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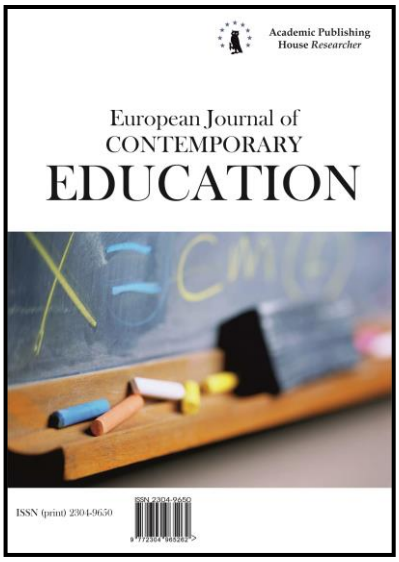

The Prediction of the Students' Academic Underachievement in Mathematics Using the DEA model: A Developing Country Case Study

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Abstract

In this study, an attempt was made to predict the students' mathematical academic underachievement at the Islamic Azad University-Yadegare-Imam branch and the appropriate strategies in mathematical academic achievement to be applied using the Data Envelopment Analysis (DEA) model. Survey research methods were used to select 91 students from the Faculties of Engineering, Science, and Humanities for the analysis using the DEA model, along with the SBM method. This study had shown that the mean and the sum of the pre-university math score rankings were higher than the university's math scores. Therefore, it was concluded that the Islamic Azad University (Rey branch, Tehran province) students had displayed academic underachievement in the math exam. Moreover, "the economic, social, and educational factor" did not have any significant relationship with the students' "math scores." Also, forming the regression equation proved meaningless indicating economic, social, and educational factors did not impact on their mathematical academic underachievement. It was shown that the low level of performance was indicative of the students' negligence and reluctance concerning the math lessons, and it revealed that the economic, social and educational factors had no involvement or impact on their math scores. The results of this research will be for the benefit of the professors, administrators, and presiding officers of colleges in the field of mathematics.

Keywords: Academic underachievement, mathematics, academic achievement, Islamic Azad University, DEA model.

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1. Introduction

One of the branches of science that have always played a significant role in the development of human technology is mathematics. Humans have always been engaged in using the inspiration gained from his natural surroundings and modeling them when creating artifacts and had been aware of the fact that, without having a firm mathematical basis, the creation of anything functional would be impossible. It must be acknowledged that the traditional practices and attitudes of the individuals whose collective mathematical endeavors are doomed to fail, especially those aimed at the direct evaluation of high-level human skills, such as patterns of thought and cognition, reasoning and conceptual understanding, problem solving and the ability to communicate both within and outside of the world of mathematics. In this domain, new approaches based on the cognitive-behavioral analysis of the learners' mathematical behavior should be invented and developed. The fact that, in the past, some researchers considered mathematical knowledge and content as the only determining factor in teaching mathematics, is no longer accepted as a relevant scientific perspective. Many learners faced educational failure and underachievement due to reasons that vary, based on the type of respective society involved. While this failure will be the basis for many of their cultural, mental, economic, social, and family problems and because of the importance of the reasons for the failure, it will directly affect their educational future. Therefore, through the accurate and comprehensive understanding of these factors, we should prevent the emergence of such problems for the individuals, families, and communities and also the loss of the used expenses (Masoumi et al., 2007). Mathematics an important role, given the characteristics of modern society, in providing such skills, since mathematics deals with observation, calculation, analysis, inference, deduction, proof and prediction, and as a communication system, helps learners to obtain the precise and correct understanding of the information (Chamanara, 2011). The primary objective of mathematics, in the first place, is enhancing the problem-solving abilities in students and is a tool for understanding the surrounding phenomena and gaining the capacity to analyze complex situations. The importance of paying attention to academic courses, especially to math, shows that through paying attention to the objectives of this course, we can create the conditions for fostering logical thinking and problem-solving skills in learners, and provide the basis for the learners' applicability of mathematical concepts in real-life (Behrangi, 2001). Mathematics is a science with abstract intellectual concepts; that is to say, many of the mathematical concepts are the visions of objects cannot be interpreted by the real world in the same intellectual way. The fact that mathematics is an abstract science has made the possibility of understanding its concepts difficult and, as a result, it has made its teaching and learning hard. Subsequently, mathematics requires special teaching methods (Latifi and Karachi, 2006) to teaching it effectively. Mathematical underachievement has long been among the concerns of experts in this field. The educational performance of students is indirectly under the influence of their poor achievement in math. Investigating the factors that have roles in the mathematical underachievement of the students seems necessary, due to the results of the international studies done by academics, such as Lax (1990), Douglas (1998), Borba (2005), and Gynnild et al. (2005), which indicate some mathematical underachievement. Students' cultural backgrounds and learning-teaching methods are the factors influencing the students' mathematical performance. These influential teaching methods include the type of homework or tasks assigned to the students, learner-centered teaching methods and teacher-centered teaching methods. Learning methods include ones where the students' individual work is done as provided in their books, or by their teacher, and additional learning methods include group or class discussions regarding classroom problem-solving tasks. According to Sitko (2013), the students' mathematical performance might be influenced by the way teachers punish the students, the teacher-student relationship, and the kind of homework assigned by their teachers. On the other hand, the students' concentration in schools is affected by their learning environment.

2. Definition of Underachievement

In defining the term "Achievement," Smith (2003) points out that the notion of "underachievement" is broadly used by journalists, academics, and politicians to refer to a rather poor educational performance, but based on the literature review, there is little agreement on its measurement and definition. She believes that the term "underachievement" is mostly mixed and

combined with the notion of poor achievement, especially in media reports. She refers to the definitions proposed by researchers for the term "underachievement", which largely appears in the literature, as "class performance, usually measured by scores, that is significantly below what is expected based on the student's mental ability, usually measured by aptitude or standardized educational texts" (p. 290). Jones and Myhill (2004) maintain that the term "underachievement," as used in the context of the underachieving boys, suggests that boys are underachievers, not poor achievers and that compared to girls, boys are more likely to perform below their potential. In point of fact, the present underachievement dispute has become almost entirely a discussion about boys. Jones and Myhill made a distinction between noteworthy and poor achievers on the one hand, as well as underachievers, on the other hand. Poor and noteworthy achievers refer to those students whose performance concords their ability, while the term underachiever refers to one whose ability does not match his performance.

3. Socio-Economic Factor

Socio-economic status acts as a predictor of mathematical achievement. It is recurrently found by studies, such as those conducted by Hochschild (2003) and Eamon (2005), that there are a positive relationship and correlation between the students' mathematical achievement scores and their parents' income. According to Ma and Klinger (2000), primary science and math achievement scores, socio-economic status plays an important role. In another study by Hull (1990), poor educational achievement of the Canadian students was due to their low socio-economic status. As reported by the Council of Ministers of Education Canada, Statistics Canada, and Human Resources Development Canada, 2001, and according to the Program for International Student Assessment, socio-economic status is considered to be one of the main predictors of educational achievement discrepancy of 15-year-old Canadian students in science, mathematics, and reading. Some of the studies revealed that parents with higher socio-economic status play more effective roles in their kids' education, compared to the parents with lower socio-economic status. According to Stevenson and Baker, (1987), this more effective role raises the positive attitude of the student toward the classes and the educational center, and enhances their educational achievement. As asserted by Jeynes (2002), due to the creation of a stressful atmosphere at home by raising conflict in the family, and facilitating potential interferences in parenting and due to it causing the prevention of the students' access to different educational resources and materials, low socio-economic status is believed to have a negative impact on students' educational achievement. That is why the students' socio-economic status is considered a common determining factor for educational achievement. It begins with a brief discussion, emphasising the distinctions between socio-economic factors that have influences on the quality of education, and the financial concerns pertaining to education. This thesis reviews some of the relevant studies that had dealt with the topic at hand. In the literature concerning education economics in developing countries, multiple and varying relations between educational outcomes and student socio-economic status have been well-reported. A series of compound and interconnected factors, both outside and inside the school system, lead to poor results at school level. Thomas and Stockton (2003) addressed the impact of the three factors of gender, ethnic, and socio-economic status on the students' achievement in mathematics. After Coleman's (1966) claim about the important impact of students' backgrounds on their school activities, socio-economic status came to be considered as an important predictor of students' educational achievement. As Payne and Biddle (1999) asserted in their study, which worked on the data gathered from the Second International Mathematics Study (SIMS), for the USA to be ranked second out of twenty-three participating countries, they would need to represent only the scores of the schools in the regions with low levels of poverty, but in only considering the school regions with high levels of poverty, USA would have ranked in a higher position than Nigeria and Swaziland. Poverty interacts with other factors, such as ethnicity as a significant predictor of educational achievement. As the findings of Harkreader and Weathersby (1998) show, ethnicity has less of an influence than economic factors do. Contrariwise, Bankston and Caldas (1998) found that there is a stronger relationship between minority status and educational achievement than the relationship between socio-economic status and educational achievement. The influences related to ethnicity and culture are significant and may be combined with gender influences for the purpose of predicting educational achievement. According to Lee and Madyun (2009), the students who grow up in deprived districts are more likely to be in the position of general, self-perpetuating

underdevelopment, compared to their peers who grow up in economically / socially stable districts, as a result of the more important social factors, far beyond the students' influence alone. Many different regional features influence the region's disadvantage and, consequently, the ability of a community to retain social control. These regional characteristics include factors such as neighborhood poverty, high residential mobility, crime, family composition, and ethnic diversity. As Lee and Madyun (2009) stated, there is a correlation between socio-economic status and the students' cognitive ability and educational attainments due to the fact that the students from families with high socio-economic status are supported by their families for their parents are apt to socialise their kids in a way that enhances their performance in IQ tests, which also indicates how they perform educationally. In a study conducted by Lee and Madyun (2009), it was found that students living in regions with low rates of poverty and crime, displayed higher educational attainment in both reading and mathematics, compared to the students in other regions. On the contrary, students living in regions with high rates of poverty and crime, compared to the students in other regions, lagged behind in reading and mathematics. Moreover, they found an important interface effect between ethnic and region type on the students' educational achievement. Wheaton (1985) argued that the presence of regional disadvantage may, ironically, encourage the students to mobilise or organise socio-economic resources to address their social marginalisation.

4. Educational Factor

In the literature, many concerns have been highlighted in the current math curricula as educational factors that underscore …."not so much a form of thinking as a substitute for thinking. The process of calculation or computation only involves the deployment of a set routine with no room for ingenuity or flair, no place for guess work or surprise, no chance for discovery, no need for the human being, in fact" (Scheffler, 1975: 184). The concerns proposed in the literature are not saying that students should not learn to compute, but rather that they are emphasizing that students should learn how to produce effective solutions through learning the ways of analyzing the mathematical problems critically. In order to do so, according to Cobb et al. (1992), they need to learn how to think in a mathematical way and how to understand difficult math concepts. Many mathematics curricula overstress the facts memorization and understate the comprehension and use of these facts for the purpose of realizing, connection makings, and testing the math concepts. For students, in order to successfully use what they learn, memorization must be elevated to realization, use and problem-solving. As mentioned by Warren and Rosebery (1996), Bransford et al. (2000), and Schauble et al. (1995), a great deal of research indicates that educational factors (in the form of a curriculum), which consider learners to be unable to meet cognitive activities, such as complex reasoning, should be exchanged with the curriculum which considers students capable of higher-order reasoning and thinking, when supported with relevant and required activities and knowledge. According to Lehrer and Chazan (1998), research has also shown proof that educational factors leading to growth in students' skills and knowledge, are significantly linked to their learning, and consequently their achievement.

5. Educational Strategies

The factors involved in mathematical success include the ability to comprehend one's current knowledge, build upon this knowledge, enhance it, and decide based on it or make changes when confronting the conflicts. For this purpose, according to Romberg (1983), we need inventing, problem solving, proving, and abstracting. These are the essential cognitive processes that students are required to develop and apply in math classes. Thus, teaching-learning methods and strategies that present learning situations to the learners, in which they can create and use higher-order operations, are necessary for mathematical achievement. In the literature, according to Wilson (1996), it is stated that teachers must provide authentic and meaningful learning tasks to make students build their knowledge and understanding in the field of mathematics so that they can accomplish learning. Moreover, as Bloom (1976) highlighted, the teaching strategies that students actively apply in their own learning is important for their success. Teaching strategies form the students' development in learning and their mathematical achievement.

6. Teacher/Professor Competency in Mathematics Education

Many studies in the literature suggest that teachers' knowledge and beliefs concerning mathematics is directly associated with their teaching procedures and choices (National Council of Teachers of Mathematics, 1989; Brophy, 1990). Moreover, Gellert (1999) stated that "in mathematics education research, it seems to be undisputed that the teacher's philosophy of mathematics has a significant influence on the structure of mathematics classes" (p. 24). Teachers are required to have knowledge and skills to use their teaching philosophy and teaching decisions. One changing educational pattern in the 21st century is about teachers' skills and roles. Research results concerning teacher skills suggest that, "If teachers are to prepare an ever more diverse group of students for much more challenging work – for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively – they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop" (Darling-Hammond, 1997: 154). According to Bransford et al. (2000), teachers need to have three types of knowledge, namely: knowledge of their students, pedagogical knowledge, and knowledge of a specific issue. Teacher proficiency in these domains is closely related to student learning, understanding, and thinking in mathematics. Undoubtedly, according to Grossman et al. (1989), for students to reach mathematical achievements, teachers are needed to have an epistemology that guides them in math teaching and a well-founded understanding of the subject matter, and also a similarly thorough understanding of different types of teaching activities that enhance the student's achievement. Experienced mathematics teachers make a careful plan to lead their students' critical thinking, to a systematized understanding of mathematical concepts, to reflective learning, and finally to mathematical attainment.

7. Educational Center Facilities

Facilities and context of the educational centers are the potential main factors in student achievement. In point of fact, educational experts have begun to focus on identifying factors related to the environment of the educational centers. For example, Reyonds et al. (1996) propose that student achievement is related to the organized and safe atmosphere in educational centers. Some factors have also been found by researchers to have a negative impact on student achievement, including deficiencies in the educational center's components or features like lighting, age, the budget for buying equipment. Considering the condition of the educational center' building, Cash (1993) found that compared to the students in above standard buildings, the students in standard buildings achieved lower achievement scores. Moreover, Rivera-Batiz and Marti (1995) worked on examining the relationship between student achievement and the overcrowded buildings of the educational centers. The study revealed the negative effect of a dense population of students in overcrowded buildings, on student achievement.

Examples of the research done similarly in this area are as follows: In eight Johannesburg public primary schools, Ndebele (2015) found the negative influence of socio-economic factors on the involvement of the parents in their children's homework assignments during the foundation phase. The study was carried out on more than 600 parents from schools in various socio-economic and geographical areas, such as townships, suburbs, and the inner city areas. Based on the results of the study, it may be concluded that the parents with higher socio-economic backgrounds and incomes are more likely to be involved in their children's homework than the parents of poorer socio-economic status. Khan (2016) examined the goals of his study to explore the influences of socio-economic background, and also the influences of gender differences in study habits of the grade seven students (100) of Government Colleges of the Amroha region. Two psychological tests, called the Socio-economic Status Scale, were used to investigate the impact of the two independent variables on study habits of the above-mentioned students. The findings revealed that the factor of gender had a significant impact on the students' study habits. However, it was found that the impact of socio-economic background on the study habits of the students was insignificant. Moreover, the interactive effect of socio-economic background and gender difference was also not significant. Scholar failure as a complex phenomenon, as stated by Romana (2014), depends on different factors – including biophysical, scholar-related, or social factors. However, scholar failure in secondary and primary education systems has different roots,

in comparison to those found in tertiary education systems. In a study that had addressed and analyzed a specific case of university student, the main causes of student failure were found to be external factors (economic pressure, social pressure, and family situation) and internal (personal) factors, as well as factors which include economic and pedagogical difficulties, teacher's needs, and disciplines difficulty (many technical disciplines).

Now, one of the concerns that many fields of study have (especially engineering fields), is academic underachievement of students in mathematics, and many of the professors in engineering faculties face this problematic issue, and they repeatedly ask this fundamental question: which reasons have caused the students' academic underachievement, and what are the appropriate strategies to be used, in order to improve academic achievement. Creating an appropriate educational setting and the extent of effective learning has always been one of the concerns of educational authorities in each country. In Iran, in recent years, students are no longer willing to take some courses, such as mathematics. Unfortunately, many factors affect the process of efficient teaching and learning of mathematics and cause the academic underachievement in these courses. Understanding these factors could help the planning required to better this problem. The teaching methodologies in universities should be modified, and provide the sociability basis of them, according to the change in social conditions and the appropriate recognition of its target group, namely students.

Understanding these factors is of paramount importance since the ministry of science, and the universities are the educational authorities for the upbringing of new generations, and if they do not revise the structure, course content and the definition of goals and educational products at the university level, they will provide grounds for the academic underachievement. When a learner changes his grade or academic level, it seems that some changes are made in the environment around him. If the changes can be effective in his learning environment, it can be an obstacle in his academic achievement or can be a factor that affects his academic progress. Educational, social, and economic factors can affect learning and academic achievement. But intra-organisational factors, that is, factors within the educational center - whether school or university - might also have an impact on this issue; factors, such as teaching methods, problem-solving skills, educational quality, sufficient resources and budget for equipment procurement, etc. In recent years, it seems that factors, such as social, economic and educational factors, collectively had an impact on the students' learning and academic achievement in mathematics. This study, with a new approach, attempts to create appropriate strategies through the creation of an efficient educational model to develop and motivate students to continue studying math, as well as effective learning of math as the basis of the courses in each field of study. Therefore, in this study, we are currently looking at investigating general, economic, social and educational factors that affect the students' academic failure. Then, the real question is, "which of the factors, such as economic, social, and educational, have more impact on their academic performance in math?

8. Methods and Material

This study is a case of descriptive-survey research. Survey study, as a branch of descriptive research, is a data-collection method in which a particular group, of people, is asked to respond to many specific questions. In this type of research, the information is directly obtained from the study group, and the sample chosen in this study is usually extensive. The purpose of this type of research is mostly focused on areas, facts, beliefs, and behaviours, and the variables under the study are limited, and what is being studied is relevant to the present. In the survey research, a questionnaire was used for data collection purpose.

The population of the study involved all the students studying at the Faculty of Science, Humanities, and Engineering at Islamic Azad University (Rey Branch, Tehran) during the academic year 2013–2014. Considering that the total population of the students was 120 students, using simple random sampling methods and, according to the Cochran table, 91 students were selected from the faculties of technical-engineering, basic sciences, and humanities. Therefore, 91 selected samples were considered.

Since no questionnaire was designed on the social, economic, and educational factors involved in students' educational failure in developing countries, the researchers designed and developed a questionnaire with a total of 33 items after a one-year study period. This questionnaire

was implemented in several stages, at different periods of an academic year, the first and the second semesters, and the summer semester on a sample group of students. The questionnaire included 33 questions in the Likert scale with three options of "yes", "no" and "to some extent", respectively. The content of this questionnaire was as follows:

- Review of the Economic factor: The data related to the students' occupation (in the demographic data)
- Review of the Social factor: The data related to the students' marital status (in the demographic data)
- Review of the Academic underachievement: The students' pre-university and university math scores (in the demographic data)
- Review of the Educational factor: The data related to the sections of students', professors', deans', and each university's status (in the 33 items of the questionnaire).

The researcher-made questionnaire was reviewed by the experts, especially in the field of teaching mathematics, and its validity and reliability were proven. The reliability of the questionnaire was confirmed using Cronbach's alpha and content validity of the questionnaire was estimated by the use of the content validity ratio (CVR) index. According to the opinions of 11 experts in the field of mathematics, teaching and educational management, the acceptable amount of CVR was shown to be 0.70. Therefore, the researcher-made questionnaire was reviewed from the viewpoints of professional experts, especially in the field of mathematics teaching, and its content validity was proven. Cronbach's alpha method was used to check the reliability of the researcher-made questionnaire. For this purpose, SPSS software was used for Cronbach's alpha. Cronbach's alpha, with the value of 0.79, showed that the researcher-made questionnaire had an appropriate degree of reliability. Therefore, all 33 modified items were eventually used.

9. Findings

In this section, the results of the descriptive statistics will be described first. Therefore, using the data collected by the questionnaire, their central tendencies and dispersion was measured, and the results are described in Tables 1 and 2:

Table 1. Results of the Scores' Descriptive Statistics

Index / Grade	N	Mean	Std	Mode
University math score	91	10.69	2.96	10
Pre-university math score	91	15.09	2.83	15

According to table 1, it is clear that there is a significant difference between the means of pre-university math score and the university math score. Moreover, the frequency of score, 15, among pre-university math scores, had been more than university math scores.

Table 2. Results of the Factors' Descriptive Statistics

Index / Factors	Mean	Std	Mode
Educational factor	2.09	0.25	2.12
Social factor	1.11	0.31	1
Economic factor	1.59	0.74	1
Math score	10.69	2.96	10

According to table 2, it is clear that no significant difference is observed between the mean of university math score, economic factor, social factor and educational factor. In order to examine the significant difference between pre-university and university scores in mathematics, it was first found with the K-S test that, since the obtained P-values only in the pre-university math score is less than 0.05, therefore, the data related to the pre-university mathematics scores were not normal. Hence, following that, we used the non-parametric U-Mann-Whitney test to analyze the

data. Based on the result of the P-value obtained for the averages less than 0.05 ($p < 0.05$), we conclude that the means of the pre-university and university math scores are not the same.

Since, in reviewing the data correlation and regression, normality is initially considered to be important, therefore first, residuals were evaluated in terms of normality by the use of K-S and Shapiro tests, and since the residuals were normal (prerequisite for using correlation and regression), therefore, regression and correlation were used with confidence, while in examining the normality of the scores, the pre-university scores were not the only normal scores. So what is important here is checking the residuals.

Then to evaluate the relationship between the factors and the data scores, Spearman correlation coefficient test was used. According to the results in Table 3, it is clear that the economic factor had no significant relationship with the students' math score ($p > 0.05$). Therefore, it can be argued that the economic factor has no significant relationship with the students' math score.

Table 3. The Correlation Coefficient Results of Economic Factor and Math Score

Coefficient	Variables		Economic factor	University math score
	Economic factor	correlation coefficient	1	0.1
		P-value	---	0.33
	University math score	correlation coefficient	0.1	1
		P-value	0.33	---

Based on the results in table 4, it is clear that the social factor has no significant relationship with the students' math scores ($p > 0.05$). It can be argued that social factors have no significant relationship with the students' math score.

Table 4. The Correlation Coefficient Results of Social Factor and Math Score

Coefficient	Variables		Social factor	University math score
	Social factor	correlation coefficient	1	-0.04
		P-value	---	0.65
	University math score	correlation coefficient	-0.04	1
		P-value	0.65	---

According to the results in table 5, it is clear that educational factors have no significant relationship with the students' math score ($p > 0.05$). Therefore, it can be argued that educational factors have no significant relationship with the students' math scores.

Table 5. The Correlation Coefficient Results of Educational Factor and Math Score

Coefficient	Variables		Educational factor	University math score
	Educational factor	correlation coefficient	1	-0.05
		P-value	---	0.62
	University math score	correlation coefficient	-0.05	1
		P-value	0.62	---

As shown in Table 5, none of the economic, social, and educational factors had any significant effect on the students' math scores ($p > 0.05$).

Table 6. The Regression Coefficient Results of Three Factors, and Math Scores

Model	Non-standardized coefficients		Standardized coefficients	Test statistics	P-value
	Beta	Standard deviation error	Beta		
Constant	2.08	0.49	---	4.26	0.000
Social factor	-0.08	0.18	-0.04	-0.45	0.65
Economic factor	0.09	0.07	0.13	1.21	0.22
Educational factor	-0.18	0.22	-0.08	-0.82	0.41

In Table 6, forming a multiple regression equation of the listed factors would be meaningless since $p > 0.05$. Therefore, none of the economic, social, and educational factors have a significant effect on their academic underachievement in math.

Since, in this research, we tried to estimate and compare the results of the two types of analysis by SPSS and DEA, it was therefore attempted to first determine the economic, social, and educational status of the students with central indicators and dispersion by descriptive statistics, and then in order to ensure the results, the correlation was estimated between the university math scores and the social, economic, and educational factors, and regression was used to find the factors which lead to academic failure. The type of regression used here is multiple regression. In fact, regression prerequisites were met, and due to the space constraints in the article, the final result of the regression will be announced. Moreover, the same analyses were repeated by the DEA-related calculations, in order to show that both methods of analysis were the same, which was a kind of innovation in analysis. Through calculating the data in the formulas that are outlined below, the researcher conducted the analysis as follows:

To calculate the DMU_0 unit's efficiency with the input x_0 and the output y_0, the following model was considered, based on the $s_m^-, \dots, s_1^- s_s^+, \dots, s_1^+, \lambda_n, \dots, \lambda_1$ variables.

$$min \quad \theta - \varepsilon \left(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+ \right)$$

$$s.t. \quad \sum_{j=1}^{n} x_{ij} \lambda_j + s_i^- = \theta x_{io} \qquad i = 1, \dots, m,$$

$$\sum_{j=1}^{n} y_{rj} \lambda_j - s_r^+ = y_{ro} \qquad r = 1, \dots, s,$$

$$s_i^- \geq 0, \; s_r^+ \geq 0 \qquad i = 1, \dots, m, \quad r = 1, \dots, s,$$

$$\lambda_j \geq 0 \qquad j = 1, \dots, n.$$

$$\varepsilon = 0.000000001$$

Table 7 includes seven columns. The first column indicates DMU. The second column indicates the factor of students, and the third column indicates the factor of math professors, the fourth column indicates the faculty factor, the fifth column indicates the university factor, the sixth column indicates the students' scores, and the seventh column indicates the students' performance. In this table, 1, 4, 58 and 49 demonstrate desirable performance, which is called 'super-performance.' The students can be divided into three categories, according to Table 7:

[0.45, 1]= Good
[0.30, 0.45]= Average
[0.10, 0.20]= Weak

The first category is the category where the students are performing at optimal performance, and it is thus called the 'good category'. The second category is the one that includes the students with average performance, which is called 'average category', accordingly. The third category is called the weak category, where the students are demonstrative of weak performance. For example, in the first category, in the cases of students like 1, 4, 58, 49, student 4 has a score of 19.5 and has inputs lower than those of the other students, but he has a better performance than the other students. The students 1, 58, and 49 are the other examples. The students who are in the average category are the students with higher inputs than the students in the first category, but they show lower rates of performance. In the first case: given that the input is low, which means that the students are in undesirable status regarding marital status, math professors' factor, and the university factor, the students demonstrated desirable performance. In the second case, which does not include a significant number, the students display average performance, which means that, compared to the first case, they have more inputs, but they have lower rates of performance. In the third case: the number of the students in this category is of more significance than the cases 1 and 2; which means that they have more inputs than in cases 1 and 2, meaning that the student and professor variables are more and that the student has a better status.

Table 7. Results of the SBM Model

Number	Input 1	Input 2	Input 3	Input 4	Output	Efficiency
1	62	47	14	11	15	1
2	115	125	25	40	11	0.17
3	92	76	27	22	14	0.32
4	70	70	17	17	19.50	1
5	81	52	14	11	10	0.29
6	64	89	35	8	10	0.26
7	75	89	22	30	17	0.40
8	85	98	22	22	11	0.23
9	86	91	27	19	16.25	0.35
10	124	124	11	8	18.25	0.28
11	94	101	24	14	14	0.28
12	73	33	25	11	5	0.19
13	75	83	19	19	16	0.39
14	72	88	17	22	4	0.09
15	56	78	25	11	7	0.21
16	94	46	14	8	7.50	0.21
17	94	105	35	20	5	0.09
18	110	68	17	22	4	0.08
19	82	88	14	17	13	0.29
20	95	94	20	20	4	0.29
21	112	81	22	20	17.25	0.35
22	84	96	22	27	12.50	0.27
23	110	93	20	22	16.25	0.31
24	94	91	19	20	16	0.33

25	73	99	17	25	9.50	0.22
26	97	84	17	14	15	0.23
27	93	45	4	9	13	0.38
28	84	99	22	19	8	0.17
29	95	105	14	8	17	0.33
30	125	95	25	8	19	0.33
31	105	124	27	19	6	0.10
32	64	87	8	11	7.50	0.19
33	110	114	22	11	9	0.15
34	125	112	17	17	10	0.16
35	94	64	14	14	16.50	0.41
36	114	72	22	11	10.50	0.22
37	97	107	27	14	12	0.22
38	73	76	17	11	6	0.15
39	97	99	2	25	15	0.29
40	88	121	8	8	15	0.28
41	97	104	20	24	13.75	0.26
42	93	75	8	11	8	0.18
43	99	140	17	20	17	0.28
44	83	65	14	13	10	0.26
45	107	91	11	13	18	0.35
46	74	54	24	8	9	0.27
47	94	76	8	8	16	0.36
48	92	86	35	19	12	0.26
49	87	75	14	11	19	0.45
50	112	119	14	11	14.50	0.24
51	119	109	30	17	14.50	0.24
52	97	58	35	8	14	0.35
53	109	59	32	14	14.50	0.34
54	80	69	11	11	4	0.10
55	81	72	14	14	11	0.27
56	81	76	20	17	10	0.24
57	130	63	25	20	19.50	0.40
58	89	44	4	11	17	1
59	112	134	30	25	14.50	0.23
60	88	99	7	14	19.50	0.40
61	110	53	14	8	17	0.42
62	82	51	19	19	13	0.38
63	83	109	20	20	13	0.26
64	102	77	22	30	17	0.37
65	97	122	30	32	14	0.25
66	70	109	14	17	13	0.29
67	109	80	30	35	17.25	0.35
68	98	71	40	22	18.50	0.43
69	114	111	11	19	13	0.22
70	115	94	25	14	17	0.31
71	67	75	11	8	13	0.35
72	102	103	19	11	14.50	0.27
73	73	101	14	7	17	0.39
74	61	67	22	8	12.50	0.38
75	112	80	35	14	19	0.38
76	89	95	19	11	13	0.27
77	69	84	14	8	13	0.33

78	91	75	5	14	14.25	0.33
79	79	91	19	8	17	0.39
80	87	76	14	11	17	0.39
81	94	122	19	11	12	0.22
82	115	83	14	8	17.50	0.34
83	84	91	40	25	16.50	0.36
84	88	82	27	11	18	0.41
85	109	108	14	8	17	0.30
86	97	101	7	11	14	0.27
87	110	112	25	24	15.50	0.27
88	115	53	22	11	8.50	0.20
89	80	53	17	22	11.50	0.33
90	94	106	14	14	10	0.19
91	109	66	25	27	12.50	0.28

In this case, it may be concluded that the poor performance shows the students' lack of attention and their reluctance towards mathematics course, which indicates, in turn, that economic, social and educational factors do not have any involvement or impact on their math scores.

10. Conclusion

Regarding academic underachievement in math, most of the students are reluctant and less interested in learning math, due to the intangibility of mathematical concepts and the abstract nature of the university-level mathematics. Mathematics is one of the core scientific courses which is of great importance, but factors such as inefficiency and traditional teaching methods, unfriendly class atmosphere, the high volume of prescribed books, and the large number of students in a class, has caused some students to endure this type of course with great difficulty, during the progression of their educational careers. Mathematics is one of the sciences that strengthens the students' creativity and increases their analytical power. However, some of the students do not show enough interest and do not have enough motivation to learn this course, and we observe their academic underachievement in this type of course. In math classes, the students who are more talented in mathematics are always cared for by the professor. A large number of students in a class hinders the teacher from checking the students' learning status, especially in math lessons. Once the students understand the application of mathematics in their daily lives, they will show more interest in learning it. Therefore, the teacher must teach this course by employing the proper methodology. The relationship between mathematics and the other subjects should be specified, and it must be taught to the other students that most of the available courses can benefit from this science.

Mathematics is among the courses that dramatically help the classification and ordering of the students' assimilated information, and increases their ability in critical thinking, creativity, and curiosity. Learning this course will raise the analytical power of the students; and one of the powerful tools for enhancing the students' thinking and reasoning abilities, is teaching mathematics, which, according to the beliefs of many experts, feeds into other sciences. Mathematics is the basis of industry and technology, and the success of the students in this type, of course, will provide the basis for their success in the other sciences. With the proper teaching of math to the students, their ability to live in today's world, which is equipped with technology and computers, will be increased. One of the effective factors in the students' academic underachievement in mathematics is their anxiety in dealing with this type of course. The students' motivation levels, collectively, have a significant relationship with their general success in mathematics so that, with the increase in their motivation, their success level in mathematics will be increased and their anxiety will be decreased.

Inappropriate methodology, when teaching mathematics, is another reason behind the students' academic underachievement. Some professors rely on old teaching methods and give the students little opportunity to show their abilities. The ineffective teaching methods, the negligence in evaluation, the improper structuring of the questions and exam methods, are effective indicators

of students' academic underachievement in mathematics. Considering this issue, the strategies, such as educational planning, can be offered, involving all aspects of mathematical skill and the solving of various mathematical problems. The necessity of having a certificate from higher education schools for employment is one of the reasons why people attend universities. Choosing an improper discipline, the unfamiliarity with academic systems in the first semester and the correct study methods, personal and family issues and so forth, are the reasons for academic underachievement in universities and especially in abstract courses, such as mathematics.

Currently, the selection of academic disciplines and occupational goal-setting creates a negative attitude and decreases the educational motivation. The right choice of academic discipline is the most important factor in academic achievement and, unfortunately, because of the problems in the job market, most of the families and students choose an academic discipline with the goal of receiving a bachelor's degree and being hired by government organizations. Paying attention to the occupational ground in the future of each area is one of the issues which needs to be culturalized, so that a part of human and economic sources, as well as potential talent, would not be annually diminished in the universities; since, otherwise, the academic underachievement will become intensified, and it would have unpleasant consequences in the one's personal and social life. Higher education volunteers are not aware enough of the academic disciplines and, as a result, through the wrong choice of academic discipline – simply receiving an educational degree in any discipline is sufficient for them. The job market's inability to attract graduates is referred to as one of the reasons for not welcoming the appropriate education.

Now, society is highly interested in entering university, but choosing the field of interest, the city and so on, is not important for them, and this issue is another underlying problem affecting the academic underachievement at university – especially when it comes to abstract courses such as math. Academic underachievement is related to the problems of the current generation, because, at this point, most of the students have jobs and do not have the opportunity to involve the academic competition and as a result, they attend the class with reluctance and only for getting a passing grade. The intertwining of the factors as mentioned earlier reduces the education morale and spirit among the students and, as a result, the academic underachievement occurs in abstract subjects, such as math.

In the past, the student's duty was only to educate, assimilate information and to do research, but today, there are students who come to class after a busy day, working in order to make money to pay for their education expenses, and this will inevitably reduce their learning performance in courses such as mathematics.

Lack of proper facilities, lack of dormitories, overcrowding in dormitories, lack of studying space and so on, collectively play an important role in the students' academic underachievement. Without considering the number of the students, available facilities, and so forth, the respective capacity of universities are expanding every year, while the lack of preparedness for the appropriate conditions causes problems, such as academic underachievement. Due to the high volume of mathematics textbooks in universities, the students undergo a great deal of pressure, which should be settled by strategic educational plans. The mental and emotional crisis, being far away from family, being single, student life problems, etc., are some of the factors that contribute to the students' problems and lead to the academic underachievement. Studying at university, especially in abstract subjects such as mathematics, requires concentration and a calm atmosphere. Due to the decrease in the academic competition, with pertaining to the quantitative development of the universities and lack of attention to the quality and the educational standards, academic underachievement has considered as a basic problem and will gradually intensify. The academic achievement requires continuous evaluation, but now due to the short duration of the semester, the professors are not able to evaluate students in courses such as mathematics. Most of the students do not study the subjects that were taught in the previous sessions and wait for the exam day. Therefore, the implementation of formative assessment can help this issue. What is certain is the diagnosis of the problems and the referred factors in the system of higher education that must be considered by the officials, teachers, and the university presidents. Especially in the field of mathematics which is the foundation of most of academic disciplines and all of the students must pass this course in the undergraduate program. What was found through the statistical findings

and the DEA method was that scientific perseverance and motivation of students in learning math is more effective than the environmental factors.

At Shahre Rey Branch (university) in the province of Tehran, as one of the largest universities in this province, an image of educational quality is shown, which indicates that factors other than those mentioned here were influential in this research. Most people believe that the major factors, such as educational, economic, and social ones, can affect the students' academic achievement in any course or field of study. But in this research, it was found that these underlying factors can not affect the decline in students' educational performance in mathematics. It is then clear that factors other than those previously-mentioned factors may show as having an influence on that. It seems that factors such as the teaching methods of mathematics professors would need to be reviewed. Mathematics professors use the traditional teaching methods that are abstract, and the students do not learn how to apply mathematical methods in real life. In the view of the professors, due to the insufficient time, it needs to be taught abstractly, which has led to the lack of motivation and the decline in students' academic performance in mathematics. Teaching methods based on books and official pamphlets lead to the students' lack of critical thinking. As long as the students' thinking is not active and the classes are not student-centered, we will continue to face this decline.

Additionally, the case that needs to be considered is one of active methods, based on creative education. In university-level mathematics classrooms, due to the lack of facilities and the inadequate allocation of time for each course, professors cannot apply the active skills when teaching mathematics. The use of active educational methods can enhance the spirit of cooperation and learning, based on the student's active participation in learning concepts, and also, with the active participation of the student, the basis for lifelong learning is provided. But this important approach is not being used in university classrooms, at present. In developing countries, the educational and curricular development system has some problems, which include untrained educators in active learning, and a lack of educational facilities. While mathematics educators/professors have not learned active teaching skills, they cannot propose active strategies for effective teaching by themselves. Moreover, lack of required funds and facilities for implementing active educational activities, by which to learn mathematical concepts better, as well as the fact that qualified professors from advanced countries are not being used, can also be barriers that lead to students' academic failure. A noteworthy example of this is in Iran, where academic communication and correspondence is in Farsi, and thus, foreign professors cannot teach there. If sufficient resources and facilities are provided for the teachers of abstract subjects; such as mathematics, the more self-confidence and self-motivation will be provided for the students. Now, answering the question of how to make these resources available to professors, requires extensive research. Especially in developing countries such as Iran, decent allocation of human and non-human resources may affect the quality of education and motivation of the learners.

Research suggestions are presented as follows:

It is suggested that the educational factors, from the angles of learning environments, math class environments, math teachers' scientific levels, length of education periods, and so on, be presented in the form of a conceptual model, and the effects of these factors on the academic underachievement of the students in mathematics courses be investigated and compared to the students from the different faculties. It is suggested that the effect of educational, social, and economic factors be investigated on the other university levels, among the masters and doctoral students in mathematics courses and lessons, and it is suggested that the effect of educational, social, and economic factors be investigated at an undergraduate level at university, among male and female students taking mathematics courses and lessons.

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