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A Study on the Causes of Low Level of Students in Undergraduate Level Compared to the Secondary School Level

Raga Hassan Ali Sheikh [a*]

[a] *Mathematics Department, Taima University College, Tabuk University, Saudi Arabia.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Abstract

This paper aims to study and address the phenomenon of low level of students in the university compared to their level in the secondary stage, through the study sample represented in the Faculty of Computer Science and Information Technology, Al-Neelain University (Batch 2019) using the statistical package (SPSS) and using its outputs to help decision makers to choose optimal solutions to address this phenomenon.

Keywords: Secondary school; study in university; low level of students; PCA.

1 Introduction

Education is a potent transformation agent that enhances livelihoods and health and promotes social stability [1]. In his work, Wennström [2] draws attention to the fact that certain educational programs fail and produce outcomes that are at odds with their intended outcomes. According to Drake [3], when there are schools and students with low economic and social levels, it results in social exclusion and student failure. This condition

**Corresponding author: Email: ragaa_e@yahoo.com;*

reduces the success and continuity of kids in the educational system. One of the most pertinent findings is that the school may indirectly and by specific activities contribute to the development of school failure [4]. It is believed that students' perceptions of their power to influence a task's result have a significant impact on their behavior, motivation, and success [5]. Academic achievement is considered one of the important aspects of the mental activity that the student performs in school, and it is seen as a mental process of the first degree and classified as a cognitive variable [6]. Expression of what you learn [7], and it includes the cognitive, skillful and emotional aspects, and despite the breadth of the concept of academic achievement, it is what is called students' achievement or their acquisition of what the educational system aims for, and it is closely related to the school [8]. Academic achievement is also considered a basic criterion for judging the extent of what the student can obtain in the future, as the general secondary school is concerned with the student's grade and total score, as well as discovering the students' different preparations [9]. Undergraduate study is considered the epitome of the educational process, through which the student is formulated and prepared to participate in the management of life affairs, as his success in it reflects the growth and development of the society to which the student belongs, and accordingly, it was necessary to make maximum use of the student's abilities acquired during the various educational stages, especially the secondary stage, and harness them To develop his capabilities and raise his level of readiness during this stage [10,11]. Although students are accepted at a high rate in the secondary certificate of the scientific and applied colleges, we find that the student's academic level drops significantly during the university stage, which is an important indicator of the existence of a dilemma that requires standing on it and searching for immediate solutions to it in order to continue the success and excellence of students and increase their academic achievement [11].

The study aims to find out the causes of the low level of students during the undergraduate level compared to the secondary stage while proposing the optimal treatment for these causes by providing decision-makers with all possible solutions drawn from the study outputs.

2 Materials and Methods

The data for the study were obtained from students of the College of Computer Science and Information Technology (Batch 2019), Al-Neelain University, Khartoum, Sudan. Eight courses including, Arabic language, English language, religious studies, mathematics, biology, physics, chemistry and add mathematics were the variables studied in this study. The sample size for both the undergraduate and secondary school levels was 100 of the same students.

The statistical package (SPSS) is considered one of the most important and powerful programs used to study social phenomena and propose optimal solutions for them through various outputs represented in tables, figures, and so on. In view of the importance of this program and its effectiveness, it was used to study and treat the phenomenon of low-level students during the undergraduate level compared to the secondary stage, through the use of all techniques and capabilities available in the package after providing it with the inputs taken from the selected sample in order to analyze and study it carefully and extensively to derive outputs that support decision-makers [12]. To compare between levels of students at the undergraduate and secondary school levels, the principle component analysis (PCA) was used in this study. The statistical analysis was performed using the computer software program SPSS.

3 Results and Discussion

3.1 Descriptive statistics

Descriptive statistics for studied traits of, the sample of students of the College of Computer Science and Information Technology (Batch 2019) was studied in its various departments (science - technology - information systems), by entering the percentages and grades of students obtained in the secondary certificate with the cumulative average for the academic year (as an indicator of the level of university students) Where the subjects of the secondary certificate were placed in various students' specializations and their differences in the form of fields, each field contains a specific symbol that symbolizes the subject, then a new field is chosen for the general average in the secondary certificate, and then another new field is chosen for the cumulative average, so that all fields are completed, through data entry in the statistical program (SPSS) All data entered into the system are analyzed using the factorial analysis method to obtain the results coefficients shown below:

Table 1. Correlation coefficient matrix

Variables	Arabic Language	English Language	Religious Studies	Mathematics	Biology	Physics	Chemistry	Add Mathematics
Correlate Arabic Language	1.000	.073	.357	-.516	-.618	-.074	.107	-.881
English Language	.073	1.000	-.732	-.306	.409	-.258	.000	-.223
Religious Studies	.357	-.732	1.000	.171	-.452	-.349	-.334	-.407
Mathematics	-.516	-.306	.171	1.000	-.2000	-.084	-.587	.260
Biology	-.618	.409	-.452	-.200	1.000	-.309	.112	.504
Physics	-.074	-.258	-.349	-.084	-.309	1.000	.693	.479
Chemistry	.107	.000	-.334	-.587	.112	.693	1.000	.326
Add Mathematics	-.881	-.223	-.407	.260	.504	.479	.326	1.000

**The table was prepared by the researcher*

Table 2. Prevalence values

	Initial	Extraction
Arabic Language	1.000	.997
English Language	1.000	.866
Religious Studies	1.000	.794
Mathematics	1.000	.772
Biology	1.000	.782
Physics	1.000	.899
Chemistry	1.000	.893
Add Mathematics	1.000	.983

** Extraction Method: Principal Component Analysis*

Table 3. Factors extracted

Component	Initial Eigenvalues			Extraction Sums of Squared Loading			Rotation
	total	% of variance	% Cumulative	total	% of variance	% Cumulative	Total
1	2.861	35.768	35.768	2.861	35.768	35.768	2.548
2	2.179	27.236	63.004	2.179	27.236	63.004	2.322
3	1.946	24.319	***87.323***	1.946	24.319	87.323	2.250
4	.883	11.039	98.362				
5	.131	1.638	100.000				

** Extraction Method: Principal Component Analysis*

Table No. (1) is a matrix that shows the simple correlation coefficients between the variables of the study. This matrix helps in examining the general correlation structure, through which we can reach the main components that help in extracting the factors that give an explanation for the bulk of the variation in the phenomenon. Even though significant correlations were found, the relationships between the variables were not highly correlated. Therefore, all variables were sufficiently interdependent to be used in the other analysis [13].

Table No. (2) contains the values of prevalence (participation), and the degree of prevalence of the variable is defined by the contributions of this variable in all factors and is measured by the sum of the squares of the coefficients of this variable in the various factors. Thus, the values of prevalence cannot be obtained before obtaining the factors, and also it can be said that they represent the ratio of the variation of the variables that the factors explain, and therefore they can be defined as the sum of the squares of the saturations of the studied factors with the variables.

This method is used because the principal components that are produced can be used as indicators of how well a pupil is performing [14]. Table No. (3), which represents the matrix of factors extracted from the total variables of the study and detailed as follows:

3.2 Initial value

As we have already mentioned, the values of the prevalence cannot be obtained before the factors, which in turn cannot be obtained except after obtaining the values of the prevalence. There are a number of methods for calculating the values of the prevalence used in the program. It is to set the initial value of the prevalence values as equal to the correct one for all variables.

3.3 Abstraction

They are the values of prevalence for the study variables that were obtained after the extraction process. The above table gives us the eigenvalues obtained using the principal components method and extracted from the matrix of correlation coefficients. It is divided into three parts. The first part is concerned with the initial eigenvalues, the percentage contribution of each component to the total variance, and the cumulative percentage of the explained variance. The second component of the table is the sum of the squares of the saturation values after the summarization process. Before rotating the axes, we notice that the first three factors give us an explanation for the largest part of the total variance (about 87.323%) of the total variance. As for the third and last component of the table, it shows us the sum of the squares of saturations after the process of rotating the axes through these results. It also turns out that the first factor explains About 35.768% of the total variance of the study variables, the second factor explains about 27.236% of the total variance of the studied variables, while the third factor gives us about 24.319% of the total variance of the variables, and therefore the cumulative percentage explained by the first three previous factors is equivalent to about 87.223% of the total variance for the variables under study. Aboagye and Mensah [14] stated that four criteria were used to decide how many factors to rotate, they added a minimum Eigenvalues of 1.0, the screen test, a minimum loading of .45, and the interpretability of the factor solution. The first two PCAs can be seen that two principal components that should be retained for final analysis, according to El-Hashash and Shiekh [15].

3.4 Initial Eigen Values

These values represent the variances of the factors, and since we used the matrix of correlation coefficients in the process of extracting the factors, and thus all the variables are converted to the standard image, meaning that each of the study variables has a variance of one correct amount, and since there are 8 variables, the total variance is equal to 8. Eigenvalues greater than one rule state that when the correlation matrix is used for Eigen analysis only values greater than one should be included in the analysis. Using Eigen values greater than one rule [14].

The column contains the subjective values (factor variances), as the first factor is the one that gives the largest percentage of the explained variance, and the next one is the factor that explains the largest amount of the remaining variance, and so on. It is noted that the extraction process stopped at the fifth factor, because the value of the sixth factor variance is smaller from the correct one.

3.5 Contrast Ratio and Cumulative Percentage

This column shows the contrast ratio (percentage of variance) that each factor explains individually, and the ratio is calculated by dividing the factor variance by the total variance and multiplying by 100. For example, for the first factor, the variance percentage that it explains is:

$$\frac{2.861}{8} *$$

The first three components accounted for 34.60%, 10.80%, and 8.78% of the item variance, respectively [16].

This column represents the cumulative percentage of the variance explained by the factors. We note that the first five factors give us an explanation for the largest part of the total variance (about 87.323%) of the total variance. The third principal component together with the first and second principal components accounts for 72.2% of the total variance in the data [14].

In extraction sums of square loafing of the table, the program keeps only the extracted factors, and sometimes there is a difference in the explained variance ratios.

3.6 Rotation

The values in this column represent the ratio of the variance explained by each of the factors after the rotation process, which is an attempt to maximize the variance explained by any of the factors through redistribution (it is noted that the ratio of the total variance explained after the rotation does not differ from before the rotation. According to Thang et al. [16], the rotational solution produced three interpretable factors: a class-related success attribution, an internal/controllable success attribution, and a task difficulty-related success attribution. However, in this rotated solution, there was a low communality for luck in the factor analysis for failure. In view of the fact that this was a reasonable solution, it was used for further analysis.

Table 4. Factors extracted

Principal Component		
1	2	3
-.981	-.173	.034
-.211	**.874**	-.066
-.297	**-.802**	-.425
.579	-.491	-.478
.479	**.732**	-.029
.213	-.128	**.886**
-.049	.271	**.934**
.916	.133	.423

** Extraction Method: Principal Component Analysis; *Rotation Method: Promax with Kaiser Normalization*

Table (4) is related to the matrix of factors after rotating the axes, through which we can clarify the variables with high proportions within each factor as follows:

* The first factor is Mathematics: Mathematics, in both its primary and specialized parts, constitutes the first factor that explains the greatest discrepancy among the three factors, about 35% of the total discrepancy, as the saturation values of mathematics are significantly higher than the rest of the other subjects shown in the equation below:

$$F_1 = 0.981\ Arabic + 0.579\ Math + 0.916\ Add\ Math$$

* The second factor, English and Biology: English and Biology constitute the second factor that explains the greatest variance after excluding the first factor by about 27% of the total variance, as the saturation values of biology are higher than the rest of the saturations of other subjects shown in the equation below:

$$F_2 = 0.874\ English + 0.802\ Relig + 0.732\ Bio$$

*The third factor, Physics and Chemistry: Physics and Chemistry constitute the third factor that explains the greatest variance after excluding the first and second factors by about 24% of the total variance.

$$F_3 = 0.886\ Phy + 0.934\ Chem$$

As for the rest of the other materials that did not appear in the previous equations, which are the literary course materials in the secondary certificate, they were deleted based on the low values of their correlation coefficients with the rest of the study variables shown in Table No. (1).

Table 5. Matrix of correlation coefficients between the extracted factors

Component	1	2	3
1	**1.000**	.027	.052
2	.027	**1.000**	.180
3	.052	.180	**1.000**

** Extraction Method: Principal Component Analysis; *Rotation Method: Promax with Kaiser Normalization*

Table (5) above shows the matrix of correlation coefficients between the factors obtained after the non-orthogonal rotation of the factors. It is clear that there is a decrease in the correlation coefficients between the different factors, as the highest value of the correlation coefficients between the factors is 0.180 between the second and third factors, meaning that the internal correlation of the factors is greater than Factors correlate with each other, and this is consistent with the general assumption of the factor analysis method. The first three principal components were retained as rules or indices for the classification of students' performance according to Aboagye and Mensah [14] and Thang et al. [16].

According to Talib and Sansgiry [17], academic performance or accomplishment is the degree to which a student, instructor, or institution has reached their short- or long-term educational goals, it can be assessed continuously or through a cumulative grade point average (GPA). Table (6) contains a set of descriptive statistics on the final averages of students in the secondary and university levels, divided according to the courses (mathematics, biology, literature), respectively. In the secondary stage, it is noted that the mathematics course average is 81.43, with a standard deviation of 1.95 and a standard error of 0.43. As for the university GPA for the same course, it is 66.22, with a standard deviation of 4 and a standard error of 0.89.

It is also noted that the biology course average is 82.54 with a standard deviation of 2.15 and a standard error of 0.96, and the university GPA for the same course is 67.68 with a standard deviation of 5.6 and a standard error of 0.93. average math students. Romer [18] discovered that a student's GPA significantly correlated with their attendance in class. Cohn et al. [19] and Devadoss and Foltz [20] concluded that previous GPA and motivation had a beneficial impact on current GPA.

With regard to the literary course, the mean value was 72.66 with a standard deviation of 9 and a standard error of 5. As for the university GPA for the same course, it was 62.75 with a standard deviation of 9 and a standard error of 1.9. These results show that the values of standard deviation and standard error are very high, which leads to extreme values affecting the average success in the secondary and university levels. In general, from these results, it is clear that mathematics is the best course, followed by biology, depending on the average success and standard error values for them. The dropout rate is rising as a result of problems with comprehension and assimilation of courses, poor teaching techniques, absenteeism, and inadequate communication between the professor and the student as a result of massification [21]. Also, in order to choose his studies and career in all of his confluences of existence with the shared concern of serving society and the development of his responsibilities, an individual must first become aware of his characteristics and develop them [22,23]. The findings by Johnson et al. [24] reported that students believed that academic issues were the most frequent causes of academic underachievement, while social adjustment causes were discovered to be the least frequent.

Table 6. Descriptive statistics

		N	Mean	Std. Deviation	Std. Error	95%condfidence Interval for mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Score at High	1.00	20	81.7750	1.94743	.43546	80.8636	82.6864	75.60	84.00
Secondary	2.00	34	82.3412	2.14647	.36812	81.5922	83.0901	75.00	88.80
School	3.00	3	72.6667	9.94300	5.7406	47.9669	97.3665	63.30	83.10
	Total	57	81.6333	3.48586	.46171	80.7084	82.5583	63.30	88.80
Score at	1.00	20	66.2195	4.01599	.89800	64.3400	68.0990	59.93	72.95
University	2.00	34	67.6826	5.39973	.92605	65.7986	69.5667	57.40	81.90
	3.00	3	62.7567	3.18586	1.8394	54.8425	70.6708	59.77	66.11
Total		57	66.9100	4.94704	.65525	65.5974	68.2226	57.40	81.90

4 Conclusion

Through the process of analysis and the results extracted, we can say that primary and additional mathematics represent the most important factors influencing the results of students at the university level, followed by biology, physics and chemistry, in addition to, without a doubt, the basic subjects for the secondary certificate. Knowing that the process of extracting the factors influencing the total variance led to the final exclusion of materials related to the literary course from the analysis due to their weak connection with the courses that are taught to students in the faculties of computer science.

Competing Interests

Author has declared that no competing interests exist.

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