Factors Influencing Academic Achievement of Undergraduate Computing Students

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ABSTRACT

Undergraduate computing students may face some problems, complications and worries in attaining respectable academic performance due to some disturbing factors. Detecting these factors is crucial to ring the bell and raise the alertness of the students and guide them to modify their behavior for better achievement. This study examines the factors affecting the academic achievement of computing students of faculty of computers and information technology (FCIT), University of Tabuk. 320 computing students from both male and female campuses responded to a self-administered questionnaire. The results report 21 affecting factors ordered by their importance.

General Terms

Computer Science, Principle Component Analysis PCA.

Keywords

Degree academic performance, computing student, academic achievement.

1. INTRODUCTION

We are living the era of knowledge where the policy makers of Kingdom of Saudi Arabia (KSA) encourage the citizens to gain the knowledge and get well education levels for better future. Saudi Arabia witnesses an incomparable support and evolutionary increasing in the number of educational institutions in KSA which prepares the citizens for the future[1]. These institutions hunt for delivering high quality education through various fields and specializations. Education is a key player in getting better life and computing specialization becomes a vital contributor to the education.

According to figures from the Central Department of Statistics and Information [2], in 2013 KSA hosts 25 public universities, enrolling a total of 1,165,091 students, among whom 1,064,880 were studying at the undergraduate level[3]. Figure 1 gives quick facts on the education in KSA [3]. Figure 2 illustrate the education system in KSA[3]. The higher education system rounds on a two-semester basis with an optional summer session for those want to complete early. The higher education system in KSA offers two-year associate degrees and four-year bachelor degrees [3]. The fields offered in each institute are based on the study of the hosting-environment and the needs of the national and international labor market.
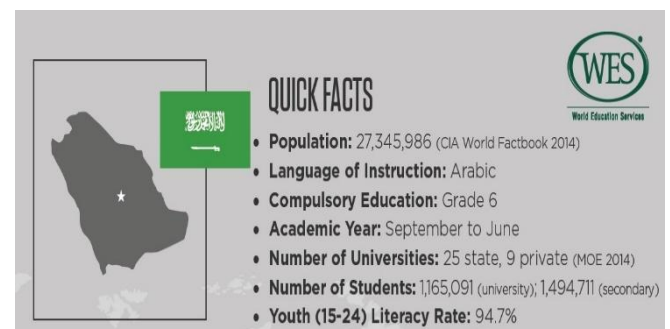

Fig. 1: Quick Facts on Higher Education in KSA, source:[3] World Education News & Reviews
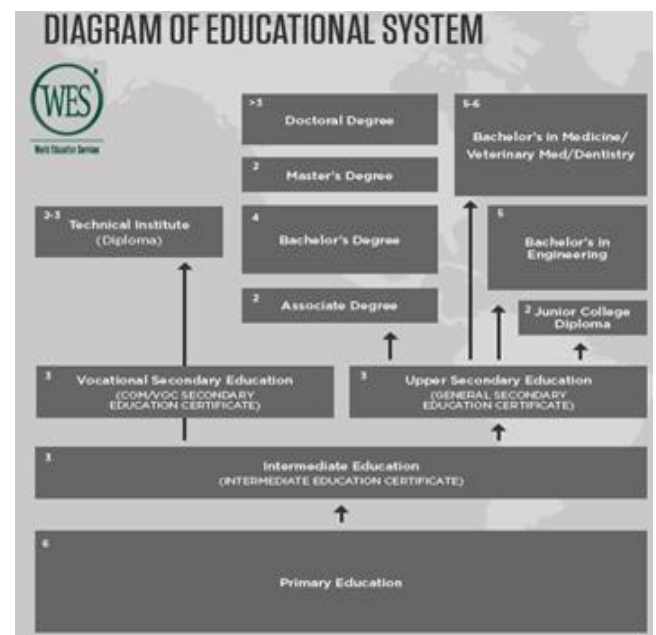

Fig. 2: Education system in KSA, source: [3] World Education News & Reviews

Faculty of computers and information technology, University of Tabuk provides various specializations namely: computer science, information technology, Information systems and computer engineering. Refining and enlightening teaching and learning in computer science is a complex task and one of the most significant challenges encompasses inspiring students [4] to attain the needed skills for the local, regional and international labor markets. Computing education pedagogy is concentrating more on the students development

and enhancing their practical skills. Low academic achievements and failure leads to students leaving the college and/or semi-qualified graduates which affect the quality of serving the society. Investigating and analyzing the major factors affecting students' academic performance in computing courses is an interesting area. It aids to provide clear vision on how to plan for better education strategies to deal with or reduce these factors to guarantee good students achievements. Furthermore, identified affecting factors might be used to predict the success of the students or help to plan for well-designed actions to prevent the failure of others. Moreover, the results will also help the education policy makers to design sufficient means to deliver the knowledge to improve the students' academic achievements. Besides that, knowing these factors will help to realize and then plan for effective programs or may lead to reform of curriculum.

2. LITERATURE REVIEW

During their study in the college, students may suffer to attain the desired learning outcomes due to some "demographic effects, specialization phobia, depression, anxiety, stress, and uncomforting due to the teaching, administrative, life-style and environment factors" [5]. Accordingly, these factors may cause undesired learning resulting students frustration and then leaving college or low-skilled graduates. Therefore, there is a strong need to identify the main factors affecting the attainment of college learning outcomes for the purpose of choosing the fitting strategies help to cope and/or reduce the negative factors to boost the confidence of the students.

Various research have been conducted to identify and study the key factors disturbing the academic performance of college students. [6] analyzed English Proficiency and number of credit hours registered per semester as primary issues touching the academic performance.[7-9] reported that "gender, difficulty in understanding, medium of instruction, social interaction, self-assessed depression, sleep disorders, peer pressure and dissatisfaction with career" are real concerns among medical students. Moreover, [10] examined the learning achievement among business students of private higher education institutions and then reported some factors influencing them while [11] determined the factors influencing students performance in accounting programs. Furthermore, [12] examined the mathematical sciences department and the issues disturbing students' academic achievement. [13] inspected student achievement in computer science, interpret the significance factors such as demographic, gender, and ethnicity then reported them as good predictors of academic achievement. A focusing research in [14] investigated the first year object-oriented programming module and analyzed fifteen factors that may influence performance. software developers and their productivity was the main issue in [15] which found different achievement among individuals that can be partially explained by the personal experience of individual. social networks like Facebook was the center of a research don by [16] that questioned whether using social networking in education may enhance and emphasize outcomes achievements more than the known face to face education style.

3. METHODOLOGY

The study investigates the academic performance among students of the faculty of computers and information technology, University of Tabuk. It includes a random sample of computing students in the second (2), third (L3), and fourth (L4) academic levels; a self-administered questionnaire as in table1- consists of 53 suggested factors- was distributed to assess parents level of education,

demographics, English language proficiency level, attendance, sitting preference, reading material, study preference, chronic disease, reading style, internet and social networks, sports, smoking, weekend educational activity, sleep duration, average hours spent on society service and more.

Table1: Questionnaire Items

#	Surveyed Factors	#	Surveyed Factors
1	Age (15-26 years)	27	how-many-cigarettes
2	Gender(male-female)	28	weekend-study-hrs
3	class-level (3rd-8th level)	29	daily-sleep-hrs
4	CGPA	30	Facebook-account?
5	Academic-Self-evaluation	31	twitter-account?
6	Major (computer science, Information technology, Computer Engineering)	32	WhatsApp-account?
7	How-You-Choose-Major (self-choose, University-Selection, parents-recommendation)	33	daily-SocialNeworks-hrs
8	residence-location (Tabuk-city, ouside-tabuk)	34	Weekly-YouTube-hrs
9	living-with? (family, with-friends, alone)	35	future-vision
10	transportation	36	sport?
11	martial-status	37	sport-type
12	father-job	38	favorite-sport-star
13	father-education	39	favorite-sport-team
14	Mother-education	40	local-football-fan
15	English-Level	41	international-sport-fan
16	attending-lectures	42	international-sport-type
17	Sitting-preferences	43	GYM?
18	reading-preferences	44	weekly-GYM-hrs
19	like-literacy	45	Sport-news-fan
20	study-alone?	46	Movies-fan?
21	exams-worry?	47	Movies-type
22	chronic-disease	48	Good-Social-life?
23	Study-preferences	49	weekly-social-hrs
24	Study-schedule?	50	friends-common-house-monthly
25	daily-habits	51	safari-camping
26	smoking?	52	society-service?
		53	society-service-type

Their performance was stratified as "excellent" (CGPA ≥4/5) or "average" (CGPA <4/5). Students were asked to complete a self-administered questionnaire. Their Participation was voluntary.

This research conducted two methods the first is statistical method and the second is using Principle Component Analysis (PCA). First, statistically analyze the factors survey by the questionnaire to discover the most-affecting factors with high significance. Variables will be expressed as the mean±SD. The t-test was used for testing the significant factors. The results are considered statistically significant when (p value ≤ 0.05). Standard statistical software (STATISTICA) was used for the statistical analyses. Second, PCA was used to identify the principal factors that lead to achieving good academic achievement. Finally, this research reported the overlapped factors -resulted from the two previous methods- as the significant factors.

4. RESULTS

This study aimed to encompass all the students in the faculty of computers and information technology (FCIT) classes who score codes as A (excellent) if their CGPA>=4 and B (Average) if their CGPA<4 as per the results in the previous semester. Questionnaires were distributed in the classes. Participants were orally briefed by the lecturers about the research objectives and how to fill the questionnaire.

4.1 Statistical Analysis Results

Out of 320, Male group includes 132 students (41.25%) and female group includes 188 female students (58.75%). The two groups consisted of 106 excellent (A) and 214 average (B) grade students. Out of 132 male computing students group, 23 male students (21.6%) among the excellent group, and 109 male students (50.9%) among the average group. While for the female computing students group, 83 female students (78.3%) among the excellent group, and 105 female students (49.06%) among the average group. As per the previous statistics, female dominance was evident: (78.3 %) among the excellent group, and 49.06 % among the average group.

STATISTICA software has been selected for the analysis. several techniques applied such as t-test, F-test for precision, Analysis of variance (ANOVA), Linear correlation and regression , etc. for comprehensive analysis of the same problem ; while more consideration was given to the results with the higher accuracy witnessed. In the following, the results of the statistical analysis are presented by applying t-test for all the surveyed factors. Table 2 illustrates the most significant factors for the two groups. The table describes the mean, standard deviation, t-values, P-value and significant difference for the two groups. Table 3 shows the percentages of those factors for the two groups.

Table2: Analysis of Variance (FCIT data preprocessed)Marked effects are significant at p < .05000)

Variable	All Groups T-tests; Grouping: CGPA (FCIT data preprocessed) Group 1: a Group 2: b					
	Mean (a)	Mean (b)	Std.Dev. (a)	Std.Dev. (b)	F-ratio (Variances)	p (Significance)
Age	3.4	2.8	0.7	0.8	1.1	0.0
Gender	1.7	1.4	0.4	0.5	1.5	0.00
Major	1.2	1.5	0.5	0.6	1.1	0.00
transportation	1.6	1.4	0.7	0.6	1.1	0.0
father-education	3.0	2.2	1.1	1.1	1.0	0.0
Mother-education	3.1	2.5	1.1	1.3	1.3	0.000281
English-Level	1.4	1.7	0.6	0.73	1.4	0.000872
Sitting-preferences	1.7	1.5	0.7	0.5	1.5	0.015786
exams-worry?	1.5	1.2	0.49	0.4	1.4	0.000000
Study-schedule?	2.3	2.5	0.70	0.62	1.2	0.041524
smoking?	1.1	1.2	0.30	0.42	1.8	0.013297
daily-sleep-hrs	1.9	1.7	0.68	0.68	1.007	0.005670
twitter-account?	1.3	1.2	0.48	0.41	1.3	0.00750
sport?	1.5	1.3	0.49	0.46	1.1	0.000054
sport-type	2.0	1.7	0.84	0.90	1.13	0.007190
local-football-fan	3.1	2.5	1.12	1.09	1.061	0.000040
international-sport-fan	1.7	1.4	0.43	0.49	1.29	0.000000
GYM?	1.8	1.5	0.38	0.49	1.651	0.000041
weekly-GYM-hrs	1.7	1.4	0.70	0.73	1.06	0.042971
Sport-news-fan	1.7	1.3	0.45	0.48	1.13	0.000000
Movies-type	3.1	2.6	1.55	1.82	1.37	0.035662
friends-common-	1.6	1.4	0.4	0.5	1.1	0.002

					6		4	051
house-monthly								
safari-camping	3.1	2.6	1.05	1.30		1.522	0.001945
society-service?	1.7	1.5	0.44	0.49		1.222	0.012616

Table 3: Percentage of the identified factors to each class of students

Variable	percentage(a)	percentage(b)
Age	99.06%	100.00%
Gender	100.00%	100.00%
Major	99.06%	99.53%
transportation	90.57%	93.93%
father-education	92.45%	93.93%
Mother-education	92.45%	90.65%
English-Level	93.40%	92.99%
Sitting-preferences	90.57%	89.72%
exams-worry?	90.57%	90.19%
Study-schedule?	78.30%	86.92%
smoking?	82.08%	85.51%
daily-sleep-hrs	86.79%	85.98%
twitter-account?	89.62%	87.38%
sport?	87.74%	89.72%
sport-type	49.06%	68.69%
local-football-fan	84.91%	73.83%
international-sport-fan	83.96%	86.45%
GYM?	78.30%	86.45%
weekly-GYM-hrs	31.13%	46.73%
Sport-news-fan	86.79%	88.79%
Movies-type	75.47%	75.23%
friends-common-	85.85%	90.19%
safari-camping	84.91%	85.05%
society-service?	89.62%	90.19%

4.2 PCA Analysis Results

Principle Component Analysis (PCA) is a well-known technique for analyzing data table which is helpful to spot numerous inter-correlated quantitative dependent variables to extract the important information from the table [17]. Table 4 explains the principle components of FCIT data with descriptive data showing the mean, standard deviation and scaling factor values. PCA extracts 39 factors among 53 surveyed factors as principle components. Table 5 labels each factor with its importance based on its power to the group of factors.

Table 4: PCA analysis of the surveyed factors

#	Variable	Valid N.	Mean	Std.Dev	Scaling factor
1	Age	271	3.077	0.81	0.8150
2	Gender	272	1.522	0.5077	0.5077
3	Major	270	1.5037	0.6262	0.6262
4	How-You-Choose-Major	236	1.5889	0.6624	0.6624
5	residence-location	270	1.2	0.4007	0.4007
6	living-with	270	1.2851	0.5881	0.5881
7	transportation	266	1.5037	0.7124	0.7124
8	martial-status	270	1.8222	0.4019	0.4019
9	father-job	266	1.8458	1.2079	1.2079
10	father-education	268	2.5970	1.1874	1.1874
11	Mother-education	269	2.8289	1.3188	1.3188
12	English-Level	270	1.7074	0.715	0.715
13	attending-lectures	270	1.359	0.54	0.545
14	Sitting-preferences	268	1.582	0.63	0.633
15	reading-preferences	265	2.437	0.791	0.791
16	like-literacy	263	1.444	0.505	0.505
17	study-alone?	260	1.315	0.465	0.465
18	exams-worry?	267	1.318	0.466	0.466
19	chronic-disease	266	1.815	0.388	0.388
20	Study-preferences	255	1.494	0.500	0.500
21	Study-schedule?	241	2.481	0.658	0.658
22	smoking?	252	1.198	0.399	0.399
23	daily-sleep-hrs	264	1.795	0.689	0.68

24	Facebook-account?	259	1.482	0.508	0.508
25	twitter-account?	260	1.265	0.442	0.442
26	WhatsApp-account?	264	1.090	0.288	0.288
27	daily-SocialNeworks-hrs	261	1.98850	0.97065	0.97065
28	weekly-YouTube-hrs	254	1.49606	0.81850	0.81850
29	future-vision	260	1.880	0.832	0.832
30	sport?	267	1.404	0.491	0.4917
31	international-sport-fan	249	1.546	0.498	0.498
32	GYM?	246	1.678	0.467	0.467
33	Sport-news-fan	253	1.509	0.500	0.500
34	Movies-fan?	260	1.246	0.4316	0.4316
35	Good-Social-life?	261	1.164	0.371	0.371
36	weekly-social-hrs	258	1.945	0.756	0.756
37	friends-common-house-monthly	261	1.586	0.493	0.493
38	safari-camping	244	2.938	1.196	1.196
39	society-service?	261	1.6704	0.4709	0.4709

Table 5: Identified factors ordered giving their importance

Variable	Power	Importance
Gender	0.694462	1
safari-camping	0.578385	2
reading-preferences	0.547417	3
chronic-disease	0.487508	4
international-sport-fan	0.448606	5
WhatsApp-account?	0.445951	6
sport?	0.436567	7
GYM?	0.397576	8
Sport-news-fan	0.39422	9
martial-status	0.37995	10
Mother-education	0.370034	11
twitter-account?	0.352188	12
father-education	0.347073	13
society-service?	0.341857	14
English-Level	0.339201	15
Major	0.309122	16
daily-SocialNeworks-hrs	0.304408	17
like-literacy	0.297295	18
Study-preferences	0.297204	19
friends-common-house-monthly	0.277971	20
residence-location	0.273705	21
Facebook-account?	0.271165	22
daily-sleep-hrs	0.260606	23
weekly-social-hrs	0.246376	24
exams-worry?	0.229866	25
smoking?	0.225556	26
Movies-fan?	0.211989	27
future-vision	0.185412	28
Age	0.18234	29
Good-Social-life?	0.179586	30
Sitting-preferences	0.168769	31
transportation	0.152534	32
How-You-Choose-Major	0.128846	33
living-with?	0.118529	34
Study-schedule?	0.090207	35
study-alone?	0.088323	36
attending-lectures	0.078457	37
father-job	0.063857	38
weekly-YouTube-hrs	0.041429	39

5. DISCUSSION

This study aims at investigating the key factors disturbing the academic performance of FCIT students (both males and females). This study used two analytical methods to examine the surveyed factors. The t-test method marks 24 effective factors while the PCA method marks 39 factors as effective factors. By intersecting the two methods, this study reports the factors in table 6 as the most significant and influencing factors to the academic performance of FCIT students. These affecting factors would be clustered into the following bands:

personal (age, gender, exams-worry, smoking, daily-sleep-hours,), academic (English-level, Major, Sitting-Preference-in-the-class, follow Study-Schedule), Family(father-education-level, Mother-education-level and transportation-type) and life-style (twitter-account?, doing-sport?, international-sport-fan, Sport-news-fan, attending-GYM?, Movies, renting common house with friends monthly, safari-camping and volunteer-society-service?).

Table 6: Intersecting factors identified by both statistical analysis and PCA

Affecting Factor
Age
Gender
Major
transportation
father-education
Mother-education
English-Level
Sitting-preferences
exams-worry?
Study-schedule?
smoking?
daily-sleep-hrs
twitter-account?
sport?
international-sport-fan
GYM?
Sport-news-fan
Movies-type
friends-common-house-monthly
safari-camping
society-service?

6. ACKNOWLEDGMENT

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