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RESEARCH ARTICLE

EVALUATION OF DSIGN PROJECTS FOR HIGH STUDENTS INTAKE

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ABSTRACT

In many engineering institutions design projects are assigned to groups of students. The evaluation of these projects may be extremely tedious and time consuming due to very high intake of students: say 250 students in a branch of engineering. A project takes about 2 ½ hours in evaluation. Hence proper evaluation is impossible if examiners are short in number having limited time to spare. This problem was solved by making evaluation committees and distributing the evaluation work in committees. To make the work of committees uniform or homogeneous a check list for project evaluation was developed. The work of evaluation committees was to a great extent uniform as evident from statistical analysis. This method enabled thorough evaluation of large number of projects in comparatively short time. The combined results of the committees fitted the normal curve with 5% level of significance. Hence the committees can be considered as substitute of single evaluation committee.

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INTRODUCTION

In the present technological age there is a growing trend for students to opt for engineering education. So the intake of the students in engineering institutions is increasing with the time. Because of the paucity of teaching faculty this high intake is jeopardizing the recommended student teacher ratio in a class room for effective teaching. In such circumstances, the smooth conduct of examination particularly for design projects which consume a lot of time can become a severe problem in the context of time pressure from Examination Department and the scarcity of examiners. This paper deals with such a problem and its remedy. It is a case study and is subjective as reader may find some issues debatable. Nevertheless, the study suggests a viable solution and approach, that is, the outcome of a number of committees can be made equivalent to one committee and the time required can be reduced. The Department of Mechanical Engineering of NED University of Engineering and Technology, Pakistan has a student intake of about 250 students per year. It has a four years undergraduate degree program. In the final year the students are assigned a design project bearing 200 marks out of a total of 1000 marks. The remaining 800 marks are for other subjects. The objective of the design project is to apply engineering principles and analysis learnt in the classroom to design a mechanical system, component or machine. The example of design projects are: design of a subsonic wind tunnel, design of incinerator for hospital waste, design of a basic oxygen furnace, design and fabrication of a vibration test rig, design and fabrication of the pick and place robot etc. A project is assigned to a group of four students. In a batch of students about 56 projects are distributed. Conducting examination of so many projects at the end of the year posed a big problem of scarce time available for project examination. This happens because project examination starts after the theory and practical examinations and should be concluded as early as possible to announce the complete final year results. The faculty members found difficulty in providing enough time for the project examination as one evaluation took up to two and half hours. As these practical difficulties were not avoidable the project examinations took longer at the expense of fatigue and stress on the faculty members and difficulties to arrange and manage the examinations. This problem was solved by making evaluation committees. The obvious question was whether the evaluation committees can be a substitute for a single committee. This question is the subject of this investigation.

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Experimental aspects

A list was made of design projects proposed by faculty members and the industry. The list was pruned to retain the projects which could be interesting and could be completed within the specified time. The list of projects was made available to students. The students did the projects in groups and each group comprised four students. A merit list of the groups was also made. The poor performing students liked to join the meritorious students but their inclusion would lower the merit rank of the group for which the group would be unwilling. Also a group composed of poor students resulted in their poor performance and would usually press for delay of examination. These problems were addressed by determining merit of a group only by considering the merit of two students in the group. Hence in a project group there was a likelihood of combination of good, average and poor students. Formation of groups in this way eliminates such frequent situations that some groups were composed of all good students and some with poor ones. This approach tried to homogenize the groups so that the variation among the groups in terms of the quality of students be less diversified. Hence it can be premised that the committees evaluated the students of similar populations. The project work mainly required a survey of project related literature, identifying the design problem, its objective and the underlying assumptions and constraints, theoretical background, and design analysis with drawings and the specifications. The projects were supervised by faculty members with at least Master's qualification. A faculty member supervised at least five projects.

The function of the supervisor was to monitor progress and divide the work among the group. This speeded the work on the project and the students learnt to work as a team and coordination of the work and reduced complaints among the members of someone not devoting to work. The supervisor guided in making the group understands the scope of the work, the contents and requirements of the design problem. As the supervisor knew and distinguished well about the contribution and effort of each member of the group of the project, hence he was considered to be a member of the evaluation team. For this reason the committees were assigned projects which their members had been supervising. The lists of design projects to be evaluated were also sent to industries for participation of practicing engineers from industries. Four committees were formed. All committees had equal members. Each committee was headed by a professor. Each committee called the group of the project for oral examination. The committee examined each student with respect to progress of project, presentation of project design analysis, knowledge in related field, drawings, models or fabrication if required. The total 200 marks were distributed as follows

Progress: 15, Presentation: 15, Literature survey: 20, Design analysis: 50, Related knowledge: 50, Drawings: 25, Model/fabrication: 25

Less than 100 marks means fail. However at this stage no student was failed, because it was expected that a candidate failed by a committee might blame the committee of being strict and might say if examined by other committee he would have passed. Hence at this stage who might fail was merely considered with poor performance. Later all such candidates were examined by a single combined committee comprising the heads of the committees and few members from the committees; this is similar to 100% inspection. Similarly all the best projects were reassessed for comparison and marks were refined by the combined committee. In the evaluation of a design it was thought to develop guidelines to determine what could be an excellent design so that all members had same criteria in mind.

The guide lines for an excellent design were as follows

- The problem is correctly defined and scope identified.
- The design problem is extensively reviewed and the technical know how is used in the design.
- Where necessary the design embodies such factors as: material handling, hauling, installation, stability, vibration isolation, safety, operational problems, control, etc.
- Major components are designed without any discrepancy, false assumptions and misleading analysis.
- The design components are nicely synchronized to achieve the objective of design.
- Design is based on comprehensive engineering analysis, proper selection of safety factors, materials, manufacturing processes and engineering codes.
- Approach to design is creative and imaginative.
- Alternative designs are explored and optimum is selected.
- The conclusions and recommendations are appropriate and justified.

Similarly for what could be considered as a poor design, the guidelines were

- The design problem is not properly defined and understood.
- The review is scarce, irrelevant or non existent.
- Only minor components are designed.
- Only few relatively less important major components are designed with serious mistakes and wrong assumptions.

Between excellent and poor design the marks were awarded by judging how much project is far from being excellent or near to poor grading.

DISCUSSION

The marks obtained by the candidates examined by the committees designated as A, B, C & D are shown in Table 1 and in Figure 1 as histograms. The histograms of all committees are different from each other in pattern. The histogram B is a bit symmetrical about the mean value. However, other histograms have significant distortions from the mean value. Figure 2 shows the histogram of the combined data of all committees. The histogram gives results as would have been expected from a single committee that is with increase of data values the frequency of the data increases to a peak value and then decreases to a low value.

The mean and standard deviation for the committees A, B, C & D are as follows

Committees	Data Points	Mean	Standard deviation
A	75	132	18.0
B	59	131	18.8
C	40	141	10.0
D	38	124	21.0

However there is a distortion at the lower data value. The mean of all data is 131.2 and the standard deviation 17.8. The means of the committees were tested using the null hypothesis [Hakim] and it was found that the mean of committees C and D were significant at 5% level of significance from the population mean. Table 2 shows the calculations for expected frequencies and chi-square values [Chaudhry]. Table 3 shows the calculations for the ordinates of the normal curve. The data is found to fit normal distribution as shown in Figure 2.

Table 1. Tally sheet of marks assigned by committees A, B, C and D

A				B				C		D	
86	II	143	II	89	I	151	II	120	I	80	I
91	I	144	III	100	II	156	II	121	I	86	I
100	I	145	I	102	I	158	I	124	I	88	I
101	I	146	I	104	I	160	I	127	II	90	I
105	I	149	III	111	I	162	I	129	II	101	I
109	III	150	I	112	I	166	I	132	II	102	I
110	III	151	II	113	II	168	I	133	I	103	I
111	II	152	II	114	I			135	II	106	I
112	I	156	I	115	II			136	III	108	II
113	I	160	IIII	116	II			137	I	112	I
115	I	161	I	119	I			139	I	113	I
117	I	165	II	122	I			140	I	115	I
120	II			123	III			142	II	116	I
121	I			124	III			143	I	118	I
125	III			126	II			144	I	120	I
126	I			128	II			145	I	124	I
127	I			130	IIIII			146	III	125	II
128	II			131	II			147	II	127	II
129	II			132	I			149	II	128	III
130	IIII			135	II			150	II	134	II
131	III			137	III			151	II	140	I
132	II			138	I			152	I	141	I
134	II			139	I			153	I	142	I
135	I			141	I			157	IIII	147	II
136	I			142	I					150	I
137	I			143	II					151	I
139	I			145	II					152	I
140	I			146	I					154	I
141	IIII			148	I					156	I
142	II			150	I					160	I

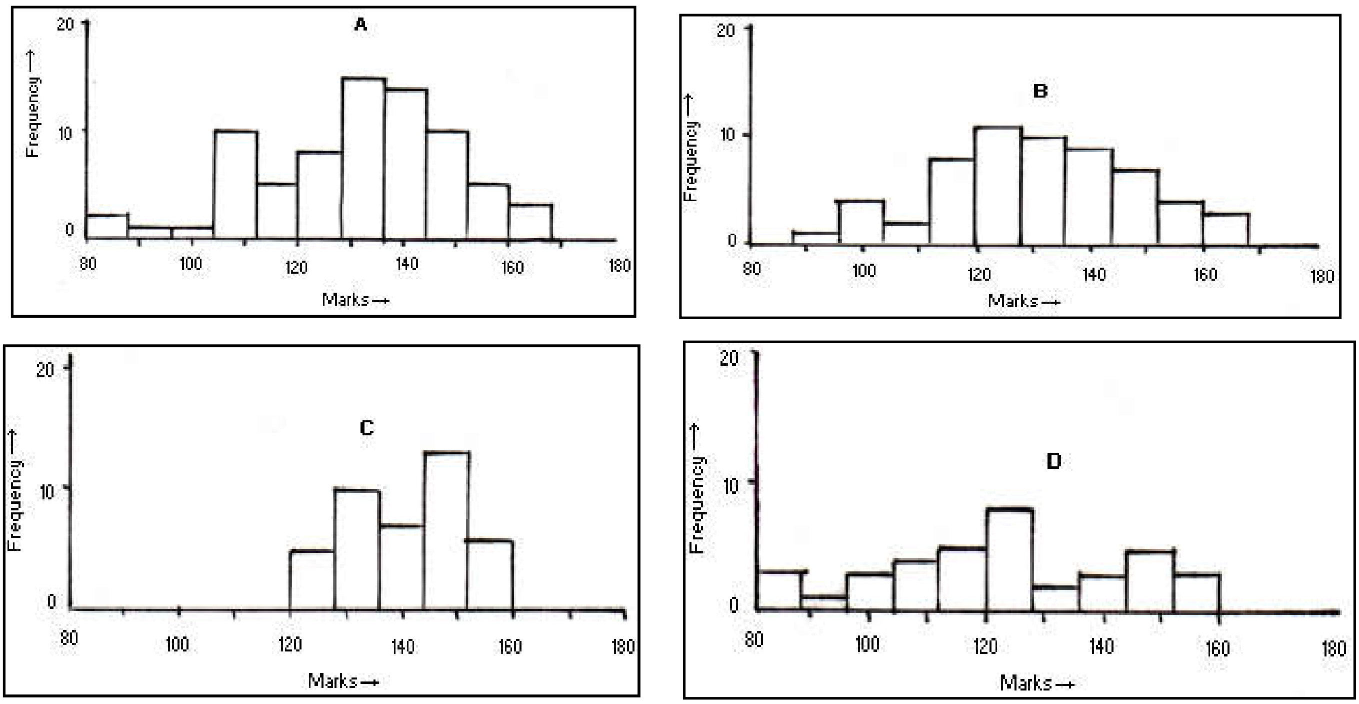

Figure 1. Histogram of committees A,B,C and D

Table 2 . Calculations for expected frequencies and chi-square values

x_i	$x_i = \frac{h}{2}$	$z_i = \frac{x_i - \frac{h}{2}}{\sigma}$	$\varphi(z_i)$	$\Delta\varphi$	*Theoretical frequency* $n \times \Delta\varphi$ F_i	*Observed frequency* f_i	$\frac{(f_i - F_i)^2}{F_i^2}$ χ^2
	-∞	-∞	0	.0019			
84	79.5	-2.9	.0019	.0052	2	5	4.5
92	87.5	-2.45	.0071	.0157	3	3	0
100	95.5	-2.00	.0228	.0366	8	9	.125
108	103.5	-1.56	.0594	.0594	16	17	.063
116	111.5	-1.11	.1335	.121	26	19	1.88
124	119.5	-.66	.2546	.166	35	31	0.457
132	127.5	-.2	.4207	.174	37	37	0
140	135.5	.24	.5948	.16	34	33	029
148	143.5	.69	.7549	.118	25	35	4.00
156	151.5	1.14	.8729	.07	15	16	.06
164	159.5	1.58	.9429	.0571	12	6	3.0
	∞	∞	1.0000			211 total	14.12

Table 3. Calculations for ordinates of normal curve

Cell boundaries	x_i	$z_i = \frac{x_i - x}{\sigma}$	$\varphi(z_i)$	ordinate $\frac{nh}{\sigma}\varphi(z_i)$
80-88	84	-2.65	.0119	1.13
88-96	92	-2.2	.0355	3.78
96-104	100	-1.75	.0863	9.21
104-112	108	-1.3	.1714	18.27
112-120	116	-.85	.278	29.63
120-128	124	-.4	.368	39.23
128-136	132	.45	.362	38.59
136-144	140	.494	.354	37.74
144-152	148	.944	.2565	27.34
152-160	156	1.39	.1518	16.18
160-168	164	1.84	.0734	7.82

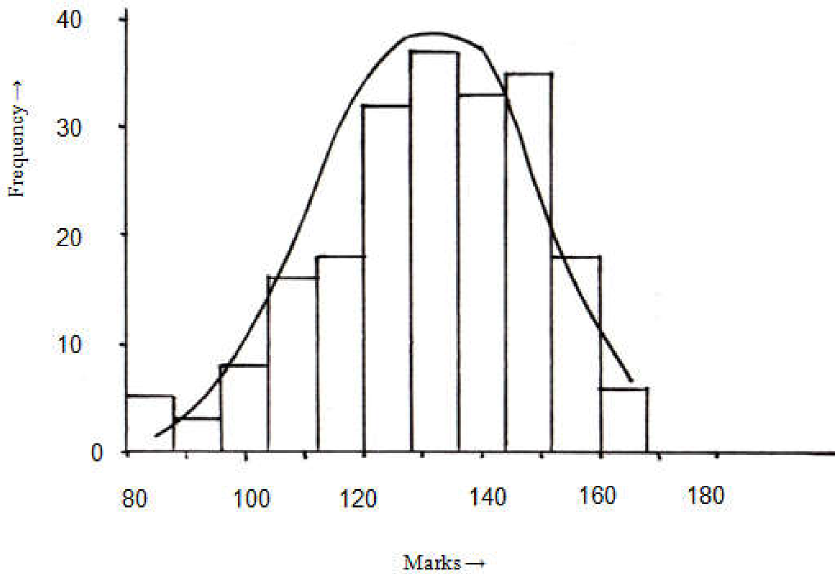

Figure 2. Histogram and normal curve of combined data

Goodness of Fit

Chi square test is used to test how good the data fits the normal curve [Dixon and Massey].

Number of cells = 11
Degree of freedom = 11 – 3
= 8

$$\sum\left(\frac{f_i - F_i}{F_i}\right)^2 = 14.12$$

$\chi^2{}_{.95}(8)$ =15.51 (from Table of χ^2 *distribution*).

Thus at 5% significance level the combined data of committees fit the normal curve. Hence the results of committees when combined can be regarded as from a single committee statistically.

Conclusion

- Project examinations can be taken by a number of committees in place of single committee and the valuable time of examiners can be saved.
- Further examinations results can be finalized rather expeditiously.
- Any deviation of results of a committee from the trend of population has no effect when data is combined and the combined results fit the normal distribution at 5% level of significance.
- It is fail safe to take examination of poor performing candidates by the Combined Committee.
- Evaluation by committees saves a lot of time of senior faculty members and does not cause fatigue and boredom to examiners due to long sitting.

REFERENCES

H.A. Hakim, *Introductory statistics for economics and management*, p-284, 285.

Chaudhry, S.M. *Introduction to statistical theory*, p 454, 443, 454, 471.

Dixon, W.J. and Massey, F. *Introduction to statistical Analysis*, p 226-227.

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