In the present paper, we study the effects of the new methods of math education on improving the learning of different students.
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Keywords: Quality of Teaching and Learning; Teaching Skills; Methods of Math education; Technology-based education; active education; Adults and Young students, Employee and non-employee students.

1. Introduction

Recently there has been a great deal of interest in designing the standards and instructional methods for mathematics and statistics education [4], [5], [7], [9]. Many researchers interested in determining the most effective factors in math learning and teaching using statistical methods For instance Vasconcelos, R. and Babtista, M. (2007) have studied social and pedagogical math education factors of 14-15 year old students using by means of some statistical methods such as Cluster Analysis and Logistic Regression models [9].

Our research has been based on a theoretical framework concerning the meaning of mathematical object and clarifying or determining the most effective factors in math learning via statistical analysis (see Godino, J. D., & Batanero, C. (1998) and Vasconcelos, R. and Babtista, M. (2007).

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This research was designed to present standards for development in Elementary Mathematical sciences Education in Islamic Azad University of Toyserkan (IAU). In this paper we study the effective and important factors in improving quality of teaching and learning in elementary mathematics and statistics at IAU of Toyserkan.

If we want to achieve the ideal goal which states "good teaching leads to good learning" [7] we have to have a two way understanding between teachers and learners. Taking information about the students' conditions, backgrounds, potential, prior knowledge of students at the previous studies at high schools and determining the differences of students and their points of view about the methods of math education, can be useful and informative.

IAU is a great non-governmental university with several branches (more than one hundred and fifty branches at different cities and countries) and it has various fields of study and many students with different conditions regarding age (adult and young students), employment (employee and non-employee students), programs of prior education and etc. For determining and modelling these factors and variables, we conduct a research project in this connection at IAU.

In the research some of the mathematics education methods were briefly introduced to Engineering and Nursing students then we asked the students to rank the methods from their points of view. In following, by this ordinal scale question, some well known methods of math education such as classic math education, conceptual education, algorithmic education, active education and technology-based methods were contrasted. In the technology-based methods we used Power Point, Microsoft MS Word, Acrobat Reader, mathematical and statistical software and data projector in teaching math sciences.

Our research project is a survey research which was done in the 2009-2010 academic year at IAU of Toyserkan. The students of four classes were participated in the research as the sample students and a questionnaire was designed in consultation with mathematics and psychology teachers. The purpose of the questionnaire was to identify students' level of interest of learning math and the level of satisfaction with each of the math teaching methods. Also in most of the items (questions) of questionnaire we measure both the score of satisfaction and importance of each item. Participants were asked to indicate the score of each item in present status and the amount of importance of each item from his/her points of view in ideal situation. The minimum score was 1 and the maximum score was 5 (Likert Scale).

There are six general factors (one dependent factor and five independent factors) in the questionnaire: Quality of Education (QE), New Teaching Methods (NTM), Teaching Skills of teachers (TS), Students Participating in classroom (SP), Education Curricula of the departments (EC) and Learning Assessment (LA). The Questionnaire also had an open-ended response section which was designed to elicit more information about other effective variables and factors which can be connected with QE.

In the pilot survey we used 20 questionnaires and in the final survey sampling we have had 125 questionnaires which some of them have not returned or have not accomplished entirely (missing data problem).

The Reliability of the questionnaires was measured by Cronbach alpha and the results (0.85) improved the questionnaires' reliability.

In the following, in section 2, the relation between the QE and the other variables were studied and a multiple regression model was presented. Finally, in section 3 we have made several suggestions in math education.

2. Results and Discussion

2.1 Qualitative analysis

As it is stated, in the questionnaire, we have measured the amount of students' interest about different methods of math teaching. Six methods (five well-known methods and one method suggested as a mixed of the other methods) were suggested and then the opinion of each student about those methods was asked by the ordinal scale questions.

The median of each item is calculated and is compared with the expected median. In a 5 options Likert scale item, the expected median is 3 and any results less than 3 is assessed as a low interest (less than average interest) and any results greater than 3 is assessed as a high interest (more than average interest).

The results of classic education responses (N=119, median=2.84), Algorithmic methods responses (N=119, median=2.56) and conceptual education responses (N=118, median=2.77) show the low interest of students in these methods.

Also the result of active education responses (N= 119, median=3.3), technology-based method (N=118, median=3.89) and the mixed one methods (N=117, median=3.77) show the high students' interest to these methods of math education.
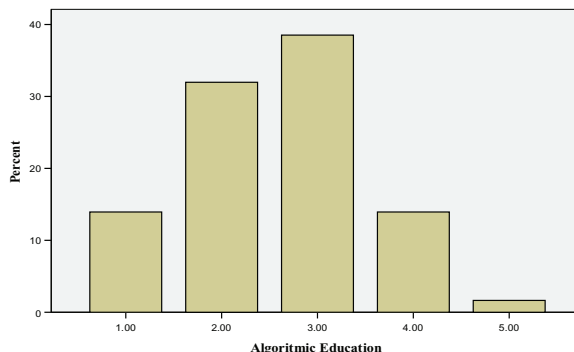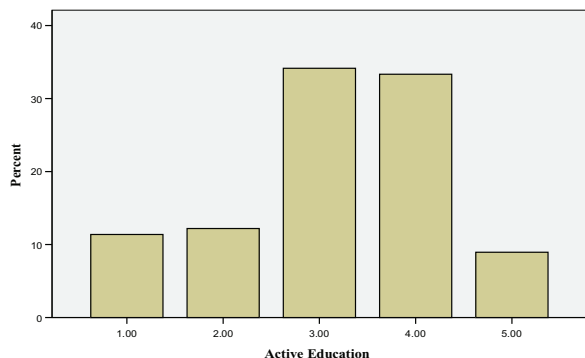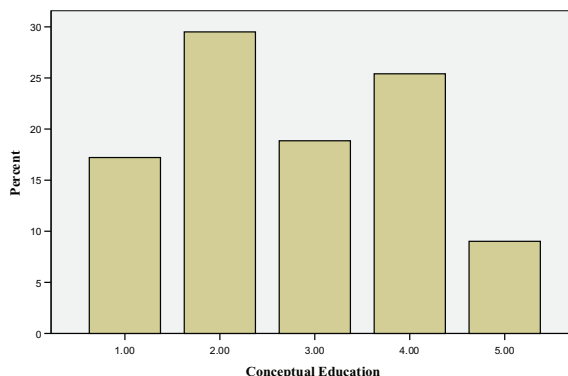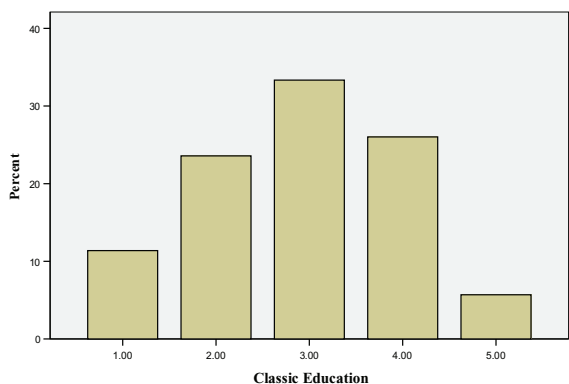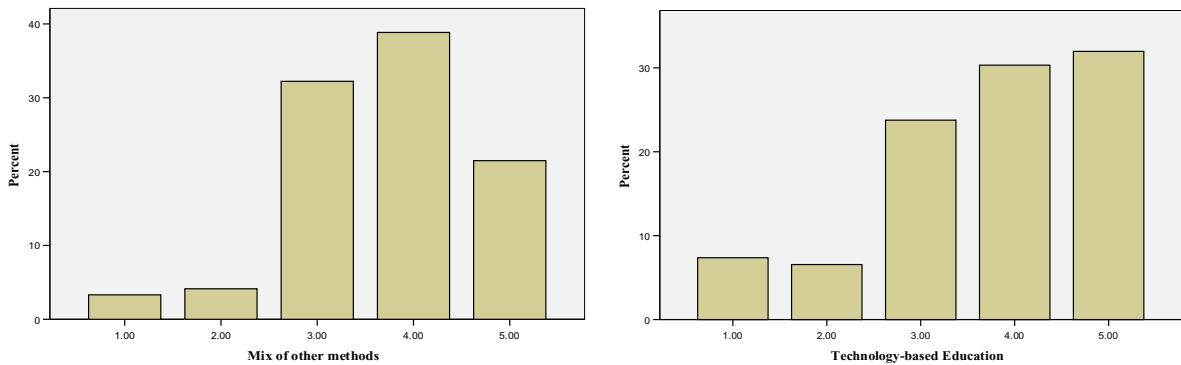
Figure (1) Bar Charts ordinal scale of methods of math education.

Also in another item of questionnaire participants were asked to rank the methods of teaching from the best one (rank 1) to the last selection of interest (rank 6). The results show in the following table:

Table (1): Ranks of Math. Education methods in all of questionnaires

method rank	Classic	Conceptual	Algorithmic	Active	Technology- based	Mixed method
1	9	10	7	16	15	25
2	7	13	11	14	20	15
3	7	15	10	23	15	10
4	11	13	19	10	10	10
5	30	15	15	4	9	6
6	19	17	11	7	3	5
Total	83	83	73	74	72	71

Where the values in the above table are the number of participants which were signed each of method ranks. The count values in the table confirm the former results about the ranks of teaching methods.

2.2　Quantitative Analysis

As we mentioned in section 1, in this research we studied the effects of several variables and factors such as New Teaching Methods, Teaching Skills of teachers, Students Participating in classroom, Education Curricula of departments, Learning Assessment, age of students and the students' employment status on the quality of education and learning. In the questionnaire each of the above factors was average of several questions or items. As a research question, we were interested in analyzing and modeling relationships and interactions of these variables. A well-known method of statistical modeling is the Regression model.

We used the multiple linear regression models with the step wise method to analyze the above factors. The step wise method can sort the most effective independent variables respectively. The step wise multiple regression's out puts, show that the independent variables; TS, SP, EC, NTM, LA, age of student, are confident. But in terms of the adjusted R square some of those variables have more share of variance of the dependent variable (QE). Hence using the analysis of variance (ANOVA) table and regression's coefficient tables we can say that the independent variables NTM, LA, age of student, have the less share of adjusted R square or they are not strictly confident and we can remove them from the regression model.

Table (2): R square and Adjusted R square changes

Model	R square	Adjusted R square	Std error of the estimate	R square change	Sig. F change	Durbin-Watson
1	0.76	0.76	6.49	0.76	0.000	1.95
2	0.90	0.89	3.98	0.14	0.000	
3	0.96	0.94	1.90	0.06	0.000	
4	0.97	0.96	1.46	0.01	0.002	
5	0.98	0.97	1.39	0.01	0.029	
6	0.98	0.97	1.35	0.00	0.033	

Models:
1. Predictors: (constant), TS. (First suggested model).
2. Predictors: (constant), TS, SP.
3. Predictors: (constant), TS, SP, EC. (Optimum model for adjusted R square= 0.94)
4. Predictors: (constant), TS, SP, EC, NTM.
5. Predictors: (constant), TS, SP, EC, NTM, LA.
6. Predictors: (constant), TS, SP, EC, NTM, LA, AGE. (Full model)
Dependent variable: QE

Also the ANOVA table is:

Table (3): ANOVA table

Model		Sum of Squares	d.f.	Mean Square	F	Sig.
3	Regression	15143.569	3	5047.856	1031.016	.000(c)
	Residual	421.075	86	4.896		
	Total	15564.644	89			

C: Predictors: (constant), TS, SP, EC. (Optimum model for adjusted R square= 0.94)
Dependent variable: QE

Also using the coefficient of regression table for model 3 we have the below model in studying the most important factors in the math education.

$$Y_i = -0.72 + 0.46X_{i1} + 0.34X_{i2} + 0.2X_{i3} + \varepsilon_i$$

Where in this linear model; Y is the Quality of Education, X_1 is the Teaching Skills, X_2 is the Education Curricula of departments and ε is the random error part of the regression model.

In order to study the effect of other variables such as employment, field of study, sex and marital status, on QE we used a univariate analysis of variance because the above independent variables have the nominal scale.

Results were shown that these factors and their interaction were not confident and in conclusion math education at IAU of Toyserkan respectively depend on Teaching Skills of teachers (TS), Students Participating in classroom (SP), Education Curricula of departments (EC), New Teaching Methods (NTM), Learning Assessment (LA) and age of the students.

3.   Conclusion

Using the statistical modeling methods including qualitative and quantitative studies, the regression and univariate analysis of variance models about the most important and effective factors on quality of education and learning at IAU, it can understand that consecutively some factors such as; improving in the teaching skills of the teachers, having suitable programs and conditions in curricula and using the new instruments of education and teaching (technology-based instruments) can provide the better education and learning conditions and can improve the level of satisfaction of the students.

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