Factor Analysis on Soft Skills Training Evaluation & Outcomes

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Abstract - **Factors represent the underlying concepts that cannot be adequately measured by a single variable. Factor analysis is carried with an objective to reduce a large number of variables into manageable smaller factors for further analysis. Several extraction methods are available, but principle component analysis (PCA) is used most commonly. PCA starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes on to the last factor. Rotations that allow for correlation are called oblique rotations; rotations that assume the factors are not correlated are called orthogonal rotations. It should, however, be emphasized that right rotation must be selected for making sense of the results of factor analysis. The main purpose of this study was to understand the conceptual background, application of factor analysis in social science research and to reduce a large number of variables into manageable smaller factors for further analysis of the impact of soft skills training on employability among B-School Graduates in Bangalore.**

Index Terms - **Factor Analysis, Principle Component Analysis (PCA), Rotation, Variance, Orthogonal rotation.**

INTRODUCTION

Factors represent the underlying concepts that cannot be adequately measured by a single variable. Factor analysis is carried with an objective to reduce a large number of variables into manageable smaller factors for further analysis. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. Factor analysis is part of general linear model (GLM) and this method also assumes several assumptions: there is linear relationship, there is no multicollinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors. Several extraction methods are available, but principle component analysis is used most commonly. PCA starts extracting the maximum variance and puts them into the first factor. After that, it removes that variance explained by the first factors and then starts extracting maximum variance for the second factor. This process goes to the last factor. Factor loading is basically the correlation coefficient for the variable and factor. Factor loading shows the variance explained by the variable on that particular factor. Eigen values are also called characteristic roots. Eigen values shows variance explained by that particular factor out of the total variance. From the commonality column, we can know how much variance is explained by the first factor out of the total variance. For example, if our first factor explains 68% variance out of the total, this means that 32% variance will be explained by the other factor. An important feature of factor analysis is that the axes of the factors can be rotated within the multidimensional variable space. This is termed as 'Rotation'. The aim of factor rotation is to produce a solution having 'simple structure'. There are several methods of rotating the initial factor matrix (obtained by any of the methods of factor analysis) to attain this simple structure. Varimax rotation is one such method that maximizes (simultaneously for all factors) the variance of the loadings within each factor. The variance of a factor is largest when its smallest loadings tend towards zero and its largest loadings tend towards unity. In essence, the solution obtained through varimax rotation produces factors that are characterized by large loadings on relatively few variables. The other method of rotation is known as quartimax rotation wherein the factor loadings are transformed until the variance of the squared factor loadings throughout the matrix is maximized. As a result, the solution obtained through this method permits a general factor to emerge, whereas in case of

varimax solution such a thing is not possible. But both solutions produce orthogonal factors i.e., uncorrelated factors. It should, however, be emphasized that right rotation must be selected for making sense of the results of factor analysis. Rotations that allow for correlation are called oblique rotations; rotations that assume the factors are not correlated are called orthogonal rotations.

A study was undertaken to understand B-school students' perspective about the importance of soft skills training provided by educational institutions. This study also focused on impact of soft skills training on employability among the student community. The MBA students under Bangalore University, Vishveshvariah Technological University and Autonomous universities were the population for this study. Stratified Random Sampling method was used for selecting the sample for the study. A sample of 3 Universities i.e. Bangalore University, Vishveshvariah Technological University and Autonomous universities with 1193 B-School Students with reference to Bangalore was taken as a representative for conducting the study. Factor Analysis was conducted to reduce a large number of variables into manageable smaller factors for further analysis in this study.

REVIEW OF LITERATURE

Literature to be reviewed encompasses all the material available in this field of study. For this study various sources such as books, articles, journals, research papers, e-resources, newspapers and magazines were reviewed.

- Mahendra Fakhri & Nurul Setyaningrum (2015) in their study conducted factor analysis using Principal Component Analysis on soft skills. One factor was created representing nine variables which included skills such as presentation, communication, initiative, organization and planning, self knowledge, time management, accepting challenges, problem solving and managing personal effectiveness through managing stress that builds students' soft skills.

- Dyah Ariningtyas Hening & David A. Koonce (2015) conducted a study in which factor analysis revealed that soft skills could be categorized as Factor I- communication skills (7 Statements), Factor II -interpersonal skills (7 Statements) and Factor III - leadership/organization skills (7 Statements) as important.

- Ivana Salopek Cubrica et al. (2014) in their study conducted factor analysis (principal component analysis) on 30 variables (soft skills). They extracted 3 factors explained by eigenvalues i.e. F1 represented productive professional and personal living skills deliberated of intention to be a leader or a manager, F2 represented focused leadership and managerial skills and F3 represented open communication and creative skills. The results obtained from each group of students indicated the most important skill to be creativity followed by ethics in profession, ability to set goals, tactful planning, managing teams, displaying leadership and conflict management skills.

- Li-Tze Lee & Tien-Tse Lee (2011) conducted factor analysis in a study to identify the soft skills categories which affects success at the workplace. There were 43 questions in the original survey; after factor analysis, 38 remained to form six new constructs Positive attitudes, Open-mindedness, Interpersonal relationships, Teamwork, Communication skills and Creativity representing the important soft skill categories.

- Andreas Blom & Hiroshi Saeki (2010) conducted a study to identify the specific skills required by newly graduated engineers in India affecting employability. The results of a factor analysis of the 25 skills were grouped into three factors using the importance ratings. They were Factor I (Core Employability Skills), Factor 2 (Professional Skills) and Factor 3 (Communication Skills).

- Andrew Borchers & Nadia Shuayto (2002) in their study conducted factor analysis which indicated that skills were categorized into 5 factors. In this solution the first component was interpersonal and communications dimension. The second dimension was a management dimension. The third dimension dealt with ethics and responsibility. The fourth dimension represented computer related skills and the fifth dimension dealt with decision making, creativity and critical thinking skills that are required by an MBA graduate entering the workforce.

OBJECTIVES OF THE STUDY

- To understand the conceptual background and application of factor analysis in Social Science Research.
- To reduce a large number of variables into manageable smaller factors for further analysis in the study (Impact of soft skills training on employability among B-School Graduates in Bangalore).

ANALYSIS

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	4.527	15.089	15.089
2	3.348	11.159	26.248
3	3.316	11.054	37.302
4	2.411	8.037	45.338
5	2.000	6.668	52.006
6	1.356	4.520	56.525

Table 1 Factor Analysis on Soft Skills Training Evaluation & Outcomes

Rotated Component Matrix[a]						
Statements	Component					
	1	2	3	4	5	6
Soft skills training has helped me to improve methodological Skills	.746	.132	.096	.132	.140	-.026
Soft skills training has helped me prepare for the process of job search	.731	.155	.217	.074	.080	.054
Soft skills training has helped me to improve personal skills	.722	.168	.100	.209	.102	-.164
Soft skills training has helped me to prepare for seeking employment	.710	.119	.235	.053	.040	.098
Soft skills training has helped me in preparing for future job interviews with confidence	.705	.243	.166	.030	.060	.155
Soft skills training has improved my confidence levels and attitude	.703	.245	.082	.119	.153	.097
Soft skills training has enhanced self awareness	.652	.090	.184	.141	.049	.076
Soft skills training has helped me to improve social skills	.516	.268	.069	.157	.063	.389
Quality of instruction is good	.223	.745	.236	.073	.041	.034
Trainer is knowledgeable	.182	.678	.395	.019	.094	-.043
Trainer collects the feedback at the end of the program	.248	.660	.081	.234	.045	.040
Class participation and interaction is encouraged during sessions	.223	.622	.118	.059	.090	.266
Soft skills trainer presents the content with clarity	.158	.601	.447	.081	.150	-.076
Soft Skills training given is according to my expectations	.302	.524	.169	.334	-.048	.140
Materials distributed are pertinent and useful.	.173	.119	.694	.159	-.011	.029
Facilities for training are satisfactory	.140	.236	.611	.199	.056	-.050
Content is updated based on present industry needs	.207	.104	.579	.320	.039	.054
Training is held during convenient time and place	.164	.321	.561	.196	.062	.104
Duration of the training program is adequate	.095	.325	.554	.246	.112	.063
Soft skills training integrates theoretical basic concepts with real world applications	.319	.135	.518	.081	.163	.045
Soft skills needs are assessed systematically (by placement cell in the college)	.129	.159	.159	.734	.043	-.043
Soft skills training provided by the college is sufficient for enhancing employability	.162	.084	.207	.675	-.030	-.229
Training objectives for each topic are fixed and implemented	.170	.124	.257	.669	.112	.114
Content is organized and easy to follow.	.126	.098	.337	.545	.035	.253
Soft skills are as important as professional knowledge (Hard Skills)	.114	.119	-.018	.161	.763	-.044
Soft skills are important for today's workplace	.121	.138	.007	.066	.756	-.030
Soft skills training is necessary in today's competitive job market to gain employability	.081	-.013	.176	-.025	.602	.416
Soft skills can be enhanced through training and practice	.150	-.054	.263	-.142	.530	.234
College should place greater emphasis on developing soft skills in students	.119	.133	.020	-.017	.133	.801
Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization						

The above table indicates factor analysis conducted on the study variables for twenty-nine items. Six factors were extracted using Eigen values. The factors with Eigen values more than one were extracted. The six factors extracted together accounted for 56.5% of the total variance. Twenty-nine items were reduced to six factors with eight items loadings of 0.746, 0.731, 0.722, 0.710, 0.705, 0.703, 0.652 and 0.516 as Factor1 which was referred to as 'Impact of soft skills training on Employability'. The second set of six items loaded as Factor 2 with factor loadings of 0.745, 0.678, 0.660, 0.622, 0.601 and 0.524. Factor 2 was referred to as 'Trainer Evaluation'. Third set of six items loaded as Factor 3 with factor loadings of 0.694, 0.611, 0.579, 0.561, 0.554 and 0.518. Factor 3 was termed as 'Soft skills content and facilities. Fourth set of four items loaded as Factor 4 which was referred to as 'Institutional planning of soft skills' with factor loadings of 0.734, 0.675, 0.669 and 0.545. Factor 5 was termed as 'Relevance of soft skills for the workplace' formed with four items with factor loadings of 0.763, 0.756, 0.602 and 0.530. A single variable represented Factor 6 with factor loading of 0.801. Since a single variable cannot be considered as a factor, factor 6 was excluded from further analysis.

DISCUSSION

The factors used in the study to analyze the effect of soft skills training on employability in B-School students were derived using extensive review of previous literature on soft skills training and employability competency. Yuzainee Md Yusoff et al. (2012) presented a method to evaluate the performance score based on employability skills for new engineers using NSW - Normalised Skill Weight. There were fifty attributes used to examine the required employability skills as valued by employers when hiring fresh engineering graduates. These fifty attributes had been grouped into ten key skills. The key skills were classified into five soft skills and five technical skills. The soft skills were communication skills (EES1), teamwork (EES2), lifelong learning (EES3), professionalism (EES4), problem solving and decision-making skills (EES5). Ivana Salopek Cubrica et al. (2014) in their study conducted factor analysis (principal component analysis) on 30 variables (soft skills). They extracted 3 factors explained by eigen values (F1 - 12,527, F2 - 8,395 and F3 - 1,448).

Loadings higher than 0.7 describe each factor (importance of soft skills), i.e., F1 represented productive professional and personal living skills deliberated of intention to be a leader or manager. F2 represented focused leadership and managerial skills. F3 represented open communication and creative skills. The current study also replicated the extraction of factors in a similar manner by classifying soft skills into personal, methodological and social skills. Mahendra Fakhri & Nurul Setyaningrum (2015) in their study conducted factor analysis using principal component analysis on soft skills among students of Business Administration, Telkom University. It was found that one factor represented the 9 variables (Communication skills, Presentation skills, Proactive skills, Planning skills, Self-understanding skills, Time management skills, Problem solving skills, Stress management skills and Personal effectiveness skills) that builds students' soft skills. This study also made use of the technique of principal component analysis on soft skills among B-school graduates. Andreas Blom & Hiroshi Saeki (2010) conducted a study to identify the specific skills required by newly graduated engineers in India affecting employability. The results of a factor analysis of the 25 skills was grouped into three factors namely Factor I (Core Employability Skills), Factor 2 (Professional Skills) and Factor 3 (Communication Skills). The current study also considers communication skills separately under social skills which affects employability. Li-Tze Lee & Tien-Tse Lee (2011) conducted factor analysis in a study to identify the soft skills categories which affects success at the workplace. Factor analysis resulted in six new constructs - positive attitudes, open-mindedness, interpersonal relationships, teamwork, communication skills and creativity representing the important soft skill categories. Andrew Borchers & Nadia Shuayto (2002) examined perceptions of MBA skills between academicians and HR professionals to suggest a new framework for how MBA skills can be viewed in general. The factor analysis categorized the skills into 5 factors. In this solution the first component was interpersonal and communications dimension. The second dimension was a management dimension, including the ability to manage one's self, a project and new technology in the organization. The third dimension dealt with ethics and responsibility. The fourth dimension represented computer related skills and the fifth dimension dealt with decision

making, creativity and critical thinking skills that are required by an MBA graduate entering the workforce. Factor Analysis extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. In this study, the factors extracted were 'Impact of soft skills training on Employability', 'Trainer Evaluation', 'Soft skills content and facilities', 'Institutional planning of soft skills' and 'Relevance of soft skills for the workplace.'

CONCLUSION

Factor Analysis has been successfully used in a wide variety of industries and fields. Its use was pioneered in the field of psychology where it is still used in various studies to identify what factors influence intelligence, attitudes, behaviors, etc. Apart from psychology, it is an extremely useful tool in the field of various physical and social science studies. Factor Analysis is a statistical tool that measures the impact of a few unobserved variables called factors on a large number of observed variables. It is used as a data reduction method for researchers. It may be used to uncover and establish the cause-and-effect relationship between variables or to confirm a hypothesis. It is often used to determine a linear relationship between variables before subjecting them to further analysis. It is inexpensive and simple to use and can be used in a wide variety of situations. Lastly, it can be used to identify a lot of underlying dormant factors that other tools may not be able to highlight in research studies.

REFERENCES

[1] Blom, Andreas., Saeki, Hiroshi. (2010). "Employability and skill set of newly graduated engineers in India", Retrieved on February 08, 2015 from http://www.npiu.nic.in/Mentoring.

[2] Borchers, Andrew., Shuayto, Nadia. (2002). "Skills preparation in MBA Programs - The Importance of computer related skills", Retrieved on February 24, 2015 from http://www. kettering.edu/~aborcher/articles/skills.

[3] Cubrica, Ivana., Kalauzb, Maja., Hudeca, Goran. (2014). "Soft skills' evaluation in textile engineering and design", Retrieved on February 16, 2015 from http://www.iced2014.se/ proceedings.

[4] Darton, R. A. (1980). "Rotation in Factor Analysis", Journal of the Royal Statistical Society. Series D (The Statistician), vol. 29, issue 3, pp. 167-194.

[5] Fakhri, Mahendra. (2015). "Students' soft skills factor analysis in Telkom University, Department of Business Administration", International Journal of Science and Research (IJSR), vol. 4, issue 6, pp 680 - 682.

[6] Gorsuch, R. L. (1983). "Factor Analysis". Hillsdale, NJ: Lawrence Erlbaum Associates.

[7] Hening, Dyah., Koonce, David. (2015). "Important soft skills for engineers to succeed in a work environment", Retrieved on January 12, 2016 fromhttp://ieomsociety.org/IEOM_Orlnado_2015/papers.

[8] Lee, Li-Tze., Lee Tien-Tse. (2011). "Investigating Soft Skills for Success in the Workforce: Perceptions of elementary school teachers", International Review of Social Sciences and Humanities, vol. 1, issue 2, pp 140-149.

[9] Mohammed Yusoff, Yuzainee., Omar, Mohammed Zaidi., Zaharim, Azami., Mohamed Azah., Muhamad, Norhamidi. (2012). "Employability skills performance score for fresh engineering graduates in Malaysian industry", Asian Social Science, vol. 8, issue 16, pp 140 - 145.

[10] Rahn, Maike. (2019). "Factor Analysis: A Short Introduction, Part 2–Rotations", Retrieved on May 14, 2019 from https://www.theanalysis factor.com/rotations-factor-analysis/.