

“EDUCATIONAL PERFORMANCE OF STUDENTS IN A NEW COLLEGE OF ENGINEERING - A COMPUTER-AIDED STUDY”

By

M.A. Sheirah* and G.S.A. Shawki**

Qatar University, Doha,
Qatar - Arabian Gulf.

ABSTRACT

A data-base computer package is herein developed to provide an effective tool for the study, evaluation and rectification of the academic performance of university students. As a test case, the newly established Faculty of Engineering at Qatar University in the Arabian Gulf is herein dealt with. Relevant results indicate that the school has established itself, that the educational components meet the needs and that the evaluation system used proved to be quite reliable. It is herein concluded that the developed package can be adapted to any educational system and that the benefits for students and Faculty deserve serious consideration for institutions elsewhere.

1. INTRODUCTION

This institutional study presents the results of a most recent experiment in engineering education conducted in one of the rapidly developing countries in the Middle East, namely in the State of Qatar.

The Faculty of Engineering was first established at Qatar University in October 1980, on a credit hour system extending over some ten semesters, the total number of credit hours required for graduation being 162 hours.

* Professor and Head of Electrical Engineering Department.

** Professor and Dean, Faculty of Engineering.

M.A. Sheirah and G.S.A. Shawki

Table (1.2), which represents, with numbers and names deleted, an example extracted from the Mechanical Engineering Discipline, comprises following components of a "General Summary Report":

- Student's Registration No. & Name
- Starting Date Country of Origin Total No. of Cr. Hours Acquired until Spring 86 Accumulated GPA Anticipated Graduation Date

Table 1.1 - Sample Reports of Data-Base System (1)

Engineering Student Records
Report (01) (Dept.:)

St. No.	Student Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
ENG/001	(A)	80/81	81/82	82/83	83/84	84/85	85/86	
		A-18(15) 2.30	A-16(13) 2.30	A-15(12) 2.00	A-15(15) 2.90	A-16(16) 2.93		
		S-18(12) 1.30	S-15(15) 3.00	S-17(11) 1.80	S-18(18) 2.94	S-23(23) 2.26		
					R-06(06) 3.33			
ENG/002	(B)	80/81	81/82	82/83	83/84	84/85	85/86	
		A-16(16) 3.10	A-13(10) 2.60	A-14(08) 1.40	A-09(06) 1.33	A-15(09) 1.06	A-13(13) 2.30	
		S-18(18) 3.00	S-18(18) 2.70	S-15(07) 0.90	S-13(13) 2.76	S-14(14) 2.42	S-07(07) 2.85	
					R-06(06) 2.50	R-04(04) 3.00		
ENG/003	(C)	80/81	81/82	82/83	83/84	84/85	85/86	
		A-18(18) 2.60	A-12(12) 3.00	A-14(0) 0.00	A-13(13) 2.70	A-14(14) 2.92	A-17(17) 3.58	
		S-18(6) 1.20	S-14(11) 2.10	S-12(9) 1.50	S-18(15) 1.94	S-17(17) 2.94	S-19(19) 3.15	
				R- 5(2) 0.80	R- 6(0) 0.00	R- 3(3) 3.00		
ENG/004	(D)	80/81	81/82	82/83	83/84	84/85	85/86	
		A-20(20) 5.00	A-15(15) 5.00	A-15(15) 5.00	A-14(14) 5.00	A-10(10) 5.00		
		S-20(20) 4.90	S-20(20) 4.90	S-15(15) 5.00	S-18(18) 5.00	S-11(11) 5.00		
					R-02(02) 5.00			
ENG/005	(E)	80/81	81/82	82/83	83/84	84/85	85/86	
		A-16(16) 2.60	A-13(13) 2.90	A-15(9) 1.20	A-11(5) 1.10	A-11(7) 1.45		
		S-18(15) 2.30	S-17(11) 1.50	S-12(7) 1.20	S-12(6) 1.25	S-12(10) 1.66		
				R- 5(2) 1.20	R-4(0) 0.00			

Educational Performance of Students

Table 1.2 – Sample Reports of Data-Base System (1)

**Engineering Student Records
Report (02) (Dept.:)**

<u>St. No.</u>	<u>Student Name</u>	<u>Start</u>	<u>Nation</u>	<u>Hours</u>	<u>Average</u>	<u>Grad.</u>	<u>Remarks</u>
ENG/001	(A)	A-80	Qatar	159	2.51*	S-86	
ENG/002	(B)	A-80	Qatar	157	2.89*	S-85	
ENG/003	(C)	A-80	Egypt	156	2.87*	S-86	
ENG/004	(D)	A-80	Egypt	165	4.19*	S-85	
ENG/005	(E)	S-81	Qatar	8	0.30*		W Quit after A-84
ENG/006	(F)	A-81	Pal	161	4.91*	S-85	
ENG/007	(G)	A-81	Qatar	122	2.13*		
ENG/008	(H)	A-81	Qatar	157	3.13*	S-86	Transfer from UPM
ENG/009	(I)	A-81	Qatar	163	4.30*	A-85	
ENG/010	(J)	A-81	Jordan	160	3.43*	S-86	
ENG/011	(K)	A-81	Canada	161	4.27*	S-85	
ENG/012	(L)	A-81	Iraq	157	2.91*	S-86	Transfer from the Faculty of Science
ENG/013	(M)	A-82	Qatar	101	2.13		
ENG/014	(N)	A-82	Qatar	111	2.33		
ENG/015	(O)	A-82	Egypt	132	2.45		Transfer from ELE to MEC (-7 hrs)
ENG/016	(P)	S-83	Egypt	69	1.69		Transfer from the Faculty of Science
ENG/017	(Q)	S-83	Egypt	135	2.94		Transfer from the Faculty of Science
ENG/018	(R)	A-83	Qatar	84	2.52		
ENG/019	(S)	A-83	Qatar	88	2.73		
ENG/120	(T)	A-83	Qatar	72	2.08		
ENG/121	(U)	A-83	Qatar	75	2.02		
ENG/122	(V)	A-83	Iraq	104	2.69		
ENG/123	(W)	A-83	Egypt	109	4.22		
ENG/124	(X)	A-84	Qatar	69	2.88		
ENG/125	(Y)	A-84	Qatar	75	3.49		
ENG/126	(Z)	A-84	Egypt	69	3.62		

Table (1.3) gives an overview of students' achievements together with a listing of relevant advisors. Entries are arranged in the following sequence:

Students' Reg. No.	Name	Total No. of Cr. Hours Acquired until Spring 86	Accumulated GPA	Name of students' Advisor
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The example shown is obtained from the Archive of the Civil Engineering Department.

Table 1.3 – Sample Reports of Data-Base System (1)

**Engineering Student Records
Report (03) (Dept.:)**

<u>St. No.</u>	<u>Student Name</u>	<u>Hours</u>	<u>Average</u>	<u>Advisor</u>
ENG/001	(A)	156	4.84 *	Dr. Ezzat Fahmi
ENG/002	(B)	156	2.94 *	Prof. Dr. Mohd Tawfik
ENG/003	(C)	156	3.48 *	Dr. Ezzat Fahmi
ENG/004	(D)	158	2.86 *	Dr. Ezzat Fahmi
ENG/005	(E)	72	1.65 W	
ENG/006	(F)	156	3.42 *	Dr. Ezzat Fahmi
ENG/007	(G)	156	2.84 *	Dr. Ezzat Fahmi
ENG/008	(H)	109	1.42	Prof. Dr. Mohd Tawfik
ENG/009	(I)	156	3.89 *	Prof. Dr. Mohd Tawfik
ENG/010	(J)	156	3.14 *	Prof. Dr. Mohd Tawfik
ENG/011	(K)	156	4.15 *	Prof. Dr. Mohd Tawfik
ENG/012	(L)	157	4.18 *	Prof. Dr. Mohd Tawfik
ENG/013	(M)	156	2.90 *	Prof. Dr. Mohd Tawfik
ENG/014	(N)	157	2.87 *	Prof. Dr. Mohd Tawfik
ENG/015	(O)	160	3.58 *	
ENG/016	(P)	75	1.38	Dr. Shamim Ahmed
ENG/017	(Q)	134	1.96	Dr. Shamim Ahmed
ENG/018	(R)	102	1.86	Dr. Shamim Ahmed
ENG/019	(S)	157	3.12 *	Dr. Shamim Ahmed
ENG/020	(T)	156	4.71 *	Dr. Shamim Ahmed
ENG/021	(U)	141	2.63	Dr. Shamim Ahmed
ENG/022	(V)	134	2.22	Dr. Shamim Ahmed
ENG/023	(W)	18	1.10 W	
ENG/024	(X)	156	4.33 *	Dr. Shamim Ahmed
ENG/025	(Y)	140	2.46	Dr. Shamim Ahmed
ENG/026	(Z)	162	3.91 *	
ENG/027	(*)	118	2.67	Dr. Mahmoud El-Nokrashi
ENG/028	(*)	75	1.62	Dr. Mahmoud El-Nokrashi
ENG/029	(*)	137	4.59	Dr. Mahmoud El-Nokrashi

Educational Performance of Students

The second system is destined to yield individual summary reports, these being found of real value to academic advisors. Table (2) presents two examples of such summary report namely, Data Cards for the cases of a graduated student and a withdrawn student respectively.

Table 2 – Sample Record of Data-Base System (2)

STUDENT RECORD

STUDENT NUMBER	:	ENG/001			
STUDENT NAME	:	(A)			
NATION	:	Qatar	Dept. : ELE		START : A-80
ADVISOR	:	Dr. Magdi Fikri			
YEAR 1	:	80/81	A-18 (15) 2.30	S-18 (12) 1.30	
YEAR 2	:	81/82	A-16 (13) 2.30	S-15 (15) 3.00	
YEAR 3	:	82/83	A-15 (12) 2.00	S-17 (11) 1.80	
YEAR 4	:	83/84	A-15 (15) 2.90	S-18 (18) 2.94	R-06 (06) 3.33
YEAR 5	:	84/85	A-16 (16) 2.93	S-23 (23) 2.26	
YEAR 6	:				
YEAR 7	:				
*					
Terms	:	10	CREDITS : 156		GPA : 2.54 -
GRADUATION DATE	:	S-85			

STUDENT NUMBER	:	ENG/150			
STUDENT NAME	:	(B)			
NATION	:	Qatar	DEPT. :		START : A-82
ADVISOR	:				

YEAR 1	:	82/83	A-16 (5) 0.75	S-12 (3) 0.50	R- 6 (6) 3.00
YEAR 2	:	83/84	A- 6 (.)		
YEAR 3	:				
YEAR 4	:				
YEAR 5	:				
YEAR 6	:				
YEAR 7	:				

* Quit after A-83

Terms	:	2	CREDITS : 14		GPA : 1.10
GRADUATION DATE:					

The third system is so planned as to provide a very effective tool for obtaining statistical measures criteria and general trends of the educational process with its so many variables and components, Tables (3) and (4).

Table (3) exhibits the structure of this system which comprises 98 fields; these are detailed hereunder:

Serial No.

- 1 – 5 : General information about the student
- 6 – 8 : Status regarding Transfer to Faculty
- 9 – 12 : Information regarding Autumn of Year (1)
- 13 – 16 : Information regarding Spring of Year (1)
- 17 – 20 : Information regarding Summer of Year (1)
- 21 – 32 : Information for the 3 Semesters of Year (2)
- 33 – 92 : Information for remaining years : (3) to (7)
- 93 – 98 : Current status of student

Table 3 – Structure of Data-Base System (3)

	Field Description		Extent	Explanation of Data Entered	
	Name	Type			
1	STNAME	Character	35	Student's Name Student's Number Nationality Department Starting Date	General Data
2	STNUM	Character	10		
3	NATION	Character	10		
4	DEPT.	Character	3		
5	START	Character	6		
6	TRANS-T-F	Logical	1		Transfer
7	TRANS-HRS	Numeric	3		
8	TRANS-AVE	Numeric	4.2		
9	AI-T-F	Logical	1	Autumn Semester – Year (1)	Year (1)
10	AI-HOURS	Numeric	2		
11	AI-CREDIT	Numeric	2		
12	AI-AVERAGE	Numeric	4.2		
13	SI-T-F	Logical	1	Spring Semester – Year (1)	
14	SI-HOURS	Numeric	2		
15	SI-CREDIT	Numeric	2		
16	SI-AVERAGE	Numeric	4.2		

continued on next page...

Educational Performance of Students

Table 3 cont'd.

	Field Description		Extent	Explanation of Data Entered	
	Name	Type			
17	R1-T-F	Logical	1	Summer Semester – Year (1)	Year (1)
18	R1-HOURS	Numeric	2		
19	R1-CREDIT	Numeric	2		
20	R1-AVERAGE	Numeric	4.2		
21	A2-T-F	Logical	1	Autumn A2	Year (2)
*				Spring S2	
*					
32	R2-AVERAGE	Numeric	4.2	Summer R2	
33	A3-T-F	Logical	1	Autumn A3	Year (3)
*				Spring S3	
*					
44	R3-AVERAGE	Numeric	4.2	Summer R3	
45	A4-T-F	Logical	1	Autumn A4	Year (4)
*				Spring S4	
*					
56	R4-AVERAGE	Numeric	4.2	Summer R4	
57	A5-T-F	Logical	1	Autumn A5	Year (5)
*				Spring S5	
*					
68	R5-AVERAGE	Numeric	4.2	Summer R5	
69	A6-T-F	Logical	1	Autumn A6	Year (6)
*				Spring S6	
*					
80	R6-AVERAGE	Numeric	4.2	Summer R6	
81	A7-T-F	Logical	1	Autumn A7	Year (7)
*				Spring S7	
*					
92	R7-AVERAGE	Numeric	4.2	Summer R7	
93	NO-TERMS	Numeric	3	Number of semesters attended	Current Status
94	T-HRS	Numeric	6	Total number of hours	
95	GPA	Numeric	5.2	Grade Point Average (Current)	
96	GRAD DATE	Character	6	Graduation Date	
97	GRADUATED	Character	1	Code for Graduated Students: *	
58	WITHDRAWN	Character	1	Code for Withdrawn Students: *	

Table (4) reproduces "Screen Formats" for editing student's data. This format can be used for updating the status and current performance of the student for each semester.

Table 4 – Screen Format of Data-Base System (3)

STUDENT DATA BASE			
Number : ENG/001		Name : (A)	
Nationality : Qatar		Starting Date : A-80	Withdraw :
Department : ELE	Graduation Data : S-85	Grad Code : *	
No of Terms : 10	Total Credit : 156	GPA : 2.54	
Transfer : F 0 0.0 0			
YEAR	AUTUMN	SPRING	SUMMER
(1)	T 18 15 2.30	T 18 12 1.30	F 0 0 0.00
(2)	T 16 13 2.30	T 15 15 3.00	F 0 0 0.00
(3)	T 15 12 2.30	T 17 11 1.80	F 0 0 0.00
(4)	T 15 12 2.90	T 18 18 2.94	T 6 6 3.33
(5)	T 16 16 2.93	T 23 23 2.26	F 0 0 0.00
(6)	F 0 0 0.00	F 0 0 0.00	F 0 0 0.00
(7)	F 0 0 0.00	F 0 0 0.00	F 0 0 0.00

3 – SALIENT EDUCATIONAL FEATURES FOR THE TEST CASE

3.1 – Student Populaton

The student population of the school has steadily increased since inauguration in October 1980 to reach some 140 students who attend offered courses regularly, Fig. (1).

Educational Performance of Students

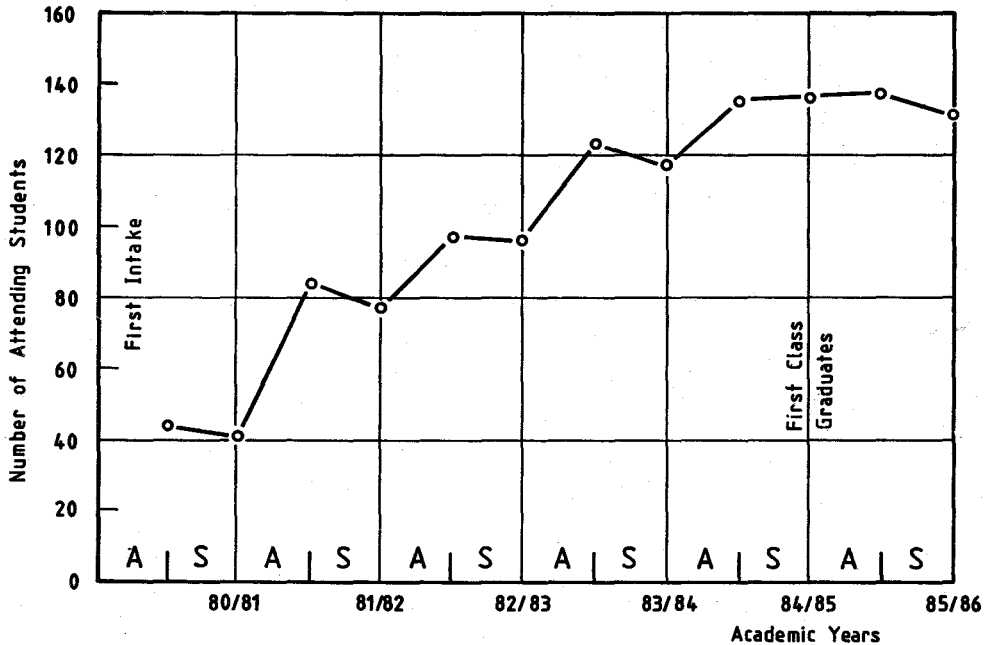


Fig. (1) - Growth of engineering students since inauguration of Faculty in Oct. 1980.

3.2- Withdrawals

Withdrawals from the school are shown to be steadily decreasing with successive classes, Fig. (2). Regular students of the latest intake (October 1986) are 38 in number. Withdrawals have decreased from some 52.5% of students intake to some 18% in the current academic year, Fig. (3). Most student withdrawals seem to take place after the first 2-3 semesters, Fig. (4). Should students endure the first few semesters, they are more likely to continue their engineering studies.

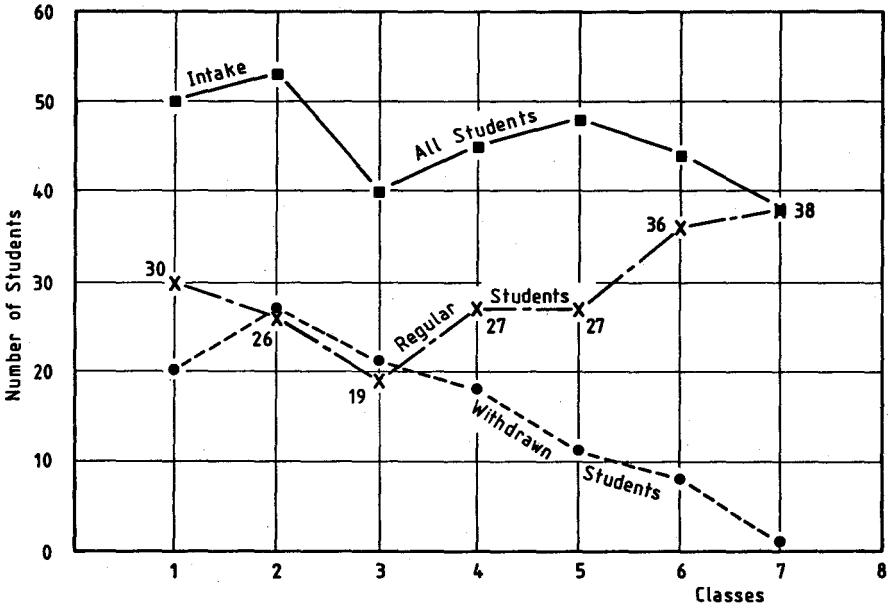


Fig. (2) – Course of variation of number of students for the first seven classes.

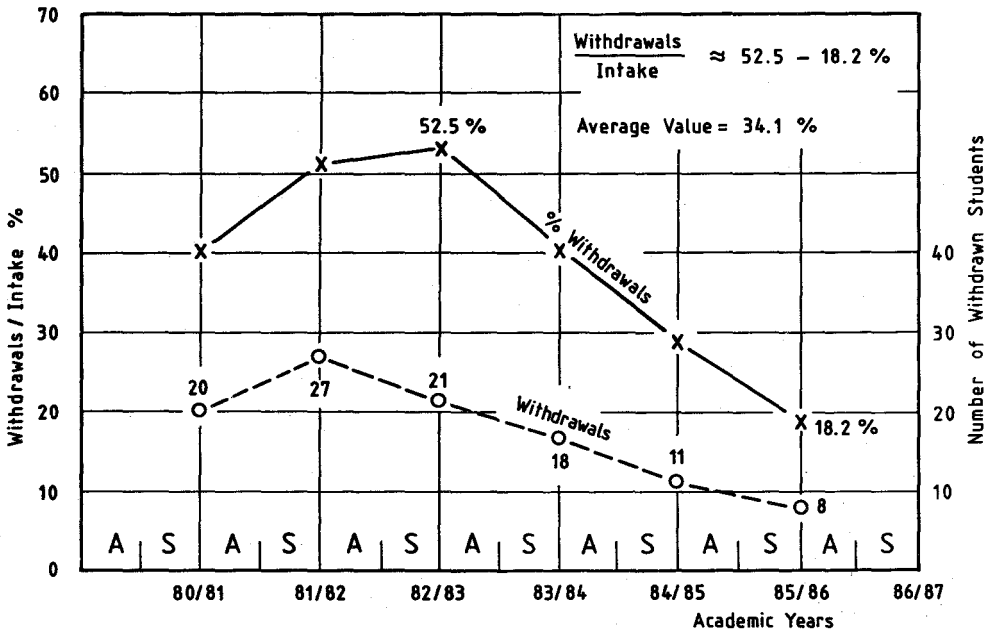


Fig. (3) – Course of variation of Withdrawals since inauguration of Faculty in Oct. 1980.

Educational Performance of Students

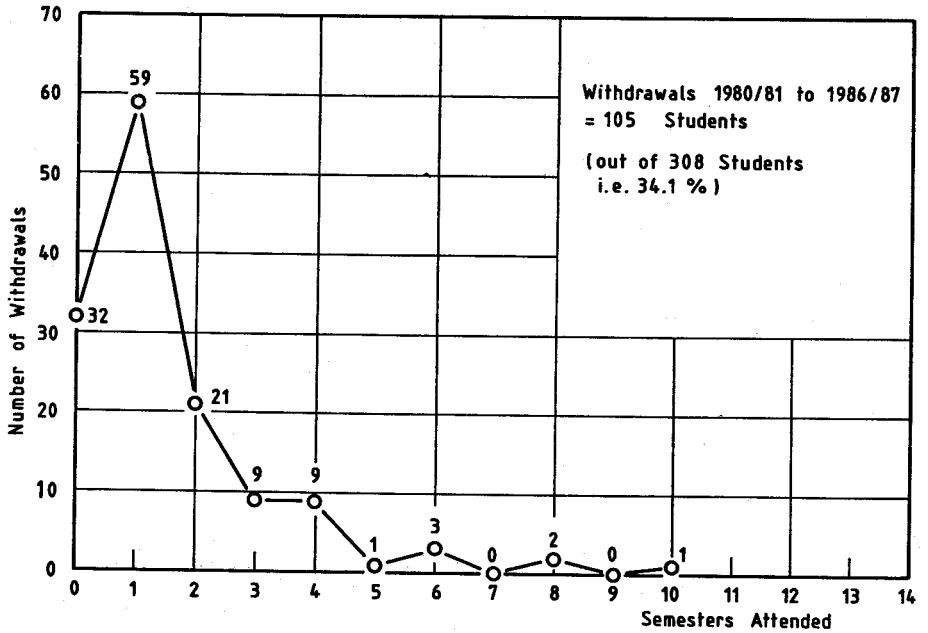


Fig. (4) - Student Withdrawals versus Semesters attended.

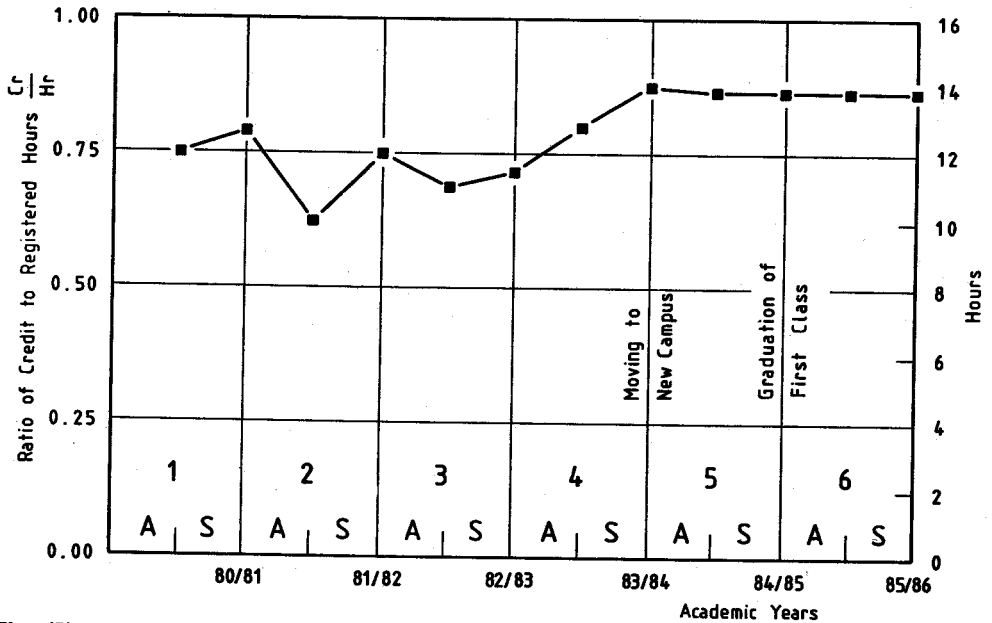


Fig. (5) : Ratio of acquired credit hours to registered hours for all regular students during their total period of attendance.

3.3 - Students Performance

The present study shows that, on the average, students have, at present, an assimilation rate of some 87.5%, i.e. out of 16 Cr. hours, the student is likely to gain only 14 Cr. hours, Fig. (5).

Comparison of classes, on basis of acquired credit hours per semester, shows that while the first and fourth classes display highest values, the sixth class exhibits lowest values, Fig. (6).

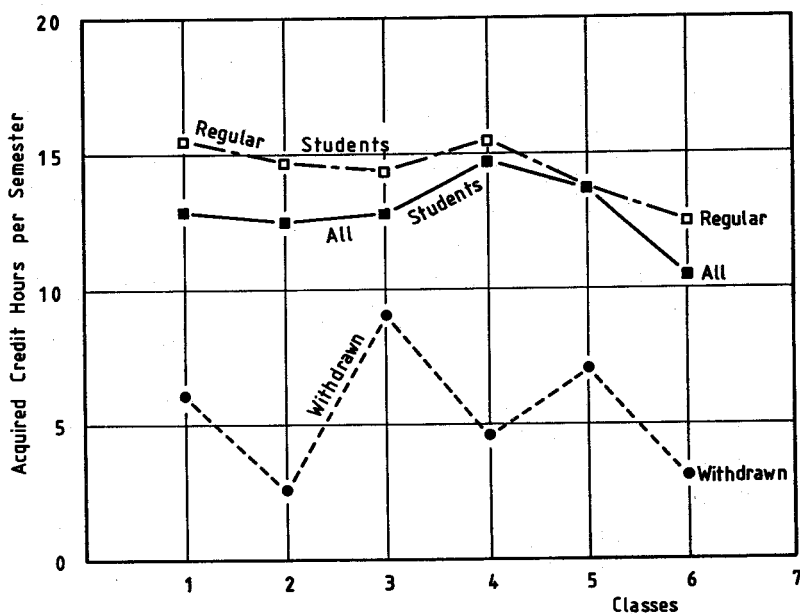


Fig. (6)- Acquired Credit Hours per Semester for the first Six Classes.

Judging by the Grade Point Average ⁽¹⁾ (GPA), there appears to be a steady improvement in students performance with semesters attended, Fig. (7). The first two classes display, as yet, highest GPA values, Fig. (8).

(1) See Legend for terminology used.

Educational Performance of Students

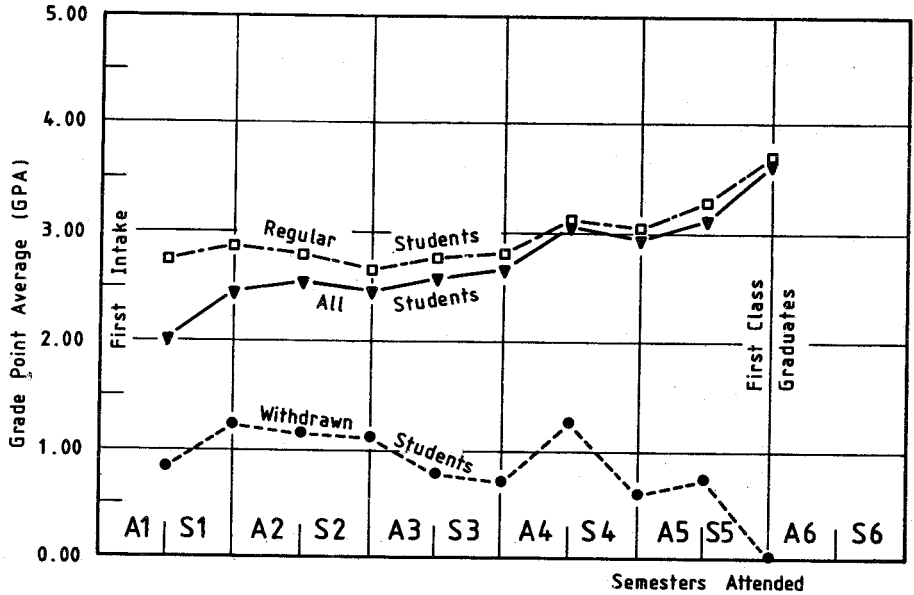


Fig. (7) – Average performance of engineering students during semesters attended.

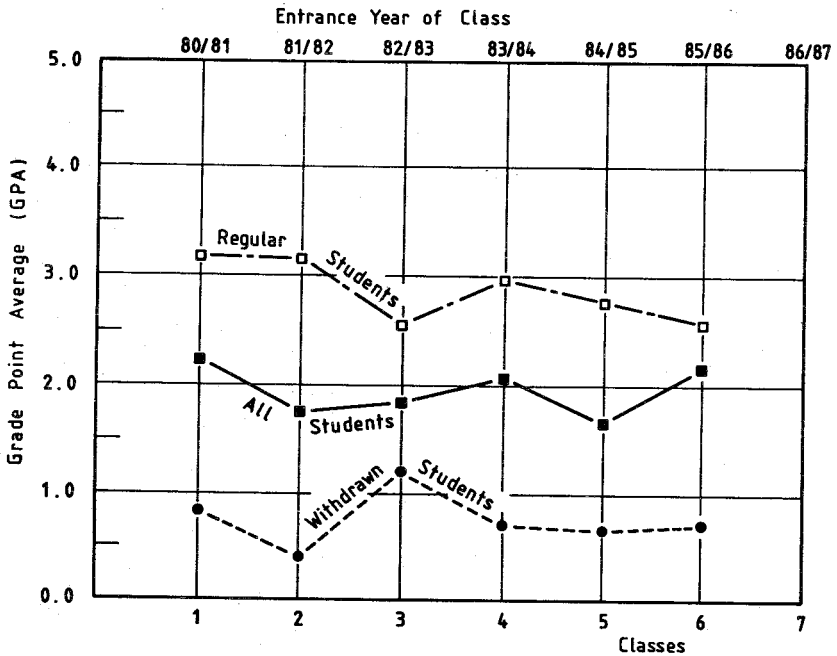


Fig. (8) – Grade Point Average values for the first six classes.

4- GRADUATES

The first two classes, who graduated in 1985 and 1986, comprise only half of the students who enrolled in the college in the years 1980 and 1981, Figs. (9-12).

On tracing the performance of students who graduated with an order of merit: "Distinction" and "Very Good", Figs. (10) & (12), it can be readily seen that relevant academic achievements are consistent. This would imply that these students well deserve their orders of merit and that the evaluation system in the school is quite sound. Lower rank students experienced improvements in their GPA attaining highest values at graduation semester. This may well serve as an example of how beneficial is the data-base package herein developed in indicating the reliability of the educational system used.

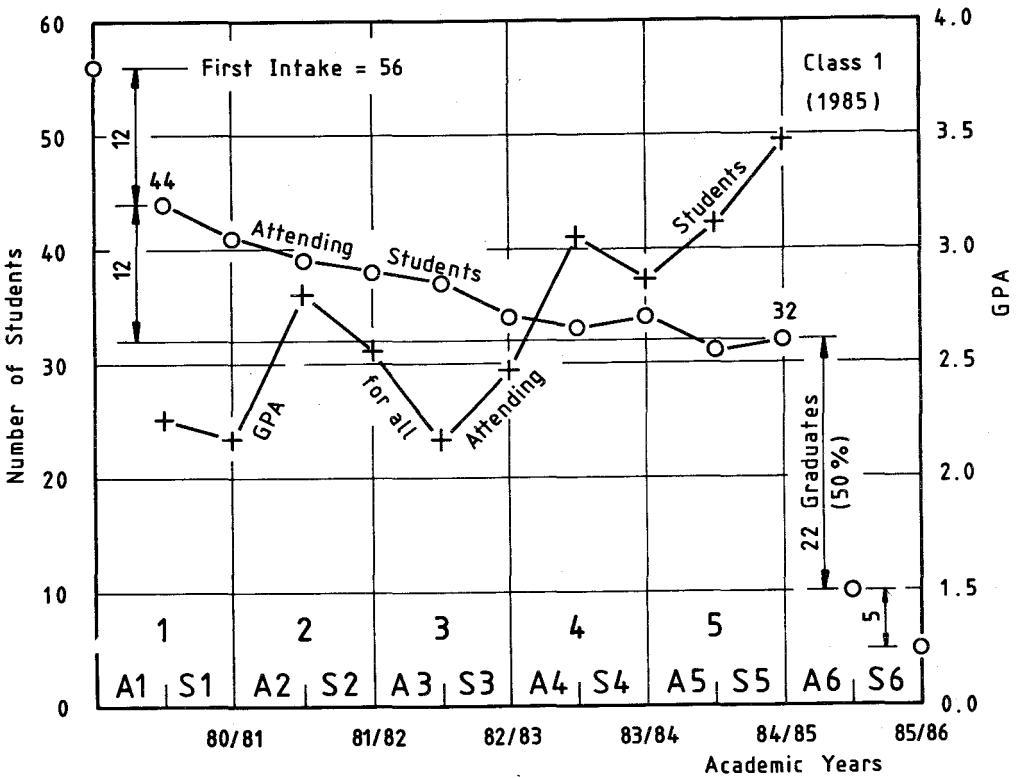


Fig. (9) - Performance of the First Class of Students.

Educational Performance of Students

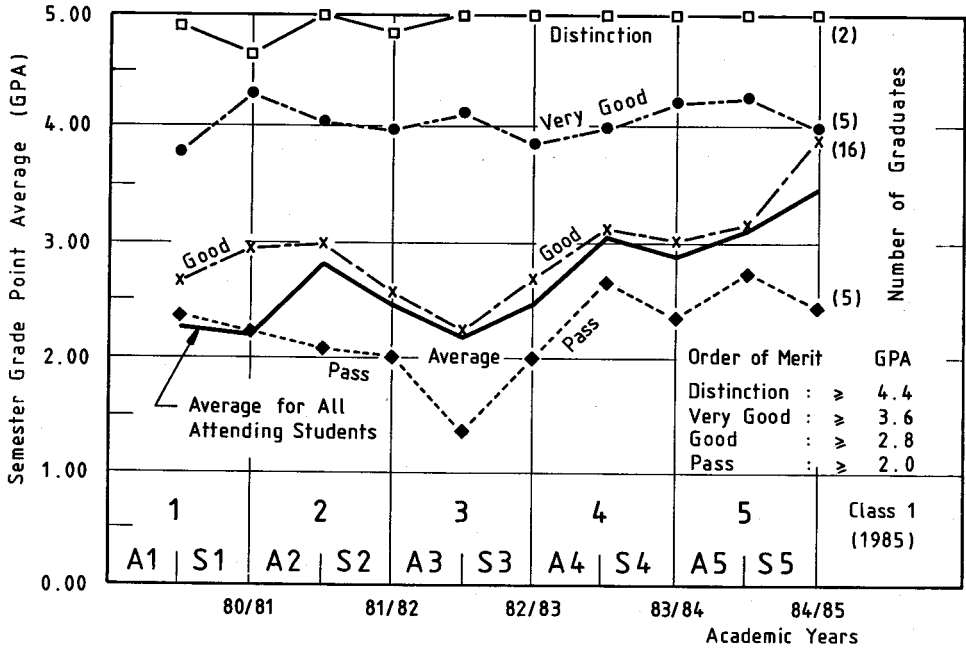


Fig. (10) – Semester Performance of students who graduated in the Class of 1985 (Class 1).

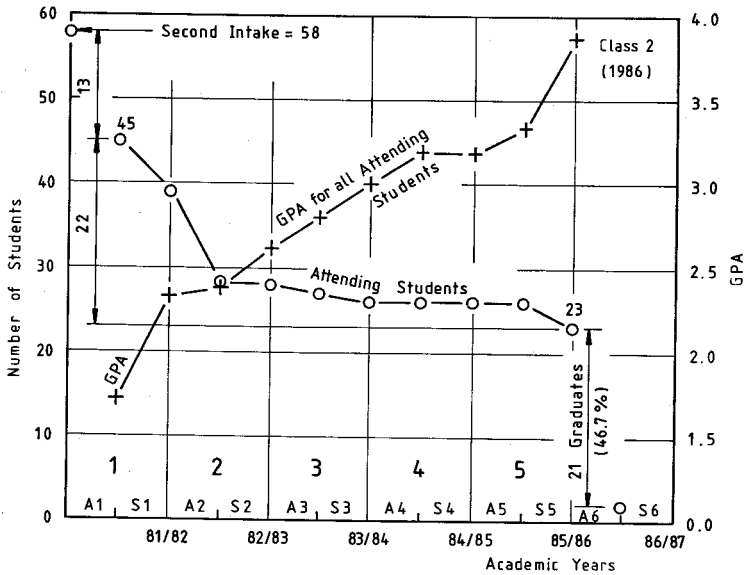


Fig. (11) – Performance of the Second Class of students.

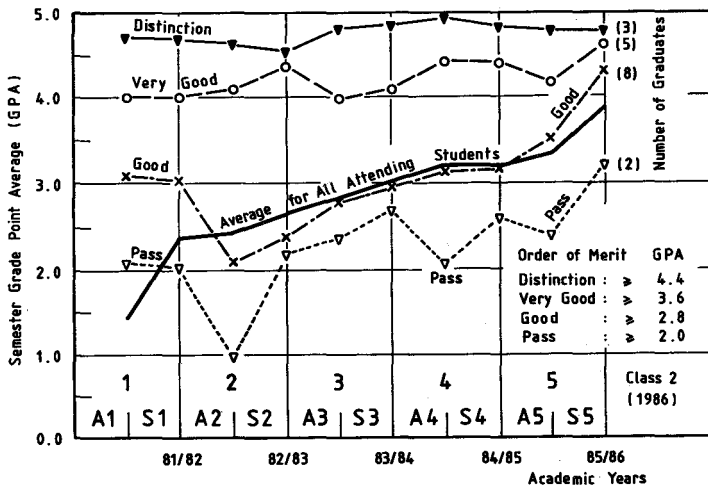


Fig. (12) – Semester Performance of students who graduated in Class of 1986 (Class 2).

5 - CONCLUSIONS

The following conclusions may be drawn:

- A- The data-base package, herein developed, proved to be quite effective in institutional studies and can be used in and readily adapted to any educational system. Performance data and relevant correlations may well be implemented for improving or otherwise changing the contents of course offered, for better adjustment of scheduling, for more efficient advising etc.
- B- For the specific case dealt with in this paper, viz. the newly established Faculty of Engineering, the following features are evident:
 1. The drop in student withdrawals and the increase in the number of students regularly attending offered courses indicate that the school has established itself and has succeeded in recruiting and motivating a more suitable intake. Moreover, the academic guidance proved to be quite influential. Optimum student performance is shown to be attained at some 14 Cr. hours per semester.
 2. The steady improvement in the Grade Point Average reflects measures taken towards recruitment of competent Faculty of supporting staff, also the enhancement of laboratory, workshop and computer facilities in the school.
 3. Only some 50% of the students intake graduate in 10 semesters.

Educational Performance of Students

4. The consistency of academic achievement, especially for graduates with higher ranks, inspired confidence in guidance, instruction and evaluation systems in the school.

LEGEND

A	:	Autumn Semester														
S	:	Spring Semester														
R	:	Summer Semester														
T-F	:	True/False Status														
80/81	:	Events occurring in the academic year 1980-1981.														
Attending Students	:	Students who formally register in the semester under the guidance of respective academic advisers (some of these students may well withdraw during the semester).														
Regular Students	:	Students who have not withdrawn from the faculty. (They may not be all attending).														
Semester Grade Point Average	:	Grade Point Average applicable to a specific semester = $\frac{(\text{Credit Hours} \times \text{Grade in Points}) \text{ for the semester}}{\text{Registered Hours in the semester concerned}}$ Maximum Value = 5.														
Grade Point Average	:	Overall "Grade Point Average" = $\frac{(\text{Credit Hours} \times \text{Grade in Points}) \text{ for all semesters}}{\text{Registered Hours in all semesters attended}}$														
Grade Points for Courses	:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Grade</td> <td style="width: 30%;">Points</td> </tr> <tr> <td>A</td> <td>5</td> </tr> <tr> <td>B</td> <td>4</td> </tr> <tr> <td>C</td> <td>3</td> </tr> <tr> <td>D</td> <td>2</td> </tr> <tr> <td>F</td> <td>Zero</td> </tr> <tr> <td>Incomplete</td> <td></td> </tr> </table>	Grade	Points	A	5	B	4	C	3	D	2	F	Zero	Incomplete	
Grade	Points															
A	5															
B	4															
C	3															
D	2															
F	Zero															
Incomplete																
Order of Merit	:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Order</td> <td style="width: 30%;">GPA (Overall)</td> </tr> <tr> <td>Distinction</td> <td>4.4</td> </tr> <tr> <td>Very Good</td> <td>3.6</td> </tr> <tr> <td>Good</td> <td>2.8</td> </tr> <tr> <td>Pass</td> <td>2.0</td> </tr> </table>	Order	GPA (Overall)	Distinction	4.4	Very Good	3.6	Good	2.8	Pass	2.0				
Order	GPA (Overall)															
Distinction	4.4															
Very Good	3.6															
Good	2.8															
Pass	2.0															
(*)	:	Indicates that the student has graduated.														
(W)	:	refers to a withdrawn student.														

A "D" average or a GPA below 3 on a 5.0 scale is considered in the U.S. insufficient for graduation, but is sufficient at this institution.