

Measuring the Psychological Stress for Undergraduate Students by Using Pareto Analysis and Control Charts Based on Total Quality Standards

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Abstract: The psychological pressure is considered as one of the modern themes in the field of psychology, because of its effect on human beings in both mental and physical respects [1]. That stress happens when a human being recognizes that his current abilities are not convenient for achieving a certain objective [2], while pressure is defined psychologically as “The degree of activating the sympathetic nervous system “[3, 4]. The research aims to recognize the psychological stress that is faced by students of the Faculty of Physical Education and Sports, based on the total quality management systems, which was defined by the American Society for Quality Control as "a set of attributes and characteristics of the goods and services that meet specific needs” [5, 6]. This recognition is through achieving the following secondary objectives (building up the psychological stress scale for undergraduate students, recognizing the most important psychological stresses that were faced by the students, by using “Pareto Analysis” and” Control Charts” as total quality management tools, establishing the total quality performance standards for the students state committee). The descriptive method “ field survey method” was used and the sample was selected randomly from the students of the faculty of Physical Education and Sports in Riyadh as 410 students from the academic year 2009-2010. Data gathering methods used are: the psychological stress scale for undergraduate students, Pareto analysis and controlling charts. The most important results were a psychological stress’ scale that was designed for undergraduate students and a number of control limits standards, which are used by the students’ states committee as a guide to recognize the stress that students face.

Key words: Psychological stress • Pareto analysis • Control charts • Total quality standards

INTRODUCTION

The presence of some obstacles in the work environment for a certain person leads him to feel helplessness, shortcoming and consequent stress, which is accompanied by some symptoms like weakness in motivation and dissatisfaction of his current situation [7]. The research aims to recognize the psychological stress that is faced by students of the Faculty of Physical Education and Sports, based on the total quality management systems through achieving the following secondary objectives;

- Building up the psychological stress scale for undergraduate students.
- Recognizing the most important psychological stresses that were faced by the students, by using Pareto Analysis and Control Charts as total quality management tools.

- Establishing the total quality performance standards for the students' state committee.

MATERIALS AND METHODS

The descriptive method has been used (field survey method). Students’ sample composed of 410 Students from Faculty of Physical Education and Sports in Riyadh, for the academic year 2009-2010 and they were chosen randomly, the certainty sample composed of 20 students whom were chosen randomly from different levels, as a sample for calculating the scientific coefficients for the suggested scale.

Data Collecting Tools

Statistical Adjustment Tools: The quality monitoring mission is to apply tests to a product, then to compare the tests’ results to the client’s requirements and standards, aiming to discover any differences or deflections, which

guide them to the right correction procedure needed. There are seven statistical quality control tools [8]; two of them were used in this research.

Pareto Analysis: This tool is considered as a graphical presentation for Pareto theory (Italian economic) which known as the 20%-80% theory. Pareto analysis is a formal technique useful where many possible courses of action are competing for attention. In essence, the problem-solver estimates the benefit delivered by each action, then selects a number of the most effective actions that deliver a total benefit reasonably close to the maximal possible one [9], its basic idea that a large majority of problems (80%) are produced by a few key causes (20%) [4, 10, 11]. That required the building of a Psychological Stress scale for undergraduate students, to find out if the stress they face is the reason to apply for a number of requests to the students' states committee of the faculty. The results of the application were analyzed.

Controlling Charts: Through his researches in 1924, the American statistic Walter Shewhart was able to develop a simple tool to measure the performance and production in a statistical way, to recognize the level of performance and production deflection away from the objected general quality standards, by determining whether it is in a state of statistical control [11-13].

The control chart can be seen as part of an objective and disciplined approach that enables correct decisions regarding control of the process, including whether or not to change process control parameters. Process parameters should never be adjusted for a process that is in control, as this will result in degraded process performance.

The Control Charts are used to monitor the process performance or activities, by drawing them through gathering the maximum possible amount of data that are related to the subject, by drawing the (X) access that represents time (in day, weeks, months or years) and the (Y) axes that represents the variable needed to be studied which is (psychological pressure) in our research, intersections and variable quantities should be added at every level, with adding horizontal lines, A center line is drawn at the value of the mean of the statistic, Upper and lower control limits (sometimes called natural process limits) that indicate the threshold at which the process output is considered statistically unlikely are drawn typically at 3 standard errors from the center line, the upper control limit can be determined mathematically by adding three standard divisions to the community's mean $UCL = \mu + 3\sigma$, the lower control limit can be determined mathematically by subtracting three standard divisions from the community mean $LCL = \mu - 3\sigma$ [12]. After deciding

the control borders, it is possible to choose individual groups to calculate their limit and mean, If the process is in control, almost all (99.73%) points will plot within the control limits. Any observations outside the limits, or systematic patterns within, suggest the introduction of a new (and likely unanticipated) source of variation, known as a special-cause variation, which means that the process is not in control. To draw the final statistic control chart, we should take small samples from the variable under study, during organized periodical periods of time and it should be investigated to decide its specifications. There are different types of Control Charts, two of them are the most famous and likely used in practical life and they are related to variables controlling (\bar{x} and R chart), which means controlling charts for means and limits [14]. Designed tables were prepared specially to be used to get the control limits and that is by using the following equations;

$UCL_x = \bar{X} + A_2R$ to determine the Upper Control Limit and $LCL_x = \bar{X} - A_2R$ to determine the Lower Control Limit.

\bar{X} = the mean of samples' averages

A_2 = constant (Attachment 1).

R = the limits mean equation [5].

Attachment 1: The constant factors to build up Control Charts for variables

The sample	A	D	D
2	1.880	0.000	3.267
3	1.023	0.000	2.574
4	0.729	0.000	2.282
5	0.577	0.000	2.115
6	0.483	0.000	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777

The Psychological Stress Scale for Undergraduate Students: A Scale was designed to recognize the psychological stress that students face in sports field and there reasons.

The Scale Building Steps

Determining the Scale Objective

Determining the Scale Basic Dimensions: Four main dimensions were detected; 1. Personal Problems; 2. Injury Stress; 3. Relationship with colleges and 4. Relationship with the teaching staff.

The experts agreed that the scale consists of 55 words, divided into 4 themes in its primary state.

Reconnaissance Application: To make sure that the phrases are clear and understandable for the individuals' sample, the scale was applied in its primary state to a

sample of 20 students from the faculty of physical Education and sports, in order to cancel the extremely easy and difficult phrases, because they were considered as extreme values and that was done using the following equations [15].

$$\text{The ease coefficient} = \frac{\text{Number of students that answered all phrases correctly.}}{\text{The total number of students}}$$

$$\text{The difficulty coefficient} = \frac{\text{Number of individuals that answered all phrases wrong}}{\text{The total number of students}}$$

The ease and difficulty levels were detected and it ranges between (0.30 – 0.70) [16] (Table 1).

Table 1 shows that phrases number 3, 6 were canceled from the first dimension, also phrase number 1 was canceled from the third dimension and phrases number 1, 4 and 7 were canceled from the fourth dimension, they didn't achieve the condition of ease and difficulty coefficient, the scale phrases becomes 42 phrases only (Attachment 1).

The Scale Scientific Coefficients: The measurement certainty procedures included three research basic procedures which are:

The Scale Validity Coefficient: The validity was calculated by:

- a. logical validity
- b. judges' validity
- c. internal consistency validity

Internal Consistency Validity: The scale final state (42 phrases and 4 dimensions) was prepared and it was applied to a sample of 20 students from different grades to calculate the scale internal consistency validity. And after applying and correcting the measurement and distributing data, The value of correlation coefficient, was calculated (Table 2).

From Table 2, the correlation coefficient between all the dimensions in the first and second application, ranges between 0.790 and 0.876 and it is greater than the scheduled correlation value, which indicates that the measurement dimensions have a statistic significant reliability coefficient at 0.05, also it indicates that the reliability coefficient for the scale total sum is 0.911 which proves that we can depend on it as an ideal scale [17].

The Scale Reliability Coefficient by Using Alpha Coefficient: The reliability coefficient for the scale was gotten by using alpha coefficient (Table 3).

Table 3 shows that the scale reliability coefficient using alpha coefficient = 0.825 as it shows also that alpha coefficient for the dimensions was restricted between (0.413 – 0.725) which is less than alpha coefficient for the whole scale, from the previous it is clear that the scale phrases and its dimensions have a significant reliability coefficient at level (0.05), which proves that it can be applied for the purpose of research (Attachment 2).

Preparing the scale final form:

Correction procedure: always = 3 marks sometimes = 2 marks rarely = 1 mark

Table 1: The percentage of phrases that ease and difficulty levels

First		Second		Third		Fourth	
n	%	N	%	n	%	n	%
1	60	1	55	1	100	1	100
2	60	2	60	2	70	2	45
3	20	3	45	3	60	3	70
4	60	4	70	4	65	4	80
5	40	5	65	5	40	5	60
6	100	6	60	6	60	6	55
7	65	7	45	7	55	7	20
8	50	8	40	8	40	8	50
9	65	9	60	9	60	9	60
10	40	10	40	10	70	10	40
11	60			11	40	11	60
12	40					12	60
13	55						
14	65						
15	60						

Table 2: The validity factor for the measurement dimensions and the total degree by using Test-Retest

Dimensions	First applying		Second applying		correlation coefficient
	mean	Standard division	mean	Standard division	
First	29.15	2.11	29.03	2.01	0.876
Second	23.05	6.16	22.17	6.34	0.790
Third	26.17	3.51	25.65	3.77	0.821
Fourth	21.15	4.43	20.82	4.02	0.801
Total	58.17	11.74	58.03	11.11	0.911

Significant level at 0.05 = 0.608

Table 3: The final form for measurement phrases alpha coefficient values

n	First Alpha	n	Second Alpha	n	Third Alpha	n	Fourth Alpha
1	0.617	1	0.424	1	0.563	1	0.713
2	0.523	2	0.515	2	0.625	2	0.611
3	0.624	3	0.613	3	0.602	3	0.712
4	0.435	4	0.472	4	0.711	4	0.725
5	0.643	5	0.663	5	0.642	5	0.612
6	0.515	6	0.542	6	0.512	6	0.534
7	0.472	7	0.538	7	0.632	7	0.670
8	0.713	8	0.617	8	0.714	8	0.708
9	0.662	9	0.506	9	0.601	9	0.486
10	0.543	10	0.532	10	0.572		
11	0.413						
12	0.621						
13	0.712						

Alpha coefficient value = 0.825

Attachment 2: Measurement of stress for undergraduate students

Personal problems dimension I feel difficulties in doing some exercises. I face difficulties to continue study because of the distance between home and collage. My studying schedule is so full that I can't achieve. My family situation is not stable, which causes me frustration weak mental abilities is the reason of me weak achievement. Having work beside studding delay my studying progress. Being the eldest between my brothers and sisters puts lots of responsibilities upon my shoulders. The absence of the father in the family increases my responsibility towards the family. My parents treatment makes me lose my self confidence in my abilities. It bothers me that my parents do not encourage my studying progress. I face less shoring from my family to complete my studies. My family careless, is the reason of my study inconstancy I don't feel that I belong to the faculty because it is study is so difficult. Health constriction dimension I see that the injury fear decreases my self confidence I see that the increase of studying makes it easy for me to get injured. The bad schedule coordination causes me studying fatigue. Injury exposition is a barrier for my studying progress. Cooperation in students activities makes me always fatigue My college's progress causes me frustration. There are no enough brakes between lectures which makes it easy for me to get injured. I can't recovery back in a suitable time after getting injured The faculty administration refused the injury excuse cause studying delay for me.	Refusing credence of medical vacates causes studying delay for me. Relationship with colleges dimension I face difficulties in getting along with friends from the same level. Most of my friends have no studying interests. I don't feel that I belong to the faculty because I have no friends. I face difficulties in doing some of my assignments without getting help of my colleges. I feel cordiality between me and my colleges during lectures. I have continues nervous tension because of my fear to lose in front of my colleges. My colleges notice me all the time which cause me less concentration. My studying delay compared to my colleges, causes me frustration. The absence of my colleges shoring, causes me to lose. The noncore of my colleges makes me feel lonely The relationship with the teaching staff dimension The over requests from teachers' causes me to feel angry. The bad coordination between teachers in exams makes me feel pressure. The increasing of periodic exams causes me to feel frustrated. Some teachers' personalities affect my relationship with them. The arguments between teachers make me feel embarrassed. It makes me feel real angry, when teachers keep me away from the special students' list. I don't accept critique directions from teachers. I feel that teachers don't feel students' needs and differences between them. There are arguments between me and some teachers. The faculty administration refused the injury excuse cause studying delay for me. Refusing credence of medical vacates causes studying delay for me.
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Statistical Method: The statistical results were used in the treatment of the following methods: arithmetic mean, standard deviation, class correlation coefficient, Cronbach alpha coefficient, easy coefficient and difficulty coefficient.

RESULTS AND DISCUSSION

Personal Problems Dimension: The general mean of first dimension phrases (personal problems) was 26.75 with standard division of 1.52, which indicates that the personal problems for the study sample is so high. Also it indicates that there are difficulties for most of students (the sample) in studying constancy, because the distance

between the faculty location and their home is too long, which had the 1st order with a mean of 2.39 and repeating of 260. then working beside studying, in the second order, with a mean of 2.36 and a repeating of 250, finally the studying schedule accumulation at the third order, with a mean of 2.39 and a repeating of 240. The researcher point of view is that most of these reasons are because of the low social and economic level of students and that most of them are outside Riyadh where the faculty located and the absence of another faculty in KSA with a degree of professions in physical education, which force students to have a job so they can provide their flats' rents, although habitation is available inside the faculty and that is what indicated by previous studies [18-21].

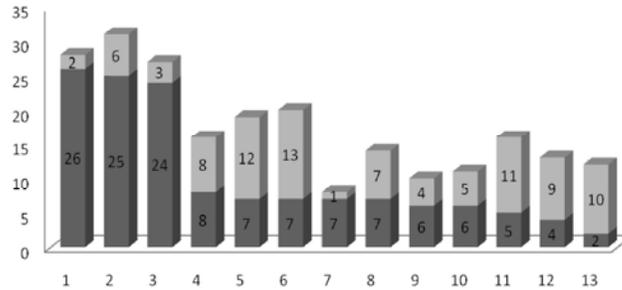


Fig. 1: Pareto Analysis for personal problems dimension

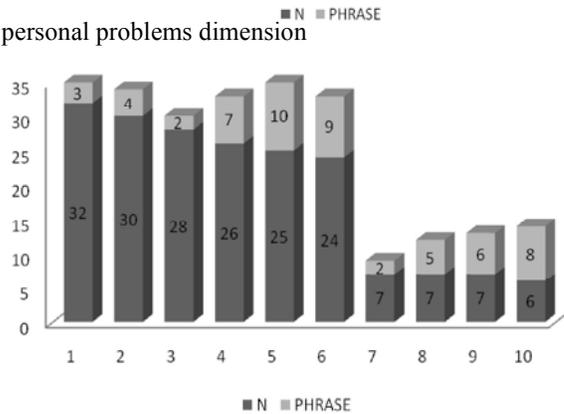


Fig. 2: Pareto measurement and evaluation

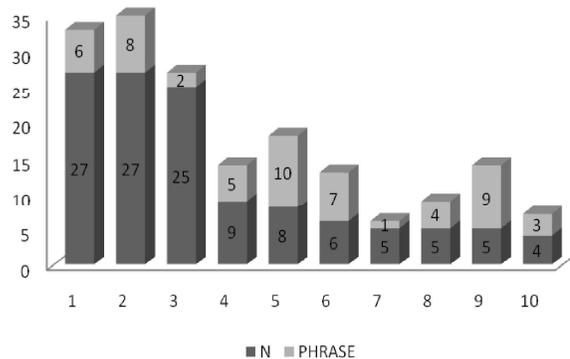


Fig. 3: Pareto analysis for relationship with colleges dim measurement and evaluation

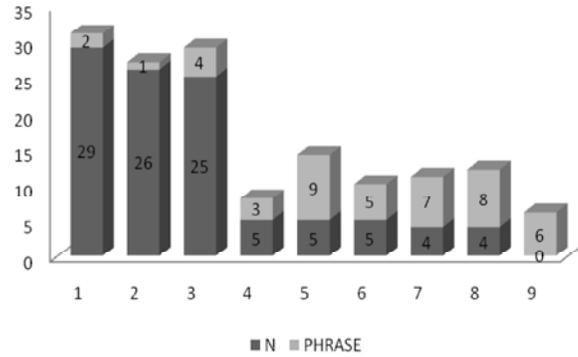


Fig. 4: Pareto analysis (relationship with teaching staff dimension)

Table 4: Means and limits for all dimensions total in the sample as whole

N	X	R	N	X	R	N	X	R	N	X	R
1	17.00	6	12	20.50	8	23	21.25	7	34	21.25	7
2	18.50	7	13	20.50	6	24	21.25	7	35	21.25	7
3	19.50	9	14	20.50	14	25	21.25	7	36	21.50	7
4	19.75	12	15	20.75	11	26	21.25	7	37	21.50	8
5	19.75	10	16	21.00	6	27	21.25	7	38	21.50	7
6	19.75	11	17	21.00	8	28	21.25	7	39	21.50	11
7	19.75	9	18	21.00	8	29	21.25	7	40	21.50	7
8	20.00	9	19	21.25	7	30	21.25	7	41	21.75	7
9	20.25	6	20	21.25	7	31	21.25	7	TOTAL	850	324
10	20.50	10	21	21.25	7	32	21.25	7	MEAN	20.731	7.502
11	20.50	8	22	21.25	7	33	21.25	7			

So, we can get the upper and the lower control limits as follows:

To determine the Upper Control Limit

$$UCL = X_2 + A R = 20.731 + (0.729 X$$

To determine the lower control limit

$$LCL = X_2 - A R = 20.731 - (0.729 X 7.502) = 15.262$$

Health Constrictions Dimension: The second dimension phrases (health constrictions) made a mean of 22.80 with a standard division of 2.90, most of students have deficiency in studying consistency as a result; the absence of arranging the student schedule had the first order, with a mean of 2.78 and a repeating of 320, while the injuries comes in the second order which causes a barrier for students in studying progress with a mean of 2. In the 2.70 and a repeating of 300, while refusing of the faculty to the medical excuses comes in the third order, with a mean of 2.36 and a repeating of 250. the researcher point of view is that most of students avoid making their medical check in the faculty’s clinic, which makes it illogic and suspicious to get medical reports from privat hospitals, which prevent the faculty to accept the excuse and that was what indicated by prior studies [2, 11, 22].

Relationship with Colleges: The general mean of the third dimension (the relationship with colleges) phrases made a mean of 19.24 with a standard division of 1.28,

which indicates that the level of psychological pressure in this dimension is normal, but there are some high repeated phrases like, delaying the studying level because of frustration, with repeating of 270, also students fear of losing competitions in front of their colleges, causes them psychological problems, that’s why the researcher recognized that it is so important for students to listen to the instructional sessions in the collage, but unfortunately most of them refuses to attend such sessions because they think that it is for misbehaving students only, which is a wrong concept and that was what indicated by studies [2, 23].

Relationship with the Teaching Staff: The general mean of the fourth dimension (the relationship with the teaching staff) phrases made a mean of 21.19, with a standard division of 1.64 which indicates that the psychological stress in the studying sample in this dimension is high, which was represented in bad coordination between teachers during exams, which made student destructed

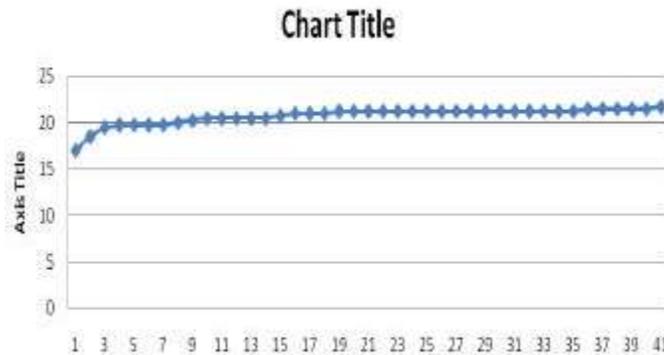


Fig. 5: The Control Chart for dimensions as whole

between them and this was by a repeating of 29, also the over requests from the teaching staff, which overload students and it mad a repeating of 26. that's why the researcher find that it is important to make periodic meetings with students to know their most important complains, also to make teachers coordinate with the students' affairs vise dean, regarding the semester exams, to avoid any miss organization.

Controlling Charts to the Mean, to Control the Psychological Stress: The controlling charts shown in Fig.5 represents the allowed controlling restrictions, that are acceptable for the psychological stress on students and that's why it is important to get the mean (x) and the limit (R) for all the dimensions' phrases, as a start to reach the mean of all averages and means,as follows in Table 4.

The sample number from Fig. 5 it is clear that all students responses were inside the upper and lower limits of control, which indicates that all students meant by this study, had responses within the acceptable limits and there is no need to worry from the phenomenon and that there is no strong reason causes these psychological stress for students and that is what indicated by other studies [24, 25].

CONCLUSION

- A psychological stress scale was built for undergraduate students.
- The control limits standards, which are used by the "students' states committee" as a guide to recognize the stress that students face were established.
- Most of the antecedent students to the students' stats committee are having a job besides being students, which affects them negatively.
- Injury fear causes students to reduce sports performance and being absent most of the time.

- Students fear from losing competitions in front of their colleges makes them tensioned during performing different tasks in the faculty.
- Students fail that prevents them to be with their colleges, causes them a continuous frustration.
- The increasing of home assignments causes students to be depressed.
- Regarding the research's results the researcher commends the following:
- Paying attention to recognizing the social and psychological problems that delay students' performance and facing problems to find suitable solutions for them.
- Paying attention to building general instructional programs for students.
- Educate teachers by different psychological skills through scientific training courses about the psychiatrist rules to overcome what students face of psychological stress which affect their performance level.
- Paying attention to recognizing the students' psychological stress causes, determine the anxiety levels and develop their achievement motivation, refusing the offensive behavior through dealing with them and getting close to them.
- The control standards that became obvious to researcher are possible to be applied, to make periodic organized tests to recognize all new topics in the stress field.

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