



**RESEARCH PAPER**

**Confirmatory Factor Analysis of Perceived Educational Effectiveness Scale for Heads of Institutions of Students with Hearing Impairment**

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**ABSTRACT**

The aim of this study was to create a native scale that would assess the perception of the heads of institutions for students with hearing impairment working in Government special education institutes of Punjab Province regarding the educational effectiveness as well as the psychometric properties of the scale's effectiveness of educational services for those heads of institutions. This study was carried out using a quantitative paradigm. The population of this study was the heads of Government special education institutions for students with hearing impairment in Punjab Province. For this investigation, the sample was chosen using a random sampling strategy. As a sample for this study, 55 heads of institutions were chosen. The researchers produced an indigenous scale. The five-point Likert scale was used to evaluate each statement. 49 statements were used to evaluate perceived educational effectiveness. Confirmatory factor analysis was carried out through IBM SPSS AMOS (Analysis of moment structure) version 25.0 using structural equation modeling (SEM).

**Keywords:**      Confirmatory Factor Analysis, Educational Effectiveness, Heads of Institutions for Students with Hearing Impairment, Scale for Educational Effectiveness

**Introduction**

Student-athletes' Regardless of caste, creed, religion, gender, or other concerns, the National Policy for Persons with Disabilities places an emphasis on empowering people with disabilities to realize their full potential in all areas of life, notably in the social, economic, personal, and political arenas (NPWD, 2002). Each program is unique since rehabilitation treatment is tailored to each person's unique needs, according to Spectrum Health Lakeland (2020). Some general treatment components for rehabilitation programs include the following:

- Treating the underlying illness and avoiding complications
- Addressing the impairment and enhancing performance
- Teaching the patient and family and assisting them in adjusting to lifestyle changes.
- Providing adaptive tools and changing the surroundings.

Eliminating laws that make a distinction between children who are deemed to be "educable" and "non-educable" ensures that children with disabilities have the same rights to education as other kids, including access to the same curriculum and opportunities to take public exams. (EFA, 2000).

**Literature Review**

Moore (2018) suggested that even if it makes sense to support deaf children in completely developing all of their skills, we can either have oral-only schooling or manual communication, not both. Despite evidence to the contrary, this false dichotomy continues to exist today. Signs and sign languages will be used as long as there are deaf people, but it

is our duty to make sure that deaf children have access to them from birth and throughout their whole academic career. Drug therapy, patient and family education, and psychological support through outpatient care, community-based rehabilitation, or involvement in a support group are all examples of rehabilitation (WHO, 2011). These factors call for an expedition to investigate the "dark side of the moon" in education. Effect sizes that may be small, high percentages of unexplained variance, the majority of variance explained by individual or aggregate student background characteristics, little generalizability of the established set of malleable factors across countries, internationally relatively small changes in performance results, and the malleable factors that are supposed to explain them, are all factors. Theoretically, this entails looking for processes that could explain both efficacy and ineffectiveness (Scheerens, 2015).

To identify the deaf education research areas that are now being prioritized and any findings that may have a significant impact on the evolution of educational practice. First, the analysis demonstrates that a number of methodological and contextual problems in deaf education research typically make it challenging to directly translate findings to teaching and learning (Swanwick and Marschark, 2010). The ability to operate in daily life requires certain abilities, which rehabilitation can help you regain, preserve, or develop. These abilities could be mental, physical, or cognitive (thinking and learning). You might have misplaced them as a result of a disease, an accident, or a medicine side effect. Rehabilitation can enhance your daily life and ability to perform (MedlinePlus, 2020).

All institutions and programs must provide electronic instructional materials while also taking into account the convenience of use and performance efficacy in order to accommodate people with special needs, particularly the deaf. It was recommended that teachers of students with special needs, especially those who are deaf, undergo training in the use of computerized instructional packages in addition to the requirement for an education technology expert for the deaf in each institution (Bagabas, 2016).

Teodorovic, et al. (2022) carried out research on the influence of instructor factors on students' interest and academic success in mathematics and biology in Serbia in order to test the dynamic model of educational efficiency. They investigated the contribution of teacher-level variables from the dynamic model of educational effectiveness to student achievement and interest in mathematics and biology, keeping in mind that student achievement and interest in the subject are some of the most important educational goals and that quality of teaching is the crucial schooling factor influencing them. The findings show that while instructor characteristics from the dynamic model did not affect students' maths and biology achievement, they did affect their interest in both disciplines.

According to Lytle, Johnson, and Hui (2005), oral/aural education and hearing restoration are China's top national policy priorities. For deaf pupils, however, a variety of Chinese Sign Language is frequently utilized in classrooms. The primary areas of study in early childhood education are speech and hearing. The curricula for elementary and secondary schools have low expectations for deaf kids and don't provide them with the same academic content as they do for hearing pupils. Higher education opportunities are few. There are no support services like note-takers or interpreters available for mainstreamed students. Programs for deaf educators or interpreters do not exist. There aren't many employment, and the majority of people who are deaf are unemployed. Interviewees for the article who are Deaf talk about their desires, goals, and the changes they have noticed, some of which are due to recent inspiring international partnerships. Using the Dynamic Model of Educational Effectiveness, Hramiak, A. (2017) examined how Teach First new teachers developed their practices. The results show that instructor level factors are not independent traits but rather are linked. Further study of teacher impact is required, particularly to enable teachers to evaluate their own influence on students and to comprehend what it is that they are doing that is differentiating.

Educational Effectiveness Scale for Heads of institutions of students with hearing impairment was based and designed through The Dynamic Model of Educational Effectiveness by Bert P. M. Creemers and Leonidas Kyriakides.

### Material and Methods

Quantitative research method was used to conduct this study along with descriptive research design.

### Population and Sampling Strategy

Population of the study was heads of institutions of the students with hearing impairment enrolled in government special education institutions in Punjab Province. Random sampling technique was used to conduct this study. 55 number of heads of institutions were selected as a sample of this study.

### Development of scale for Heads of Institutions of the Students with Hearing Impairment

The first part of the questionnaire for the heads of the government special education institutions in Punjab province was contained demographic information of the respondents about the age, gender, marital status, religion, qualification, working experience, designation, job scale, Job status, salary, city, district, school and language. All information regarding the demographics helped to define the demographics of the sample as well as the characteristics of sample. The questionnaire was based on The Dynamic Model of Educational Effectiveness by Creamers and Leonidas Kyriakides. The questionnaire consisted of five parts. The first part of the questionnaire was based on the effectiveness of education at system level. The second part of the questionnaire was based on school level, to check the effectiveness of education at school level. The third part of the questionnaire had been drawn to check out the effectiveness of education at classroom level. The fourth part of the questionnaire was at of student level and the fifth part of the questionnaire was based on the outcomes, the real outcome, and the real result of all the procedure. This part of the questionnaire was deal with the achievements of the students with hearing impairment enrolled in government special education institutions in Punjab province.

While following the rules and regulations of The Dynamic Model of Educational Effectiveness, each and every phase of the questionnaire was being measured by taking into account the five dimensions. Those dimensions were frequency, focus, stage, quality and differentiation. All the factors of this questionnaire defined the effectiveness of education while taking into account these five dimensions. The questionnaire was consisted on 49 questions. Researcher recorded the responses of the teachers of students with hearing impairment against five points.

**Table 1**  
**Descriptive Statistics of the Heads of the Institutes for the Children with Hearing Impairment.**

Variables	Heads (N = 55)	
	<i>f</i>	%
Gender		
Men	17	30.9
Women	38	69.1
Age		
20-25	2	3.6
25-30	5	9.1

<b>Variables</b>	<b>Heads (N = 55)</b>	
	<b>f</b>	<b>%</b>
30-35	12	21.8
35-40	8	14.5
40-45	12	21.8
45-50	8	14.5
50-55	4	7.3
55-60	4	7.3
<b>Education</b>		
M.Sc	34	61.8
M.Phil	21	38.2
<b>Experience</b>		
0-5	9	16.4
5-10	10	18.2
10-15	9	16.4
15-20	14	25.5
20-25	7	12.7
25-30	2	3.6
30-35	4	7.3
<b>Designation</b>		
J.S.E.T		
S.S.E.T		
<b>Divisions</b>		
Bahawalpur	3	5.5
D.G.Khan	7	12.7
Faisalabad	11	20.0
Gujranwala	9	16.4
Lahore	11	20.0
Multan	5	9.1
Sahiwal	2	3.6
Sargodha	7	12.7
<b>Districts</b>		
Bahawalpur	3	5.5
D.G.Khan	4	7.3
Rajanpur	2	3.6
Layyah	1	1.8
Faisalabad	4	7.3
T.T.Singh	7	12.7
Gujranwala	1	1.8
Hafizabad	5	9.1
Sialkot	3	5.5
Lahore	11	20.0
Khanewal	1	1.8
Multan	3	5.5
Lodhran	1	1.8
Okara	2	3.6
Sargodha	4	7.3
Mian Wali	3	5.5
<b>Institute</b>		

Variables	Heads (N = 55)	
	f	%
Center	32	58.2
School	20	36.4
College	3	5.5

### Data Collection from Heads of Institutions

Data was collected for this study from 55 number of heads of the institutions of the students with hearing impairment enrolled in Govt. special education institutions in Punjab Province. From Punjab Province, eight divisions were included while data collection. Those divisions were Bahawalpur, D.G.Khan, Faisalabaad, Gujranwala, Lahore, Multan, Sahiwal and Sargodha. From these eight divisions, sixteen districts were included in the process of data collection, those were, Bahawalpur, D. G. Khan, Rajan Pur, Layyah, Faisalabad, T.T.Singh, Gujranwala, Hafizabaad, Sialkot, Lahore, Khanewal, Multan, Lodhran, Okara, Sargodha and Mian Wali. The data was collected from centers, schools and colleges of Govt. special education institutions of Punjab province. Both male and female heads of institutions were included in data collection.

### Results and Discussion

#### Confirmatory Factor Analysis of the educational effectiveness questionnaire (EEQ) for heads

To validate the factor structure of the educational effectiveness questionnaire (EEQ) for heads of students with hearing impairment, confirmatory factor analysis (CFA) was conducted on 49 items. Confirmatory factor analysis was carried out through IBM SPSS AMOS (Analysis of moment structure) version 25.0 using structural equation modeling (SEM). The EEQ consisted of five sub-factors, labeled as system, school, classroom, students and outcomes. The indices of the model fit are indicated in table 2

**Table 2**  
**Confirmatory Factor Analysis of Educational Effectiveness Questionnaire for Heads of Students with Hearing Impairment**

Model	$\chi^2$	Df	$\chi^2/df$	GFI	CFI	NNFI	RMSEA	SRMR
Initial Model	2635.26	1117	2.36	.44	.42	.41	.11	.09
Model Fit	2441.27	1115	2.19	.92	.90	.89	.09	.07
$\Delta \chi^2$	193.99*							

Note. GFI= Goodness of fit index, CFI=comparative fit index, NNFI = non-normed fit index; RMSEA=root mean square error of approximation, SRMR=Standardized root means square,  $\Delta \chi^2$  = chi-square change.

Table 2 shows the fit indices of the educational effectiveness questionnaire (EEQ) (heads version) for both absolute and relative model fit. The first model's absolute fit index revealed that the estimations of the fit were excellent, estimates as  $\chi^2 (1115) = 2441.27 p < .05$ . In a typical model, the sample size and the number of estimated parameters is thought to have a significant impact on the chi-square statistic, which is used to measure the absolute model fit (Hair et al. 2010). Therefore, in this perspective, researchers advised taking into account various relative fit indices, such as the Goodness of Fit Index (GFI), Cumulative Fit Index (CFI), Normative Fit Index (NFI), Root Mean Square Approximation Error (RMSEA), and Standardized Root Mean Square (SRMR).

Some guidelines were suggested to be followed in order to assess the model's fit; for instance, the  $\chi^2/df$  should vary between 0 and 3. To be deemed excellent estimates for the model, the RMSEA and SRMR estimates must be .08 or less, while the CFI, NNFI, and GFI

estimates must be .90 or higher (Hu & Bentler, 1999). The fit indices of the initial model were observed and found that the  $\chi^2/df$  was 2.36. Whereas the estimates of the RMSEA and SRMR were .07 and .07 while the CFI, NNFI, and GFI were .44, .42, .41 respectively. As a result, the specified criteria for model fit were not fully met by the present estimations of the relative fit.

So, the model modification procedure was started in order to achieve the model fit. Therefore, only those covariances between the error terms that had contextual meaning were extracted from the indicators of the measurement model of the EEQ (Heads Version) (Kenny, 2011). Following the drawing of the covariances between the error components, the absolute and relative fit indices were once more compared. The GFI, CFI, and NNFI values were .92, .90, and .89, respectively, while the RMSEA and SRMR were .09 and .07, respectively. As a result, the model fit indices and criteria fell into the category of good model fit.

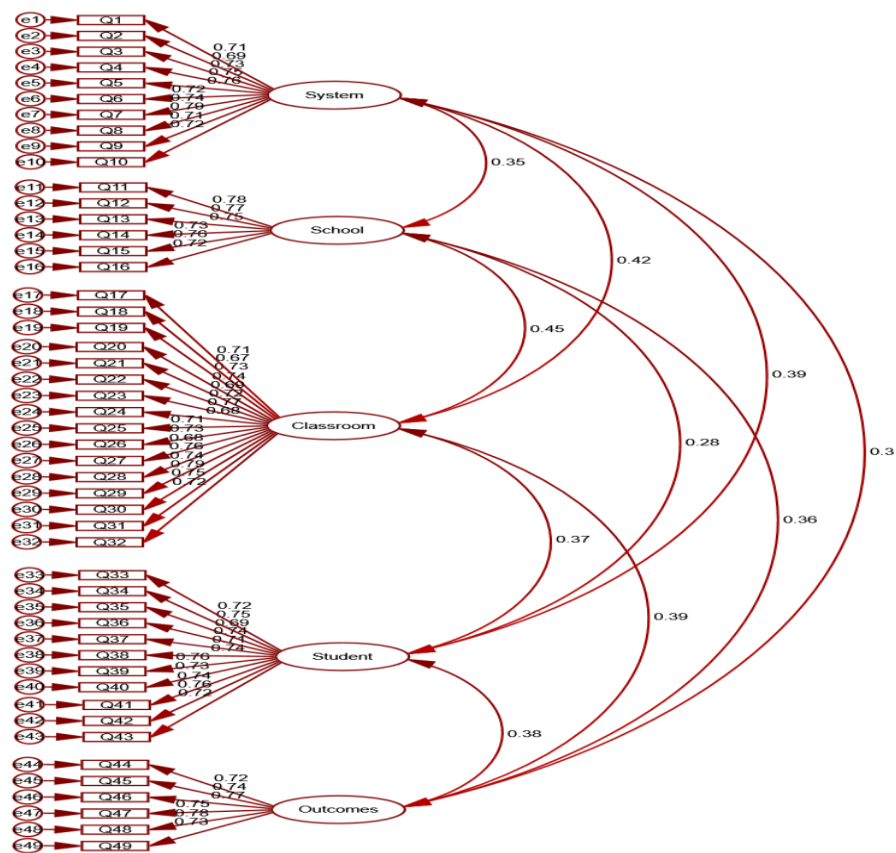


Figure 1 Confirmatory Factor Analysis of Educational Effectiveness Questionnaire for Head of Students with Hearing Impairment

**Table 3**  
**Confirmatory Factor Analysis of Educational Effectiveness Questionnaire for Heads of Students with Hearing Impairment**

Factors	$\alpha$	CR	AVE	MSV	$\lambda$
<b>System</b>	<b>.91</b>	<b>0.920</b>	<b>0.537</b>	<b>0.203</b>	
1. There has been an upsurge in enrollment at the institutions.					0.71
2. Mother tongue is a current national policy priority.					0.69
3. The requirements of the pupils with hearing impairments can be met by the present national policy.					0.73
4. The stakeholders of kids with hearing impairment work closely together to advance the national educational policy.					0.75
5. The policy's vision and purpose can be reviewed by all principals.					0.76

6. To accomplish school goals, administrators, teachers, and staff efficiently collaborate.					0.72
7. The educational services are subject to rigorous oversight.					0.74
8. Institutions have sign boards available for students who have hearing impairments.					0.79
9. Students with hearing impairments can access the environment of educational institutions.					0.71
10. The learning environment is open and kind.					0.72
<b>School</b>	.87	0.886	0.565	0.176	
11. Following monitoring, the school's educational strategy is evaluated.					0.78
12. School planning takes social trends into account.					0.77
13. The national policy is related to the school policy.					0.75
14. The staff of the school sets objectives to be achieved.					0.73
15. Teachers get time at the school for professional development.					0.76
16. The objectives established for students with hearing impairments are reachable.					0.72
<b>Classroom</b>	.92	0.947	0.526	0.203	
17. The teachers of students with hearing impairments receive ongoing training so they can learn more about these students.					0.71
18. Interaction between teachers and hard of hearing students.					0.67
19. Students are told by their teachers what is expected of them in class.					0.73
20. The lecture's events are all well planned.					0.74
21. Effective teaching strategies are used by teachers to help students understand the course material.					0.69
22. Students who have hearing loss can use what they have learned in practical situations.					0.72
23. The utilization of current materials is flexible for teachers of kids with hearing impairment.					0.77
24. The evaluation process for kids with hearing loss is open and honest.					0.68
25. Teachers carefully plan the day's activities for learning.					0.71
26. Every teacher has a record of the kids' development.					0.73
27. Students with hearing impairments' academic learning is evaluated using a variety of techniques.					0.68
28. Teachers of pupils with hearing loss devote as much time to instruction as is necessary.					0.76
29. Additionally, extracurricular activities are planned for the students who have hearing loss.					0.74
30. For efficient learning, there are quiet classrooms available.					0.79
31. Students with hearing impairments are given access to a supportive learning environment.					0.75
32. There are sufficient classrooms for efficient learning.					0.72
<b>Students</b>	.91	0.927	0.537	0.152	
33. A variety of programmes are set up to improve the cognitive and physical capacities of hearing-impaired students.					Q33
34. For the persistence of the hearing-impaired kids, a support system is developed.					Q34
35. The tasks related to education are given enough time to be completed.					Q35
36. Each hearing-impaired student has an equal opportunity to participate and ask questions to ensure their understanding.					Q36
37. Without regard to their socioeconomic condition, students with hearing impairment receive services.					Q37
38. For the benefit of the students who have hearing impairment, gender equality is guaranteed.					Q38
39. The social and economic standing of the pupils who have hearing loss is not a factor in any discrimination.					Q39
40. Students with hearing loss are given every opportunity to develop their social skills.					Q40

41. It is assumed that students with hearing impairments will learn in comfortable surroundings.	Q41
42. Students with hearing loss are encouraged to develop their creative skills.	Q42
43. Students with hearing impairments are encouraged and motivated by role models.	Q43
<b>Outcomes</b>	.87 0.884 0.560 0.152
44. This educational system helps pupils with hearing impairment reach their full potential.	0.72
45. Because of this educational structure, a child with hearing loss is a trustworthy citizen.	0.74
46. Hearing-impaired students are seen as better citizens after graduation.	0.77
47. After graduation, hearing-impaired students start working.	0.75
48. Your youngster with hearing loss has additional employment options now as a result of these educational services.	0.78
49. After graduation, hearing-impaired students frequently pick up new skills.	0.73

Note. CR = Composite reliability, AVE = Average variance extracted,  $\lambda$  (lambda) = standardized factor loading

After achieving the stringent criteria of model fit, the factor structure of the educational effectiveness questionnaire (EEQ) was psychometrically evaluated and reliability and validity (convergent and discriminant) of the educational effectiveness questionnaire was determined. The investigators suggested that composite reliability and Cronbach's alpha reliability coefficients should be .70 or greater for the constancy of the factor structure while the index of average variance extracted (AVE) should be .50 or greater to claim the good convergence of the measurement (Hair et al. 2010; Henseler et al., 2016). The average variance extracted (AVE) is the average of the square root of the factor loading for the respective factor (Hair et al., 2010).

The percentage of the variance for the educational effectiveness questionnaire (EEQ) was .54, .53, .53, .54 and .56 for system, school, classroom, students and outcomes respectively. However, the reliability coefficients, including composite and Cronbach's alpha, ranged from .87 to .94 for the all five factors.

**Table 4**  
**Descriptive Statistic and Fornell-Larcker Criterion for the Educational Effectiveness Questionnaire for Heads of Students with Hearing Impairment**

Factors	<i>M</i>	<i>SD</i>	MaxR(H)	Student	School	Classroom	System	Outcomes
Student			0.928	<b>0.733</b>				
School			0.887	0.390	<b>0.752</b>			
Classroom			0.948	0.280	0.350	<b>0.725</b>		
System			0.922	0.370	0.420	0.450	<b>0.733</b>	
Outcomes			0.885	0.380	0.310	0.360	0.390	<b>0.749</b>

To determine the discriminant validity, two distinctive ways were adapted (Henseler, Hubona, and Ray 2016; Voorhees et al., 2016). In the first method, the square root of average variance extracted AVE ratio of each factor was compared with proceeding correlations of the factors (Fornell and Larcker, 1981). The evidence showed that the square root of AVE is greater than the correlation (see Table 3). In the second method, the AVE was compared with the maximum shared variance MSV of each respective factor. Haire et al. (2010) suggested that the maximum shared variance should be less than the value of average variances extracted, which means the percentage of explained variance of the same factor should be greater than any other factor. Hence, the estimates showed that the average variance extracted was greater than the maximum shared variance of all respective factors.



**Table 5**  
**Descriptive Statistics and Cronbach's Alpha for System, School, Classroom, Student Levels and Outcomes for the Heads (N = 55) of the Institutes of the Students with Hearing Impairment.**

Variables	Ranges					$\alpha$
	K	M	SD	Actual	Potential	
System Level	10	36.58	5.62	23-50	10-50	.91
School Level	6	23.09	3.81	11-30	6-30	.87
Classroom Level	16	62.87	9.43	35-79	16-80	.92
Student Levels	11	44.14	5.63	28-54	11-55	.91
Outcome	6	22.49	3.65	9-29	6-30	.87

Note. K = number of items,  $\alpha$  = Cronbach's Alpha.

The above table shows the descriptive statistics including (mean, standard deviation, actual and potential ranges) and internal consistency by using Cronbach's alpha reliability of system, school, classroom, student levels and outcomes for the heads of the institutes of the students with hearing impairment. The reliability evaluation exhibited an excellent internal consistency ranging from .82-.93 for the constructs.

### Conclusions

A trustworthy and valid scale was used. It matched the subscales in a consistent manner. It could be applied again in a related field.

### Implications

To determine the educational efficiency for various disabilities including visual impairment and physical handicap, this scale can be utilized with a few minor modifications. This scale can be used in different areas of Pakistan to determine the effectiveness of the educational system for heads of institutions of hearing-impaired students. With a few simple modifications, this scale can be applied to private as well as non-governmental institutions to determine the perceived value of education.

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