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Analysis of Factors Affecting the Stress Level of Engineering Students*

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This paper examines the main factors that affect the stress level of engineering students. Our questionnaire is based on the scale, Inventory of college students' recent life experiences (ICSRLE). Randomly collected data from 200 students are analysed with MINITAB14. The Six sigma techniques of Pareto Analysis, SIPOC Analysis, Cause and Effect matrix and Relationship charts are used to identify the most significant factors. It is found that the teachers' communication and marking skills are the most critical factors. The findings of this research underscore the importance of having a transparent marking system to the course's both inside and outside the educational institutions and to guide teachers in improving their communication and marking skills to reduce stress in students.

Keywords: student stress; engineering students; communication skills; six sigma

1. INTRODUCTION

Nowadays, stress has become a universal explanation of human behavior [1]. It can not only hinder the proper functioning of a person's body [2] but can also define the limits of their physical and mental capabilities [3] in coping with different situations.

Students face a great deal of stress in higher education [4] and their studies weigh on them [5]. Stress developed at a young age gradually becomes permanent and, in university, students may begin to consider gaining an education to be a stressful activity [6]. Students face different kind of stresses: academic pressures [7]; an uncertain future [8]; short term stress caused by examinations [9]; and severe stresses before and during examinations, the effects of which can even persist several days after an examination [10].

Students have less social support [11] and being away from their homes, can become homesick [12] and develop stress [13]. Students living in university residences may experience poor living conditions and a lack of balanced diet, and thus may self-medicate for the treatment of minor problems, leaving them ill for longer [14].

Stress is often regarded as a negative experience known as 'distress' [15]. However, it can also be considered to be something positive [16], known as 'eustress' [17]. Thus, stress can be either good or bad depending upon the level of the stress [18]. Students' perceptions, based on their expectations from educational institutions, highlight the impact of stress in either ways [8]; however, some researchers are of the view that this variation in stress does not create any significant difference in the behavior of students [19].

Different scales are developed by researchers to calculate stresses among students. Some of these scales are; The Hassles Scale [20]; the Academic stress scale [21]; and the Inventory of College Students' Recent Life Experiences Scale (ICSRLE) [22] showing that lot of research is carried out on vocational, medical, law and social work students, while only portion of the study is conducted on engineering students [19]. Engineering education is an important component in an overall education system that plays a vital role in the socio-economic development of any country. In developing countries in particular, engineering is considered very prestigious among the middle classes due to its role in upward mobility [23]. Communication skills are essential in transferring one's thoughts and ideas, however communication is essentially important in the teaching profession, where a proper delivery of knowledge by the teacher to the student totally depends on their communication skills. It was thus felt that research should be carried out in a typical developing country, such as Pakistan, in order to determine practically the factors that affect the stress level of students.

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2. SCOPE

A cross sectional study was conducted on the undergraduate engineering students in the province of Punjab. It comprised five out of a total of eleven engineering universities in Pakistan where 11000 of the 18125 students are studying in different engineering disciplines. The participants freely agreed to take part in this study and only 4 students declined to participate.

The Students' Stress Level Scale (SSLS) was used as a tool for data collection. Data were collected randomly and analyzed with MINITAB 14. Pareto analysis was performed in order to identify the main factors. SIPOC analysis was used to reach the inputs and outputs of those factors. Subsequently, the methods of: Cause and Effect matrix, scatter plots and co-efficient of correlation were used to shortlist the most significant factors.

3. STUDENT PROBLEMS

To measure the existing stress level of students and its related factors, the Student Stress Level scale (SSLS) was used. A preliminary survey was conducted and an ICSRLE questionnaire was modified for the engineering students by excluding those questions that were irrelevant to the students in this environment leaving 26 factors, which are as follows:

1. Finding course uninteresting.
2. Concepts not clear.
3. Disliking your studies.
4. Overloaded with studies.
5. Financial conflicts with family members.
6. Not enough leisure time.
7. Finding studies difficult.
8. Dissatisfaction with your mathematical ability.
9. Homesickness.
10. Dissatisfaction with teaching skills of teachers.
11. Less time for assignments.
12. Having your contributions overlooked.
13. Worry about future.
14. Dissatisfaction with your reading ability.
15. Lower grades than expected.
16. Loneliness.
17. Less time for sleep.
18. Conflicts with your family.
19. Finding courses too demanding.
20. Disturbance due to poor health of a friend.
21 Difficulties with transportation.
22. Disliking fellow students.
23. Dissatisfaction with your writing skills.
24. Getting poor utility services.
25. Dissatisfaction with your physical appearance.
26. Being let down by friends.

4. DATA COLLECTION

Data were randomly collected with the help of the questionnaire based on Student Stress level scale. Two hundred students from different engineering universities participated in the questionnaire. Respondents indicated their experiences on a 4 point Likert-type scale, (0 = Not at all part of my life, 1 = Only slightly part of my life, 2 = Distinctly part of my life and 3 = Very much part of my life). As a result, the average stress level of the engineering students was found to be 54 %.

5. DATA ANALYISIS

Pareto analysis, for example, was used to separate the factors that were responsible for 80% of the stress from those that caused just 20%. First of all, number of complaints was calculated against all

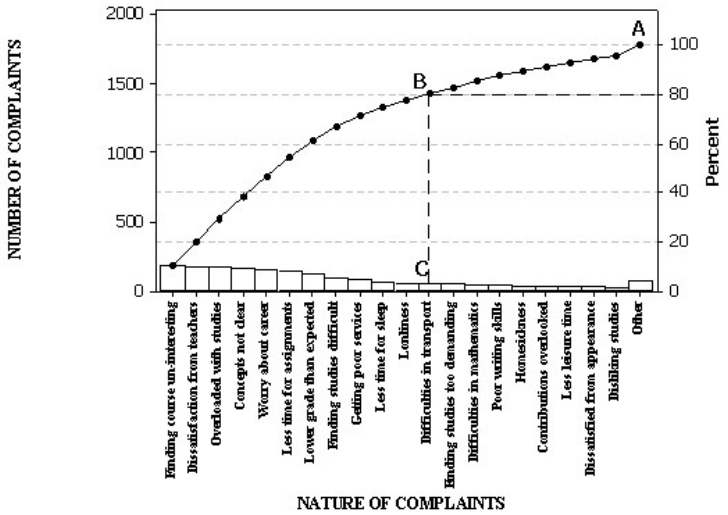

Fig. 1. Pareto Analysis to show different types of complaints and their frequencies. The cumulative line of these complaints defines point A indicating 100% on the vertical axis. The line starting from 80% intersects the cumulative curve at point B, from where a vertical line is drawn to cut the horizontal axis at point C.

Table 1. Twelve critical complaints as processes. The stake holders of these processes are suppliers and customers, who are responsible for creating inputs and receiving outputs respectively

S Supplier	I Input	P Process	O Output	C Customer
Teacher	Poor course design	Finding course un-interesting	Poor knowledge of students	Student
Teacher	Poor communication skills	Dissatisfaction from teachers	Lack of interest by students	Student
Teacher	Poor course distribution	Overloaded with studies	Student's lacking in other activities	Student
Teacher	Less knowledge	Conceptual conflicts with teachers	Student's hesitation in asking questions	Student
Administration	Lack of job fairs	Confusion about career planning	Student's getting less job opportunities	Student
Teacher	Non-realistic attitude	Less time for assignments	Student's doing incomplete assignments	Student
Teacher	Careless marking	Lower grades then expected	Higher stress in students	Student
Administration	Poor resource utilization	Difficulty in meeting academic standards	Student's missing learning opportunities	Student
Administration	Lazy attitude	Getting poor utility services	Time loss of students	Student
Family	Extra responsibilities	Less time for sleep	Poor health of students	Student
Parents	Poor attention	Loneliness	Student's lack of socialization	Student
Administration	Lack of funds	Difficulties with transportation	Fatigued students	Student

questions with the help of a 4 point Likert-type scale. For this purpose, students were asked to select any of the four points (0–3) according to the persistency of that problem in their life. In the present analysis, any of the two points (2 and 3) showing that the problem remained distinctly or very much part of students' life was fixed as a criterion of complaint. In this way, the total number of complaints against each question were numbered, arranged in the descending order, and then plotted as shown in Figure 1.

A cumulative line of these complaints was drawn to cut the right vertical axis at point A. The vertical distance between point A and the x-axis was divided into 100 equal parts. A horizontal line was then drawn from the 80% point to cut the cumulative line at point B, which defines point C on the x-axis. Figure 1 show that twelve factors

Table 2. Cause and Effect matrix as tailored in the present work It shows the inputs and outputs of processes in the second row and second column respectively. The summation of the assumed correlation values in rows 3–14 and columns 3–14 are listed in the last row and the last column.

		Process outputs												
		Poor knowledge of students	Lack of interest by students	Student's lacking in other activities	Student hesitation in asking questions	Students getting less job opportunities	Students doing incomplete assignments	Higher stress among students	Student's missing learning opportunities	Time loss of students	Poor health of students	Student's lack of socialization	Fatigued students	Total
Process inputs	Poor course design by teachers	9	9	0	0	0	0	9	9	3	0	0	0	39
	Poor communication skill of teachers	9	9	3	9	0	9	9	9	9	0	3	3	72
	Poor course distribution by teachers	3	9	0	0	0	3	9	3	9	0	0	9	45
	Less knowledge of teachers	9	9	0	9	0	0	9	9	3	0	0	0	48
	Lack of job fairs by administration	3	3	3	0	9	0	3	3	0	0	3	0	27
	Non-realistic attitude of teachers	0	9	0	3	3	9	9	3	3	0	0	0	39
	Careless marking by teachers	3	9	3	3	9	9	9	9	9	9	0	3	75
	Poor resource utilization by admin.	3	3	3	0	3	0	3	3	9	3	0	9	39
	Lazy attitude of administration	0	3	3	0	3	0	9	3	9	3	3	3	39
	Extra responsibilities from families	3	9	9	0	3	3	9	9	9	9	3	3	69
	Poor attention from parents	0	0	9	0	3	0	9	3	3	3	9	0	39
	Lack of funds by administration	3	3	3	0	3	0	3	3	0	3	0	9	30
	Total	5	75	36	24	36	33	90	66	66	30	21	39	

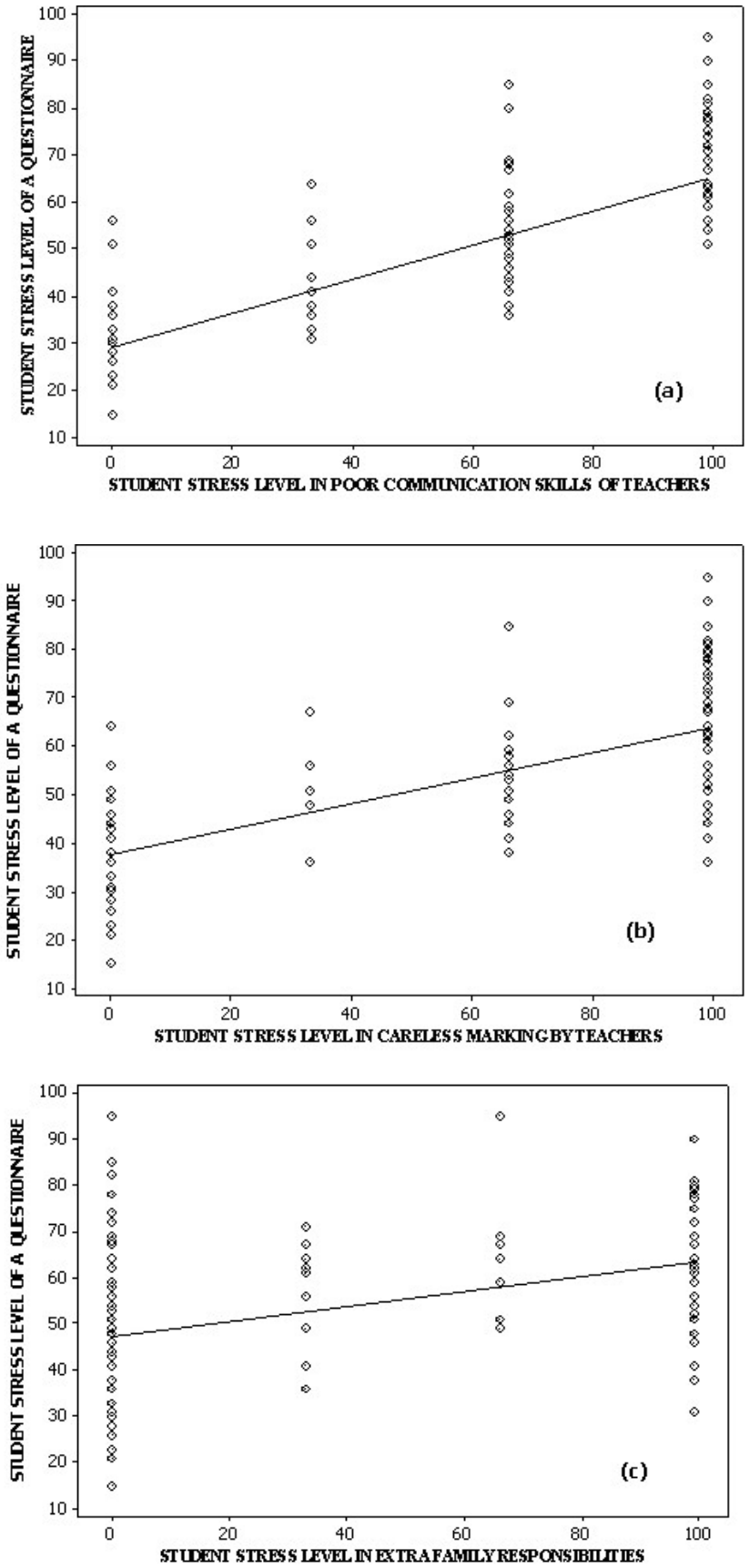

Fig. 2. Relationship charts between students' stress and three complaints; (a) Poor communication skills of the teachers, (b) Careless marking by teachers and (c) Extra responsibilities from family. The straight line shows their mean values

located to the left of point C were responsible for 80% of the stress while the remaining fourteen resulted in only 20% of the stress. An analysis of twelve complaints is summarized in the SIPOC diagram, as shown in Table 1.

Suppliers and customers are responsible for creating inputs and receiving outputs. Similarly, these inputs and outputs respectively are crucial in creating and observing any change in these complaints.

The Cause and Effect (C&E) matrix, e.g. as shown in Table 2, uses the inputs and outputs of SIPOC diagram that are outlined in the second row and second column respectively. A ranking scale is assumed to correlate inputs and outputs as follows:

No correlation	Remote effect
0	1
Moderate effect	Strong effect
3	9

Appropriate correlation values are shown in Table 2.

The sum of the assumed correlation values in rows 3–14 as well as in columns 3–14 are listed in the last row and last column respectively. Results indicate that the higher stress among students with 90 points is the best indicator for any noticeable change in the inputs as it has the strongest link with all of them, while the three inputs of 'careless marking by teachers', 'poor communication skills of teacher' and 'extra responsibilities from family' with their respective totals of 75, 72 and 69 are responsible for creating the maximum changes in the outputs. Scatter plots in Fig. 2(a), (b) and (c) are used to illustrate the relationships between three inputs and an output.

Student stress levels for the whole questionnaire are plotted on the y-axis and the corresponding stress levels of the three individual questions are shown on the x-axis. A straight line is drawn to show the mean values. Positive relationships between student stress and three factors highlight that any change in these parameters can produce a reciprocal change in student stress level. However, further analysis is performed to investigate the strength of the relationship between student stress and the three factors using the Pearson correlation coefficient:

- Poor communication skills of teachers 0.79
- Careless marking by teacher's 0.76
- Extra responsibilities from family 0.41

It reveals that teachers' poor communication skills and their careless marking have the strongest effects on students' stress levels.

Up to a certain level the stress in students is propotional to their efficiency. However above a certain limit, this stress becomes inversely propotional to student efficiency. Necessary stress is defined as 'eustress' or 'healthy stress' to increase output. However, there is also unnecessary stress known as 'distress' or 'toxic' stress. The optimum level of stress depends on the individual: the level beyond which his or her heart beat increases and he or she starts to feel tense.

These effects are further multiplied by the employment criteria of developing countries, where students with higher grades are given better jobs in government departments. Nevertheless, the private sector is flourishing in Pakistan and students still prefer jobs in these public sector organizations due to better social standing, job security, more authority and comparatively relaxed working environments. Thus, the fear of unexpected bad results due to a hidden assessment system keeps the students under enormous pressure during their studies. Giving them as proper guidance about the assessment criteria not only reduces stress but also helps the students to obtain better scores, this in turn increases their motivation and learning [24].

6. CONCLUSIONS

This study underscores the significance of teachers' communication and marking skills in reducing stress in students. In developing countries such as Pakistan, the shrinking job markets puts a lot of responsibility on the shoulders of teachers to develop further the personalities of their students. Identification of these skills can help teachers to improve their evaluation and communication with the students, which eventually contributes to a more knowledgeable and confident input to society. The findings of this research highlights the importance of a transparent marking system that not only increases the confidence level of students but also enhances the credibility of the educational institution in today's competitive environment. This increase in an institution's ranking among future employers surely contributes to a reduction in stress level among the students and subsequently increases their confidence level in their educational institution. In this way, future research can be performed to investigate those factors that improve the communication and marking skills of teachers to provide a better and more conducive environment in education institutions.

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