

## *Full Length Research Paper*

# **Analysis and evaluation of new calculus textbook of mathematics strand's third grade in high school**

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Changing educational system exist suitable opportunity until it ripen review in curriculum and mathematical context in high school. In Iran, this matter has importance, because of focusing on educational system and lack of various educational media of textbook. In fact, one of the powerful improved mathematics educations is production of curriculum and suitable mathematics sub-materials and compilation of textbook proper in regard to designed needs. The aim of this study is analysis and evaluation of new calculus textbook of mathematics strand's third grade in high school. Research method is experimental and through cluster sampling on 40 teachers and 24 students thereby two instruments; questionnaire of teachers and calculus and geometry exams and also using One-Sample Kolmogorov-Smirnov test, one sample sign test and independent samples T-test in meaningful level of 0.05, we shown that teachers did not agree to respected period of time for instruction of this book and they believed to low period of time. They believed that context of textbook in relation to pre-taught contents and teachers can use active instruction methods and invitation of cooperation of students. In second and third chapters of textbook, practices and problems have harmony to context of textbook but this harmony does not observe in fourth and fifth chapters. Results of students' marks shown that marks' mean of students had not change to new textbook and it do not observe considerable improvement.

**Keywords:** Analysis, evaluation, calculus, curriculum, academic achievement.

## **INTRODUCTION**

Textbook is one of the important references and learning sources of students in educational systems today that provide collections of learning opportunities for educational general and partial aims and because all teachers fix self-activities on it, students need to read and comprehend of textbook also. Examination and evaluation limited to its contents for academic achievement also (Sheykholeslami, 2002). Result of third international mathematics and science study and its repetition that is implemented via the international association for the evaluation of educational achievement (IEA) shown that Iranian students' performance is very weak than other students' performance and has very distance to global median. This study was the important and the biggest study of this association in decade of 90 and toward 41 countries of members of association

participated in this study. It is usual that all people who relate to mathematics education any way, intend to discover reasons of suddenly results after getting these weak results. Gooya (1997) believed that need to ten continuum years until attained favorable results in educational revolutions. Therefore, proper time shall spend to proper and profit changes in education. Improvement of a country need to change of educational system and change of textbooks consequently. It has important that we studied whether these changes harmonize to corrective methods of education and existent conditions of country. Textbook has very important in identifying content and educational policy and all education' makers consider to it. Improper educational conditions such as lack of educational situations, educational assistive instruments, mass of students make increase to use of textbook. Lack of enough teachers' skills in educational aims' cognition and application of instructional methods is made of their more rely on textbooks and also evaluation methods of examination, learning needs limit to memorize and

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comprehend of textbooks' information that collection of these deficiencies are made of all programs and educational aims confined to learn only. In other hands, main changes in various directions which bode on necessary of changing curriculum, content, instruction method and mathematical evaluation wholly. The change of educational system arise proper opportunity until make to review in curriculum and mathematical content in high school. In Iran, this matter has importance, because of focusing on educational system and lack of various educational media of textbook. In fact, one of the powerful improved mathematics educations is production of curriculum and suitable mathematics sub-materials and compilation of textbook proper in regard to designed needs. In direction, Gooya (2007) stated that consideration to cultural-social features of Iran is a necessary and authors of new textbooks shall consider instruction and learning as social activities and professional improved program had focused on it. Also considered curriculum shall estimate prospects which we have expectancy of idealist human. National curriculum is main rule of education and this curriculum will universal map and educational framework system in country. Base on document of national curriculum, belief, science, act and behavior posit on center of students' curriculum. In regard to multi-dimension of this program, presence of students and teacher will not be unique to class only and they will presence in educational, social and cultural situations in addition to class and schools also (Alamiyan, 2010). Instance, mathematical curriculum should responsible on education of creative, critic, selective and determinant humans. Therefore, programmers and authors of textbooks shall select and provide favorable contents and collect using educational results in textbooks framework for students properly in regard to instruction, learning, principles and roots of setting content. In present mathematics textbooks, it is considered to students-centered in mathematical problem solving especially. New procedure which follow in compilation and corrections of mathematics textbooks in different academic grades, is application of mathematical concepts and implementation of mathematical problem solving. Base on whatever Nosrati (2009) explains, one of the important problems which mathematics education programmers consider to it, is effect of problem solving method on achievement of mathematics lessons. In educational centers, it shall change this method. It shall consider to their education in all fields than increasing preservations levels of students and stress to young's brain (Shariatmadari, 1995). In Islam, education method was not instruction only but instruction was how instruct. If we studied quality of instruction of religion's principles which is one of the important problems of instruction of Islam, we observed that religion's principles is not imitate and it means that ever person should comprehend

important religion' problems through thinking independently and priest and child shall think through self-independent logic and method not that learn through mimic method.

## Literature

Among mass of researches in analysis and evaluation of calculus textbook and also curriculum, three researches had considered more and more; I) Pauli et al (2007) had studied the effects of two educational dimensions, self-regulation and instruction thereby problem solving method on 79 mathematics classes in eighth grade via video cases of mathematics lessons and questionnaires of students and teachers and also achievement tests in their article. Results show that provided often situations for self-regulation learning in surface instruction of teachers and obtained situations for independent problem solving in regard to their deep instructional levels. Constructivists' beliefs of teachers effect on situation of preparation for problem solving only and do not effect on situations of self-regulatory learning. Situations of self-regulatory learning have positive affective on learning experience of students. Professional improvement shall encourage teachers until consider both deep and surface level's features of instruction. Added usage of descriptive instructional methods and students-centered will not lead to create learning opportunities which its aim is bring higher thinking skills and response to problem solving process but these dimensions had rather realized independent of other yet. These results have harmony to items which corrections of instruction is implemented in international texts, II) Dudaite (2007) stated that students believed that their achievements in mathematics indebted change of traditional instruction to problem solving and active methods. Students know attractive mathematics learning when its subjects is relate to their life and vocation. Therefore respected instructional aims were as forms "mathematical information development, research and mathematical problem solving instruction, mathematical standard solutions, mathematical deduction, mathematical positive attitudes, spread of mathematical study, scientific framework as mathematical form" during instructional correction that had led to math success of students in Lithuania and III) Gooya (2007) studied the beliefs and opinions of teachers about corrections of geometry. She believes that teachers and their beliefs are two the most effective factors in correction in any program. In regard to previous research, shortage of studies obvious in analysis and evaluation of calculus textbook and how change curriculum in Iran. In this research, it is tried to study that calculus textbook which had written and taught in high school in direction of cooperation to national curriculum and changing textbook

in 2010.

### **Hypothesis**

- I) There are lack of period time in budging contexts during academic year.
- II) Content of textbook is provided in regard to pre-taught of students.
- III) In ever subject, examples, practices, drills and problems have harmony to content of textbook.
- IV) Teachers can use of active instruction methods and invitation of students' cooperative in regard to textbook's content.
- V) Changing textbook make to increase in marks of students in final exam.

### **METHODOLOGY**

Used method is experimental method in this research. Needful data attained through three methods. To access literature of research, it is used of library method and in experimental method, it is used of questionnaire and marks of students. In this method, marks of geometry 1 (which had taught thereby previous calculus textbook) in 2009-2010 and (which had taught thereby changed calculus textbook) in 2010-2011 is considered as control group and marks of calculus is considered as experiment group in same years. Independent variable is the analysis of changed calculus textbook and dependent variables are opinions of teachers and students' marks in final exams.

### **Participants**

In this research, statistical society is calculus teachers at 9 and 19 zones and third grade girl students in high school in mathematics strand at 9 zone of Tehran. Fourteen calculus teachers are selected thereby cluster sampling method. Also, samples of students had gotten 24 students through Cochran formula.

### **Instruments**

In this research is used of calculus and geometry exams and questionnaire.

### **Questionnaire**

It is used of questionnaire as research instrument to access respected data. This questionnaire included of 22 questions and having four scales of Likert; "low", "very low", "median" and "desirable". This instrument is provided of mathematics group in Tehran. Content reliability of questionnaire had emphasized via experts

and specialists in mathematics fields and general correlation's coefficient had equaled to 0.85 that questionnaire has acceptable validity. This questionnaire had completed via calculus teachers.

### **Calculus and geometry exams**

In this research, it is used of marks of geometry 1 as control group' marks and final exam's marks of caculus as experiment group' marks. Marks of geometry 1 is replaced to marks of math until level of students had evaluated in same lessons. Because geometry 1 textbook is taught both groups. Content reliability of this exam emphasized via mathematics group and teachers in high school. It is used of Split-half test (two half method) that in regard to  $r = 0.73$ , these exams have acceptable validity.

### **Collecting data**

After providing questionnaires, researcher distributed it among calculus teachers randomly through participating in educational sessions in respected zones that are collected after their resposing to questionnaire. Of course, some teachers send their responses via E-mail and also marks of calculus' final exam had collected via manegers, counterparts and archives of respected high schools.

### **Data analysis**

In descriptive statistic section, we consider mean, Std.deviation and mode. In deductive statistic section in meaningful level of 0.05, firstly we evaluated the normality of marks and data of questionnaire thereby One-Sample Kolmogorov-Smirnov test then we used of one sample sign test for evaluating resulted data of questionnaire and finally it is used of Leven's test and independent samples T-test for evaluating marks in control and experiment groups.

### **RESULTS**

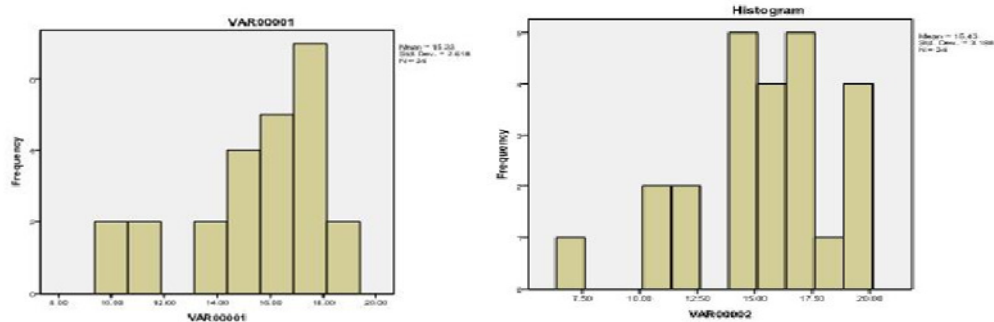
In descriptive statistic section, we studied marks of pretests and posttests of control and experiment groups. As shown in Table 1, marks of pretests of geometry has not meaningful difference in both perivous and new calculus textbooks ( $M = 15.42, 15.33$ ). Also, marks of posttests of calculus has about difference among perivous and new calculus textbooks ( $M = 12.49, 13.48$ ). In Table 2, resulted data of questionnaire show that more teachers had response to items; "median" and "desirable".

**Table 1.** Marks of control and experiment group

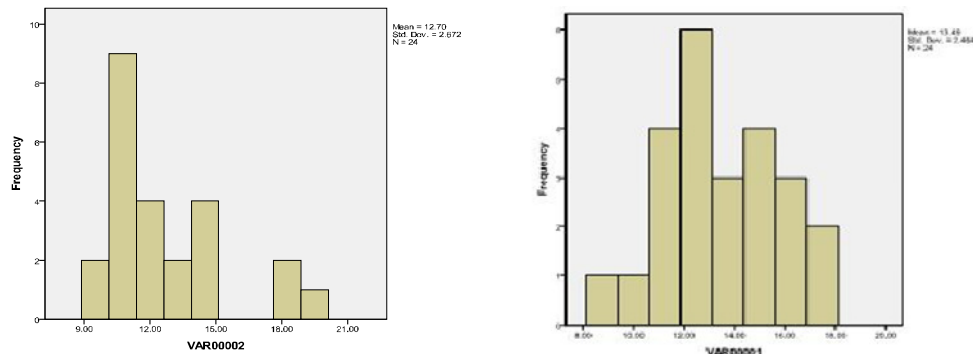
	N	Mean	Std. deviation
Pretest's marks of geometry 1 (control group) [Pervious calculus textbook]	24	15.42	3.18
Pretest's marks of geometry 1 (control group) [new calculus textbook]	24	15.33	2.61
Posttest's marks of calculus (experiment group) [Pervious calculus textbook]	24	12.49	2.67
Posttest's marks of calculus (experiment group) [new calculus textbook]	24	13.48	2.46

**Table 2.** Data of questionnaire

<b>Questions</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>
<b>Mode</b>	3	3	4	3	4	3	4	4	3	3	3
<b>Mean</b>	3.32	3	3.52	3.15	3.57	3.25	3.42	3.8	3.2	3	2.97
<b>Std.deviation</b>	0.57	0.87	0.50	0.69	0.50	0.70	0.74	0.40	0.72	0.67	0.53
<b>Questions</b>	12	13	14	15	16	17-1	17-2	17-3	17-4	17-5	18
<b>Mode</b>	4	3	3	1	3	3	4	3	3	3	3
<b>Mean</b>	3.42	3.39	2.92	1.42	2.92	3.1	3.45	3.25	3.1	3.07	3.25
<b>Std.deviation</b>	0.63	0.59	0.57	0.59	0.69	0.84	0.67	0.7	0.63	0.52	0.7



**Figures 1.** Pretest's marks of control group in geometry 1(right site: pervious calculus textbook) / Pretest's marks of control group in geometry 1(left site: new calculus textbook)



**Figures 2.** Posttest's marks of experiment group in calculus (right site: pervious calculus textbook) / Posttest's marks of experiment group of calculus (left site: new calculus textbook)

As shown in Figures 1 and 2, marks of geometry 1 are same in both groups; pervious calculus textbook and new calculus textbook but marks of posttests of calculus (new calculus textbook) are about more than marks of

posttests' calculus (pervious calculus textbook). Now, we evaluated marks and data of questionnaire thereby One-Sample Kolmogorov-Smirnov test. According to Table 3, P-values are more than 0.05 ( $P > 0.05$ ) in two control and

**Table 3.** Normality of control and experiment groups

	Pretest of geometry 1 [Pervious calculus textbook]	Pretest of geometry 1 [new calculus textbook]	Posttest of calculus [Pervious calculus textbook]	Posttest of calculus [new calculus textbook]
<b>N</b>	24	24	24	24
<b>Z</b>	0.9	0.78	0.5	1.11
<b>P-value</b>	0.39	0.56	0.96	0.16

**Table 4.** Normality of data of questionnaire

Questions	1	2	3	4	5	6	7	8	9	10	11
<b>Z</b>	2.15	1.73	2.22	1.64	2.38	1.66	1.92	3.09	1.52	1.73	2.33
<b>P-value</b>	0	0.005	0	0.009	0	0.008	0.001	0	0.019	0.005	0
<b>N</b>	40	40	40	40	40	40	40	40	40	40	40
Questions	12	13	14	15	16	17-1	17-2	17-3	17-4	17-5	18
<b>Z</b>	0.2	1.84	2.86	2.45	1.69	1.59	2.16	1.61	1.97	2.41	1.61
<b>P-value</b>	0.001	0.002	0.00	0.00	0.006	0.012	0.00	0.011	0.001	0.00	0.011
<b>N</b>	40	40	40	40	40	40	40	40	40	40	40

**Table 5.** Results of one sample sign test

Questions	1	2	3	4	5	6	7	8	9	10	11
<b>Median</b>	3	3	4	3	3	3	4	4	3	3	3
<b>P-value</b>	0.00	0.33	0	0.13	0	0.00	0	0	0.06	0.59	0.72
<b>N</b>	40	40	40	40	40	40	40	40	40	40	40
Questions	12	13	14	15	16	17-1	17-2	17-3	17-4	17-5	18
<b>Median</b>	3	3	3	1	3	3	4	3	3	3	3
<b>P-value</b>	0.00	0.00	0.77	1	0.82	0.14	0.00	0.02	0.22	0.27	0.02
<b>N</b>	40	40	40	40	40	40	40	40	40	40	40

**Table 6.** Results of independent samples test in pretests of control groups

	Leven's Test for Equality of Variances		T-test for Equality of Means			
	F	Sig	t	df	sig	Mean Difference
Equal Variances Assumed	0.38	0.53	-0.11	46	0.91	-0.93
Equal Variances Not Assumed			-0.11	44.31	0.91	-0.93

**Table 7.** Results of independent samples test in posttests of experiment groups

	Leven's Test for Equality of Variances		T-test for Equality of Means			
	F	Sig	t	df	sig	Mean Difference
Equal Variances Assumed	0.01	0.9	1.06	46	0.29	0.79
Equal Variances Not Assumed			1.06	45.7	0.29	0.79

experiment groups. Marks of pretests and posttests are normal. Also, we observe that P-values in all questions of questionnaire are less than 0.05 ( $P < 0.05$ ) in Table 4. Then data of questionnaire are not normal.

In Table 5, results of one sample sign test shows that P-values of questions; 2,4,9,10,11,14,15,16,17-1, 17-4,17-5 are more than 0.05 ( $P > 0.05$ ) in meaningful level of 0.05, that is, these questions accepted but other

questions are rejected because P-values of it is less than 0.05 ( $P < 0.05$ ).

Now, in Table 6, we consider Leven's test for equivalences of variances of control group and then we used of independent samples test for comparison of marks of experiment group in meaningful level of 0.05. Results of Leven's test show that variances of marks are equal ( $F=0.38$ ,  $P > 0.05$ ). Also, results of independent test show that mean of geometry's marks are equal in pretests of control group ( $T = -0.11$ ,  $P > 0.05$ ).

As shown in Table 7, we consider Leven's test for equivalences of variances of experiment group and then we used of independent samples test for comparison of marks of experiment group in meaningful level of 0.05. Results of Leven's test show that variances of marks are equal ( $F=0.01$ ,  $P > 0.05$ ). Also, results of independent test show that mean of calculus' marks are equal in posttests of experiment group ( $T = 1.06$ ,  $P > 0.05$ ). That is; there are not meaningful differences between marks of pervious calculus textbook and new calculus textbook

## CONCLUSION

This research had tried to discovered and explained existant real problems in new written textbook and using final marks of students were on standard questions and harmony in throught country, then results is generalized. In questionnaire; I) teachers were not agree on considered period time for instruction of textbook and they believed that this time is rare, then first hypothesis had emphasized, II) teachers believed that context of textbook relate to pre-taught, then second hypothesis had accepted, III) in second and third chapters, examples, practices, drills and problems have harmony to content of textbook but first, fourth and fifth chapters, in ever subject, examples, practices, drills and problems have not harmony to content of textbook, then related hypothesis had accepted in second and third chapters and had rejected in first, fourth and fifth chapters, IV) teachers can use of active instruction methods and invitation of students' cooperative in regard to textbook's content and this result is acceptable in fourth hypothesis and V) mean of marks of students had not changed with new textbook and this result rejected fifth hypothesis also. According to results of this research, following suggestions recommend in improvement of mathematics education; 1) in adjustment and compilation of textbooks, programmers and authors shall consider to opinions of teachers who had responsible on instruction of textbook until use of their profit experiences in instruction, 2) guidance booklet which included of beginning lesson with problem shall get to teacher until their self-students have

to think in its problem and 3) inservice instruction shall implement to teachers that relate to lessons which had changed and in these instructions, instruct using software also. Limitations of this research included of; 1) results of this research is relate to calculus textbook only and we can not generalize to others textbooks such as geometry, physic,... and 2) lack of harmony in sessions mathematics education groups with proper time for presence of researcher for completion of questionnaire.

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