

Extraction of Latent Factors or Competency Clusters using Factor Analysis : A Study on Professional Social Workers

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Abstract

The present research paper offers insight into the extraction of latent factors or competency clusters using the statistical tool Factor Analysis, which is crucial from the perspective of Competency Mapping. In this context, the researcher employed a mixed research method. Firstly, due to the unavailability of a suitable scale, the researcher developed a new one using the qualitative method in an earlier separate research paper. Here in this research, a random sampling technique was used, along with the survey method. A seven-point scale was prepared for data collection. This conversion facilitated the transformation of qualitative data into quantitative, making it conducive for further analysis using the Quantitative method. Data were collected from six hundred and sixty-five respondents and the statistical tool Factor Analysis, specifically Exploratory Factor Analysis, and more specifically Principal Axis Factoring, with Oblique Promax Rotation, was employed. Finally, three latent factors or competency clusters were extracted.

Keywords: factor analysis, exploratory factor analysis, principal Axis Factoring competency clusters

1. Introduction

McClelland, D. C. (1973) challenges the predominant focus on intelligence testing, advocating for a shift towards assessing competencies. Currently, competency-based strategic human resource management and competency-based education are prevalent globally. Competencies comprise diverse attributes fostering superior performance in various domains, shaping competency mapping as a process aligning individual traits with job requirements, organizational goals, and personal-social needs. This research extends valuable insights to various stakeholders. The "Unit to Complete" approach proposed by the researcher entails assembling characteristics to form competencies. These competencies are then organized into clusters, contributing to a broader Competency Framework or Model. The objective of the present work is to examine the application of factor analysis to extract the Factors or Competency-clusters responsible for superior performance.

2. Review of Literature:

Factor analysis assumes that all variables are correlated to some degree. It is particularly useful for identifying the factors underlying the variables by

grouping related variables into the same factor [1]. The author of the research paper identified sixteen job-specific or domain-departmental or horizontal competencies, ten organizational development-specific or generic-administrative or vertical competencies, and fifteen personal-social progression-specific or psycho-social or spherical competencies responsible for the superior performance of professional social workers based on agreeableness percentage of respondents [2], [3], [4]. Due to the unavailability of a suitable scale for competency mapping, the researcher developed and standardized a Competency Scale for competency mapping, which was used in this study to extract the latent factors or competency clusters [5]. An eigenvalue exceeding one is considered significant, indicating that the factor explains more common variance than unique variance [6]. Factor extraction should cease at the point where the plot shows an 'elbow' or levels off, indicating that unique variance begins to dominate over common variance [7]. If the rotated component matrix exhibits numerous significant cross-loading values, the factor analysis should be rerun. This involves removing variables that load significantly on multiple components, aiming to achieve items loading on only one component [8].

3. Methodology

In this context, the researcher employed a mixed research method. Firstly, due to the unavailability of a suitable scale, the researcher developed a new one using the qualitative method in an earlier separate research paper. The extraction of latent factors or competency clusters based on quantitative data involved two primary steps within the Principal Axis Factoring method: I) Factor Extraction: In this study, Principal Axis Factoring with Oblique Promax Rotation was employed to identify underlying factors. The determination of the number of factors to retain was based on two techniques: i) Kaiser’s (Eigenvalue) Criterion: Factors with eigenvalues greater than one were retained. ii) Scree Test: Proposed by Cattell (1996), this graphical test helped determine the number of factors to extract. Factor extraction should cease at the point where the plot shows an 'elbow' or levels off. II) Factor Rotation and Interpretation: For clearer interpretation, when the rotated component matrix exhibited numerous significant cross-loading values, the factor analysis was rerun and significantly cross-loaded items were deleted, resulting in items loading on a specific factor.

4. Result & Discussion

In this section the results obtained with the statistical software JMP version 17 are presented.

4.1 Extracting Latent Factors or Competency Clusters using the Factor Analysis:

4.1.1 Factor Extraction: Employed extraction method such as Principal Axis Factoring and rotation method such as Promax rotation with Kaiser Normalization to extract Latent factors.

i) Kaiser’s (Eigenvalue) Criterion: There are three factors having Eigenvalue more than one. It represents the amount of the total variance explained by that factor. The remarkable factors having eigenvalue greater than one are retained.

Table 1. Eigenvalues (EV) and Total Variance Explained

Number	Eigenvalue	Percent	Cumulative Percent
1	21.3332	52.032	52.032
2	1.6254	3.964	55.997
3	1.1058	2.697	58.693

ii) Scree Test: There are three factors above the levelling of the plot or elbow for this study. Cattell (1996) proposed a graphical test for determining the number of factors. This test is used to identify the optimum number of factors that can be extracted before the amount of unique variance begins to dominate the common variance structure.

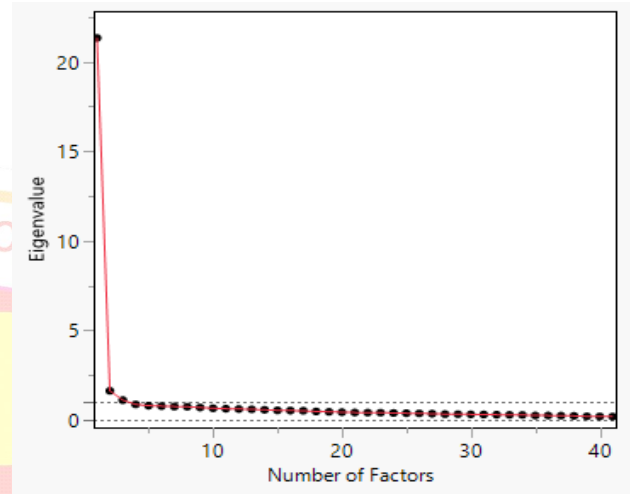


Figure 1. Scree Plot

4.1.2 Factor Rotation and Interpretation:

In this study, Oblique Promax Factor Rotation is used because factors are correlated, it results in solutions that are easier to interpret and to report. If the rotated component matrix shows many significant cross-loading values, then it is suggested to rerun the factor analysis to get an item loaded in only one component by deleting all cross loaded variables and variables having less than 0.40 Pattern matrix loading. On that basis Variable C-22, and C-29 are deleted.

Table 2. Extraction of Latet Factors or Competency Clusters

Pattern Matrix ^a				
Label	Name of Competency	Factor 1	Factor 2	Factor 3
C1	Adhering to Professional Values & Ethical Principles	.621		
C2	Concept Clarity on Social-service, Social-welfare & Social Work	.547		
C3	Selecting the Appropriate Level of Practice & Practice-wise Roles	.618		
C4	Choosing Appropriate Models & Approaches	.680		

C5	Selecting the Proper Social Work Method	.666		
C6	Using the appropriate 'Attending, Furthering & Counselling Skills	.617		
C7	Using the 'Tools & Techniques of RRA/ PRA / PLA'	.623		
C8	Capability to perform PESTEL Analysis	.538		
C9	Working with the other Professionals	.586		
C10	Identifying the Real Problem & Development Opportunity	.596		
C11	Diagnosing & Deciding the Appropriate Intervention Plan	.659		
C12	Adopting proper Helping Process as an Intervention	.499		
C13	Adopting proper Enabling Process as an Intervention	.568		
C14	Adopting proper Empowering Process as an Intervention	.646		
C15	Business Acumen of Agency & Strategic Decision Making	.442		
C16	Conducting Monitoring-evaluation & Making Changes Accordingly	.664		
C17	Organizational Awareness & Systematism			.517
C18	Capability to Undertake the Research			.519
C19	Ethical Administration & Faith in Stakeholders first			.538
C20	Techno-savviness			.688
C21	Using Sources / Resources Optimally			.567
C23	Adhering to Equitable &			.604

	Sustainable Development			
C24	Capability of Project proposal formulation & Project Management			.552
C25	Accounting & Record Keeping			.412
C26	Undertake Administrative & Financial Reforms			.556
C27	Self-awareness & Resilience		.438	
C28	Positive Work Attitude & Developing Related Habits		.497	
C30	Setting High Motive		.564	
C31	Choosing Proper Medium of Instruction & Effective Communication		.540	
C32	Developing Endurance or Physical Stamina		.727	
C33	Upholding Appropriate Politico-legal thought & Empathy		.806	
C34	Social-awareness & Social-visioning		.667	
C35	Using Human Skills Properly		.595	
C36	Team building & Courageously Leading		.678	
C37	Observing Proper Low & High Values		.608	
C38	Handling Own & Other's Emotions		.678	
C39	Continuous Individualization in Group and Community		.706	
C40	Balancing Individual Ambitions & Social Norms		.615	
C41	Observing Balanced Local, National, Global & Universal Citizenship		.606	

Extraction Method: Principal Axis Factoring, Rotation Method: Promax with Kaiser Normalization. a. Rotation converged in 9 iterations.

5. Conclusion

The study aimed to identify latent factors or competency clusters pertinent to competency mapping. Factor analysis, a method capable of predicting significant factors explaining maximum variability within a group, was employed. The findings revealed three competency clusters, categorized by the researcher as follows:

- 1) Domain-departmental or Job-specific or Horizontal Competency Cluster,
- 2) Psycho-social or Personal-social Progression-specific or Spherical Competency Cluster, and
- 3) Generic-administrative or Organizational Development-specific or Vertical Competency Cluster. Notably, the first cluster differs across academic disciplines, whereas the second and third clusters are universal. Further research required on the joint and individual contributions of these clusters. Structural Equation Modeling is also necessary for comprehensive analysis. Thus, the research contributes significantly by extracting latent factors or competency clusters.

6. References

- [1] Verma, J., & Abdel-Salam, A. (2019). Testing statistical assumptions in research. John Wiley & Sons Inc.
- [2] Garole P. D., (2024). Exploring Technical Job-specific or Domain-departmental or Horizontal Competencies: A Study on Professional Social Workers: Aayushi International Interdisciplinary Research Journal 11(3), 14-16
- [3] Garole P. D., (2024). Unveiling Organizational Development-specific or Generic-administrative or Vertical Competencies: A Study on Professional Social Workers: Aayushi International Interdisciplinary Research Journal 11(3), 26-29
- [4] Garole P. D., (2024). Investigating Personal-social Progression-specific or Psycho-social or Spherical Competencies: A Study on Professional Social Workers: Aayushi International Interdisciplinary Research Journal 11(3), 36-39
- [5] Garole P. D., (2024). Creating and Standardizing a New Scale for Competency Mapping: A Study on Professional Social Workers: Aayushi International Interdisciplinary Research Journal 11(4), 01-04
- [6] Verma, J. (2013). Data analysis in management with SPSS software. Springer.
- [7] Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). Multivariate data analysis (5th ed.). Prentice-Hall.
- [8] Thompson, B. (2004). Exploratory and confirmatory factor analysis: Understanding concepts and application. American Psycho