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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

ACKNOWLEDGMENTS

REFERENCES

APPENDIX/ANNEXURE

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- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

ONLINE RESOURCES

- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

AN EMPIRICAL STUDY ON THE EFFECTS OF COMPUTER OPERATING HOURS ON STUDENT STRESS LEVEL USING TOPSIS METHOD

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ABSTRACT

The efficient performance of engineering graduates in corporate sectors and the undergraduate scholars in their respective institutions greatly depends upon their stress levels. Most of the works in the engineering profession require the use of computers. Many professionals have a doubt whether the use of computers, continuously over a long period of time may affect their day to day activities or routine life, particularly computer engineers and those who work in the field of information technology. Our paper tries to find the effect of computer operating hours on stress levels of undergraduate scholars of computer science and civil engineering. Multi Criteria Decision Making (MCDM) tool called Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) has been used to identify the stressed professionals.

KEYWORDS
Decision making, Stress, TOPSIS and undergraduate students.

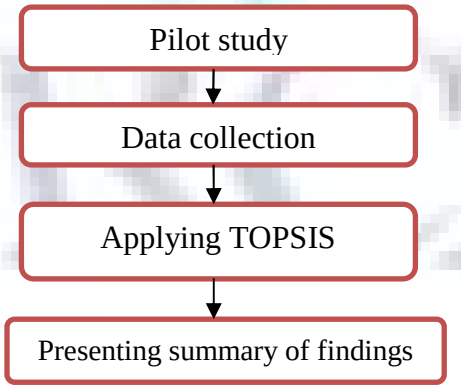
1.0 INTRODUCTION

Multiple criterion decision making (MCDM) [1] refers to making decisions in the presence of multiple, usually conflicting criteria and constraints. The decision making is more challenging today. Necessary conditions for achieving efficient decision making consist in understanding the current and upcoming events and factors influencing the whole problem environment, in exploring the nature of decision-making processes and the reach of different typologies of methods and techniques, and finally in structuring appropriately the decision-making approach based on a wide range of issues related to problem environment.

2.0 METHODOLOGY

The methodology of the paper is presented below,

FIGURE 1: METHODOLOGY OF THE PAPER

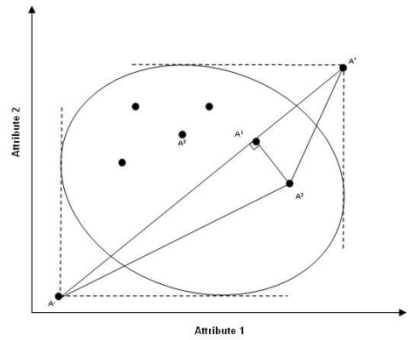


The methodology of the paper involves the pilot study, identifying the factors which causes stress, designing questionnaire, distribution of questionnaire, data collection, applying TOPSIS, presenting summary of findings and finally suggestions to reduce the stress.

3.0. TECHNIQUE OF ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS) METHOD

Technique for Order Performance by Similarity to Ideal Solution (TOPSIS), one of known classical MCDM method, was first developed by Hwang and Yoon [4] for solving a MCDM problem. TOPSIS, known as one of the most classical MCDM methods, is based on the idea, that the chosen alternative should have the shortest distance from the positive ideal solution (PIS) and on the other side the farthest distance of the negative ideal solution (NIS) in a geometrical (Euclidean) sense. The TOPSIS-method will be applied to a case study, which is described in detail. The TOPSIS has two main advantages: its mathematical simplicity and very large flexibility in the definition of the choice set.

FIGURE 2: EUCLIDEAN DISTANCE TO PIS AND NIS IN TWO-DIMENSIONAL SPACE



4.0 PILOT STUDY

"The Week", June 29, 2008 [5]. A survey conducted in 2008 says that 16000 students in India committed suicide between 2004 and 2008.Stress gradually collapses the personality of an individual. The person affected with stress feels like mentally weak. Stress thus affects the day today activities and one day the individual attains the state that he or she could not concentrate on the routine duty. The individual finally enters the state of unbearable anxiety where he feels or behaves completely detached from the society, family and friends.

Academic stress has been studied extensively as an important factor in college student adjustment. In general, college-related stress has been found to be inversely related to academic performance among traditional undergraduates. Stress has also been identified as a factor negatively affecting performance for college students.

College students have many obstacles to overcome in order to achieve their optimal academic performance. It takes a lot more than just studying to achieve a successful college career. Different stressors such as time management, financial problems, sleep deprivation, social activities, and for some students even having children, can all pose their own threat to a student's academic performance.

4.1 QUESSTIONNAIRE DESIGN

The questionnaire is designed based on the following factors,

4.1.1 INSTITUTIONAL FACTORS

Institution is one of the main sources of stress among students. Such stress comes from plenty of assignments, unsatisfactory academic performance, preparation for tests, lack of interest in a particular subject, and teacher's punishment, language problem during discussion with staff members, noisy classrooms and friend's disturbances.

4.1.2 PERSONAL FACTORS

Personal factors play a main role in causing stress. Some of the personal factors are family economic problem, headache, lack of facilities, personal feelings, intolerance for failures, feelings of privacy lost, too much work in holidays, not sound in English fluency and poor time management

4.1.3 ENVIRONMENTAL FACTORS

Environmental factors are also one of the reasons for stress. Some of the factors are travelling between college and residence, waiting for bus, conflict with conductors, traffic jam, railway crossing, breakdown and crowd in bus.

5.0 CRONBACH'S ALPHA ANALYSIS

Cronbach's alpha is a coefficient (a number between 0 and 1) that is used to rate the internal consistency (homogeneity) or the correlation of the items in a test. A good test is one that assesses different aspects of the trait being studied. If a test has a strong internal consistency most measurement experts agree that it should show only moderate correlation among items (.70 to 0.90).

If correlations between items are too low, it is likely that they are measuring different traits (e.g. both depression and quality of life items are mixed together) and therefore should not all be included in a test that is supposed to measure one trait. If item correlations are too high, it is likely that some items are redundant and should be removed from the test.

Cronbach's α is defined as

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

where K is the number of components (K-items or testlets), σ_X^2 the variance of the observed total test scores, and $\sigma_{Y_i}^2$ the variance of component i for the current sample of persons.

The higher the score, the more reliable the generated scale is. Nunnaly (1978) has indicated 0.7 to be an acceptable reliability coefficient.

5.1 CRONBACH'S ALPHA RESULT FOR ORGANIZATIONAL STRESS ASSESSMENT QUESSTIONNAIRE

The questionnaire contains 12 items, out of which 4 are physical symptoms, 4 are behavioural symptoms and 4 are mental symptoms. stress symptoms were rated according to the frequency in 5 scales (from 1 to 5). 5- Very often 4- Often 3- Some times 2- Seldom 1-Never.

Cronbach's alpha result Organizational stress assessment questionnaire

Scale: ALL VARIABLES

TABLE 1: CASE PROCESSING SUMMARY

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0
List wise deletion based on all variables in the procedure.			

ABLE 2: RELIABILITY STATISTICS

Cronbach's Alpha	N of Items
0.793	12

Here, cronbach's alpha value is greater than 0.7. Hence it is proved that the selected questionnaire for organizational stress is reliable.

5.2 SAMPLE SIZE DETERMINATION

In case of finite population stated formula for determining sample size is

$$n = Z^2 N\sigma^2/(N-1)e^2+z^2\sigma^2_p \quad (1)$$

From our pilot study we have to find out standard deviation of 100 sample is σ_p= 3.3582

Z=1.96(from normal distribution table)

$$e=z\sigma_p/\sqrt{n} \quad (2)$$

So, we have to choose our sample size 'n' according to the results obtained from equation 1.

6.0 DATA COLLECTION

It was decided to identify the factors that are causing stress to the students of engineering discipline and to collect the data from the students who are pursuing their under graduation.

The following table shows the factor scores for the students from civil engineering,

TABLE 3 - FACTOR SCORES FOR CIVIL DEPARTMENT STUDENTS (HOSTELLERS)

Student	Institutional	Personal	Environmental
1	15	28	20
2	29	31	30
3	31	21	24
4	16	29	30
5	15	30	16
6	13	19	16
7	14	18	17
8	16	21	19
9	18	21	30
10	17	29	14
11	19	24	16
12	16	21	17
13	14	27	20
14	16	21	18
15	15	21	13
16	16	39	21
17	27	39	24
18	16	16	16
19	15	23	15
20	13	23	13
21	14	19	14
22	16	22	16
23	18	26	18
24	17	24	17
25	19	24	19
26	16	22	16
27	14	21	14
28	16	24	16
29	15	21	15
30	16	16	20
31	22	28	15
32	26	32	13
33	24	21	14
34	18	22	16
35	23	33	16
36	21	30	17
37	23	34	19
38	19	29	16
39	16	21	14
40	16	16	16
41	15	21	17
42	15	19	28

From the above table, the data for various factors are collected from civil engineering students are displayed.

The following table shows the factor scores for the students from civil engineering,

TABLE 4 - FACTOR SCORES FOR CIVIL DEPARTMENT STUDENTS (DAY SCHOLARS)

Student	Institutional Factor score	Personal Factor score	Environmental Factor score
1	27	38	27
2	17	20	10
3	23	40	28
4	16	39	26
5	13	29	20
6	22	32	23
7	15	24	21
8	13	29	14
9	26	23	20
10	23	19	13
11	20	30	11
12	12	23	18
13	17	20	12
14	23	33	11
15	18	30	23
16	16	24	20
17	14	20	17
18	20	24	10
19	17	31	14
20	23	25	20
21	16	18	16
22	14	19	13
23	22	30	12
24	15	24	18
25	13	21	17
26	26	28	13
27	23	30	21
28	20	27	21
29	12	18	20
30	17	24	23
31	23	30	21
32	19	20	15
33	18	23	22
34	25	20	21
35	22	35	22
36	15	33	23
37	13	19	14
38	28	33	22
39	15	33	23
40	12	28	20
41	17	33	21
42	33	32	30

As per the above table, the data for various factors are collected from civil engineering students are displayed.
The following table shows the factor scores for the students from computer science engineering,

TABLE 5 - FACTOR SCORES FOR COMPUTER SCIENCE DEPARTMENT STUDENTS (HOSTELLERS)

Student	Institutional	Personal	Environmental
1	18	38	23
2	25	20	23
3	22	40	24
4	15	39	26
5	13	29	19
6	15	32	16
7	13	31	25
8	26	30	21
9	23	32	23
10	20	31	21
11	22	34	14
12	15	33	25
13	13	32	22
14	15	31	23
15	13	33	21
16	26	21	16
17	23	33	25
18	20	30	21
19	17	31	23
20	23	31	21
21	16	24	14
22	25	35	25
23	22	34	22
24	15	33	23
25	13	32	21
26	26	23	13
27	23	31	21
28	20	30	21
29	12	28	20
30	17	32	23
31	23	34	21
32	26	33	25
33	18	34	22
34	25	31	21
35	22	36	22
36	15	33	23
37	13	18	14
38	28	35	22
39	15	35	23
40	12	29	20
41	17	32	21
42	33	38	30

From the above table, it is inferred that the data for various factors are collected from the students of computer science engineering is displayed. The following table shows the factor scores for the students from computer science engineering,

TABLE 6 - FACTOR SCORES FOR COMPUTER SCIENCE DEPARTMENT STUDENTS (DAY SCHOLARS)

Student	Institutional	Personal	Environmental
1	28	20	11
2	24	24	29
3	25	21	24
4	23	29	28
5	14	26	17
6	17	36	29
7	18	35	32
8	25	29	27
9	14	28	18
10	16	35	18
11	18	21	25
12	19	36	27
13	27	31	26
14	16	16	16
15	21	29	29
16	28	31	28
17	26	21	25
18	28	34	25
19	18	30	29
20	25	34	34
21	20	29	27
22	14	33	23
23	17	34	20
24	18	35	20
25	25	31	24
26	16	16	20
27	22	28	20
28	26	32	29
29	24	21	22
30	18	29	27
31	23	33	25
32	21	30	26
33	23	34	29
34	19	29	26
35	17	33	19
36	16	34	20
37	17	21	27
38	19	35	27
39	19	20	17
40	12	16	22
41	28	36	31
42	29	33	29

From the above table, it is inferred that the data for various factors are collected from the students of computer science engineering is displayed.
By comparing the computer operating hours of CSE students and Civil engineering students, the observations are as follows,

TABLE 7: DATA FOR CSE STUDENTS

S.NO	PLACE	COMPUTER OPERATING HOURS / DAY	COMPUTER OPERATING HOURS / WEEK
1	Institution	3 (Laboratory- 5 days/week)	15
		1 (Library- 5 days/week)	5
2	Home	2 (Monday to Friday)	10
		5 (Saturday and Sunday)	10
TOTAL working hours / week			40

TABLE 8: DATA FOR CIVIL STUDENTS

S.NO	PLACE	COMPUTER OPERATING HOURS / DAY	COMPUTER OPERATING HOURS / WEEK
1	Institution	3 (Laboratory- only on 1 day/week)	3
		1 (Library- 5 days/week)	5
2	Home	2	14
TOTAL working hours / week			22

From the above tables, it is identified that the computer operating hours are comparatively high for the computer science engineering students with civil engineering students.

7.0 ANALYSIS USING TOPSIS

The procedure of Technique of Order Preference by Similarity to Ideal Solution is as follows,

Step 1: The weightages for the factors are calculated. To find the relative normalized weight of each criterion, the geometric mean of ith row in the pair-wise comparison matrix is calculated by

$$GMi=\sqrt[n]{\prod_{j=1}^{n} X_{ij}} \quad i=1,2, \qquad .m \tag{3}$$

Then, geometric means of the rows in the comparison matrix are normalized as:

$$Wi=GMi \Big/ \sum_{i=1}^{m} GMi \quad i=1,2, \quad .m \tag{4}$$

Step 2: The normalized decision matrix is constructed. This step converts the various attribute dimensions into non dimensional attributes. An element rij of the normalized decision matrix R is calculated as follows:

$$Rij=\frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}^2} \quad , i=1,2,\ldots.m; j=1,2,\ldots.n$$

$$\text{Where } N=\left\lfloor R_{ij} \right\rfloor_{m\times n} \tag{5}$$

Step 3: The weighted normalized decision matrix is calculated. The weighted normalized value vij is calculated as:

$$Vij=wjrij \ , i=1,2,\ldots.m;j=1,2,\ldots.n$$

$$\text{Where } V=\left\lfloor v_{ij} \right\rfloor_{m\times n} \tag{6}$$

Step 4: The positive ideal solution and negative ideal solution is identified.

$$\hat{A}=\{\hat{V}_1,\hat{V}_2,\ldots,\hat{V}_n\}=\{(\max_j v_{ij} \mid i\in I'),(\min_j v_{ij} \mid i\in I'')\} \tag{7}$$

$$\bar{A}=\{\bar{V}_1,\bar{V}_2,\ldots,\bar{V}_n\}=\{(\min_j v_{ij} \mid i\in I'),(\max_j v_{ij} \mid i\in I'')\} \tag{8}$$

Step 5: The separation measure is finally calculated. In this step the concept of the n-dimensional Euclidean distance is used to measure the separation distances of each alternative to the ideal solution and negative-ideal solution. The corresponding formulas are
The separation from the positive ideal alternative is:

$$S_i^* = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^*)^2}, \qquad i=1,2,\ldots.m. \tag{9}$$

Similarly, the separation from the negative ideal alternative is:

$$S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2}, \qquad i=1,2,\ldots.m \tag{10}$$

Step 6: Calculate the relative closeness to the ideal solution. The relative closeness of the alternative Ai with respect to A* is defines as:

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-} \ , \qquad i=1,2,\ldots.m$$

$$\text{Where } 0 \le C_i^* \le 1 \text{ that is, an alternative i is closer to A* as } C_i^- \text{ approaches to 1.} \tag{11}$$

Step 7: The preference order is ranked. Choose an alternative with maximum C_i^* or rank alternatives according to C_i^* in descending order.

8.0 RESULTS

The TOPSIS results are shown below for both the civil engineering and computer science engineering students,
The following table shows the TOPSIS scores for the civil engineering students (Day scholars)

TABLE 9 - FACTOR SCORES FOR CIVIL ENGINEERING STUDENTS (DAY SCHOLARS)

Rank	Student no	Ci* value
1	1	0.809
2	42	0.809
3	3	0.744
4	38	0.680
5	35	0.609
6	4	0.597
7	6	0.583
8	27	0.539
9	31	0.539
10	15	0.490
11	36	0.489
12	39	0.489
13	41	0.489
14	9	0.470
15	20	0.449
16	28	0.445
17	14	0.443
18	26	0.441
19	34	0.434
20	23	0.396
21	30	0.396
22	33	0.379
23	5	0.370
24	19	0.363
25	11	0.357
26	40	0.348
27	7	0.337
28	16	0.330
29	10	0.290
30	8	0.287
31	24	0.280
32	18	0.257
33	29	0.244
34	12	0.243
35	32	0.240
36	25	0.204
37	17	0.203
38	21	0.193
39	13	0.157
40	2	0.143
41	37	0.116
42	22	0.104

From the above table, it is inferred that the TOPSIS scores for the civil engineering students (Day scholars) are displayed.
The following table shows the TOPSIS scores for the civil engineering students (Hostellers)

TABLE 10 - FACTOR SCORES FOR CIVIL ENGINEERING STUDENTS (HOSTELLERS)

Rank	Student no	Ci* value
1	17	0.800
2	2	0.773
3	37	0.595
4	16	0.579
5	4	0.543
6	3	0.538
7	35	0.535
8	32	0.519
9	36	0.469
10	9	0.455
11	31	0.422
12	38	0.409
13	1	0.388
14	5	0.381
15	42	0.376
16	10	0.364
17	13	0.359
18	23	0.357
19	25	0.345
20	33	0.328
21	11	0.305
22	24	0.286
23	28	0.261
24	34	0.246
25	8	0.244
26	14	0.226
27	19	0.216
28	22	0.215
29	26	0.215
30	12	0.208
31	30	0.208
32	41	0.196
33	20	0.190
34	39	0.172
35	29	0.167
36	15	0.153
37	27	0.148
38	7	0.133
39	6	0.122
40	18	0.122
41	40	0.122
42	21	0.097

From the above table, it is inferred that the ranked TOPSIS scores for the civil engineering students (Hostellers) are displayed.
The following table shows the TOPSIS scores for the computer science engineering students (Day scholars)

TABLE 11 - FACTOR SCORES FOR COMPUTER SCIENCE DEPARTMENT STUDENTS (DAY SCHOLARS)

Rank	Student no	Ci* value
1	42	0.943
2	38	0.699
3	22	0.699
4	3	0.684
5	32	0.682
6	17	0.630
7	35	0.616
8	31	0.589
9	1	0.588
10	23	0.587
11	9	0.585
12	4	0.583
13	34	0.570
14	8	0.567
15	20	0.538
16	27	0.538
17	33	0.523
18	39	0.507
19	12	0.501
20	10	0.489
21	30	0.488
22	11	0.481
23	24	0.478
24	36	0.478
25	19	0.471
26	18	0.471
27	28	0.471
28	41	0.462
29	7	0.448
30	14	0.445
31	15	0.432
32	13	0.427
33	2	0.418
34	25	0.415
35	6	0.381
36	16	0.365
37	26	0.365
38	40	0.342
39	5	0.337
40	29	0.323
41	21	0.205
42	37	0.040

As per the above table, it is inferred that the TOPSIS scores for the computer science engineering students (Day scholars) are displayed.
The following table shows the TOPSIS scores for the computer science engineering students (Hostellers)

TABLE 12 - FACTOR SCORES FOR COMPUTER SCIENCE DEPARTMENT STUDENTS (HOSTELLERS)

Rank	Student no	Ci* value
1	41	0.911
2	20	0.878
3	42	0.837
4	28	0.797
5	16	0.779
6	33	0.775
7	18	0.750
8	13	0.729
9	7	0.722
10	8	0.695
11	31	0.687
12	4	0.686
13	12	0.686
14	6	0.679
15	38	0.679
16	15	0.671
17	25	0.666
18	19	0.637
19	32	0.637
20	21	0.624
21	2	0.623
22	30	0.593
23	34	0.591
24	24	0.552
25	17	0.534
26	23	0.529
27	22	0.527
28	36	0.518
29	3	0.507
30	27	0.506
31	10	0.501
32	35	0.501
33	37	0.461
34	29	0.461
35	11	0.437
36	9	0.376
37	1	0.369
38	5	0.324
39	39	0.283
40	40	0.276
41	26	0.262
42	14	0.176

From the above table, it is inferred that the TOPSIS scores for the computer science engineering students (Hostellers) are displayed.
The detailed analysis shows the results as below,

TABLE 13: MAXIMUM STRESSED STUDENTS (DAY SCHOLARS)

Number of stressed students in civil day scholars	9
Number of stressed students in computer science day scholars	19

TABLE 14: MAXIMUM STRESSED STUDENTS (HOSTELLERS)

Number of stressed students in civil day hostellers	8
Number of stressed students in computer science hostellers	16

According to the above table, it is identified that stressed students in civil engineering are low when compared with computer science engineering students. Both the hostellers and days scholars are highly stressed due to institutional factor, personal factor and environmental factor.

10.0 SUMMARY OF FINDINGS

From the above analysis the following findings are made,

- The students of CSE department are subjected to more stress
- The students are subjected to stress as they spare more time with computers
- The maximum stressed students don't have any involvement in physical activities like sports, dance, yoga, NCC, NSS etc…
- The students are suggested and advised to indulge in some stress relieving techniques like listening to music, songs, participate in sports, cultural, dance, etc.
- The students must also start practicing yoga, asanas and meditation.

11.0 CONCLUSION

A study was conducted at an engineering college, situated near Madurai. The parameters chosen for the analysis are personal, institutional and environmental factors. The Multi Criteria Decision Making tool called Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) has been applied to identify the maximum stressed students from the departments of civil engineering and computer science engineering from both day scholars and hostellers. The comparative table reveals that computer science engineering students are highly stressed compared to civil engineering students. It is advised to practice stress relieving techniques and participating in extra-curricular activities to reduce the stress.

12.0 FUTURE WORK

The analysis will also be done for other undergraduate disciplines too. The same analysis might be conducted at various institutions like arts, medical and so on. Validation might also be done by using other Multi Criteria Decision Making (MCDM) tools like Fuzzy logic Decision Making Approach, DEA, ANN and so on.

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